

R15

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
*(Established by Govt. of A.P., Act. No. 30 of 2008)*  
**ANANTHAPURAMU – 515 002 (A.P.) INDIA.**

Course Structure for B.Tech-R15 Regulations

**ELECTRICAL & ELECTRONICS ENGINEERING**

I B.Tech. - I Semester

S.No	Course code	Subject	L	T	P	Drg	C
1.	15A52101	Functional English	3	1	-	-	3
2.	15A54101	Mathematics – I	3	1	-	-	3
3.	15A05101	Computer Programming	3	1	-	-	3
4.	15A56101	Engineering Physics	3	1	-	-	3
5.	15A03101	Engineering Drawing	0	-	-	6	3
6.	15A52102	English Language Communication Skills Lab	-	-	4	-	2
7.	15A56102	Engineering Physics Lab	-	-	4	-	2
8.	15A05102	Computer Programming Lab	-	-	4	-	2
Total			12	4	12	6	21

I-II Semester

S.No	Course code	Subject	L	T	P	C
1.	15A54201	Mathematics – II	3	1	-	3
2.	15A52201	English for Professional Communication	3	1	-	3
3.	15A51101	Engineering Chemistry	3	1	-	3
4.	15A01101	Environmental Studies	3	1	-	3
5.	15A02201	Electrical Circuits – I	3	1	-	3
6.	15A51102	Engineering Chemistry Lab	-	-	4	2
7.	15A02202	Electrical Circuits Lab	-	-	4	2
8.	15A99201	Engineering & IT Workshop	-	-	4	2
Total			15	5	12	21

- \* L - Lecture hours
- \*T - Tutorial hours
- \*P - Practical hours
- \*Drg - Drawing
- \*C - Credits

**II B. Tech (EEE) – I Sem**

S. No	Course Code	Subject	L	T	P	C
1	15A54301	Mathematics –III	3	1	-	3
2	15A02301	Electrical Circuits – II	3	1	-	3
3	15A02302	Electrical Machines – I	3	1	-	3
4	15A02303	Control Systems Engineering	3	1	-	3
5	15A04301	Electronic Devices & Circuits	3	1	-	3
6	15A05201	Data Structures	3	1	-	3
7	15A02305	Electric Circuits Simulation Laboratory	-	-	4	2
8	15A04305	Electronic Devices & Circuits Laboratory	-	-	4	2
Total			18	6	8	22

**II B. Tech (EEE) – II Sem**

S. No	Course Code	Subject	L	T	P	C
1	15A54402	Mathematics – IV	3	1	-	3
2	15A52301	Managerial Economics and Financial Analysis	3	1	-	3
3	15A02401	Electrical Machines – II	3	1	-	3
4	15A02402	Electrical Power Generating Systems	3	1	-	3
5	15A02403	Electromagnetic Fields	3	1	-	3
6	15A04409	Analog Electronic Circuits	3	1	-	3
7	15A02404	Electrical Machines Laboratory – I	-	-	4	2
8	15A02405	Control Systems & Simulation Laboratory	-	-	4	2
9	15A02406	Comprehensive Online Examination – I	-	-	-	1
Total			18	6	8	23

**B.Tech III-I Semester (EEE)**

S. No.	Course Code	Subject	L	T	P	C
1.	15A02501	Electrical Measurements	3	1	-	3
2.	15A04509	Linear & Digital IC Applications	3	1	-	3
3.	15A02502	Electrical Power Transmission Systems	3	1	-	3
4.	15A02503	Power Electronics	3	1	-	3
5.	15A02504	Electrical Machines – III	3	1	-	3
6.	15A04510 15A02505	<b>MOOCS -I</b> Digital Circuits and Systems Networks Signals and Systems	3	1	-	3
7.	15A02506	Electrical Machines Laboratory – II	-	-	4	2
8.	15A02507	Electrical Measurements Laboratory	-	-	4	2
9.	15A99501	Audit course – Social Values & Ethics	2	0	2	0
<b>Total</b>			<b>20</b>	<b>6</b>	<b>10</b>	<b>22</b>

**B.Tech III-II Semester (EEE)**

S. No.	Course Code	Subject	L	T	P	C
1.	15A52601	Management Science	3	1	-	3
2.	15A02601	Power Semiconductor Drives	3	1	-	3
3.	15A02602	Power System Protection	3	1	-	3
4.	15A04601	Microprocessors & Microcontrollers	3	1	-	3
5.	15A02603	Power System Analysis	3	1	-	3
6.	15A02604 15A02605 15A02606 15A01608	<b>CBCC -I</b> 1) Neural Networks & Fuzzy Logic 2) Programmable Logic Controller & Its Applications 3) Optimization Techniques 4) Intellectual Property Rights	3	1	-	3
7.	15A04607	Microprocessors & Microcontrollers Laboratory	-	-	4	2
8.	15A02607	Power Electronics & Simulation Laboratory	-	-	4	2
9.	15A52602	Advanced English Language Communication Skills (AELCS) Laboratory (Audit Course)	-	-	2	-
10.	15A02608	Comprehensive Online Examination - II	-	-	-	1
<b>Total</b>			<b>18</b>	<b>6</b>	<b>12</b>	<b>23</b>

**B.Tech IV-I Semester (EEE)**

S. No.	Course Code	Subject	L	T	P	C
1.	15A02701	Electrical Distribution Systems	3	1	-	3
2.	15A04603	Digital Signal Processing	3	1	-	3
3.	15A02702	Power System Operation and Control	3	1	-	3
4.	15A02703	Utilization of Electrical Energy	3	1	-	3
5.	15A02704 15A02705 15A02706	<b>CBCC-II</b> a) Modern Control Theory b) Switched Mode Power Converters c) Energy Auditing & Demand Side Management	3	1	-	3
6.	15A02707 15A02708 15A02709	<b>CBCC-III</b> a) Smart Grid b) Flexible AC Transmission Systems c) Power Quality	3	1	-	3
7.	15A04608	Digital Signal Processing Laboratory	-	-	4	2
8.	15A02710	Power Systems & Simulation Laboratory	-	-	4	2
<b>Total</b>			<b>18</b>	<b>6</b>	<b>8</b>	<b>22</b>

**B.Tech IV-II Semester (EEE)**

S. No.	Course Code	Subject	L	T	P	C
1.	15A02801 15A02802 15A02803	<b>MOOCS – II</b> 1. Instrumentation 2. Power System Dynamics and Control 3. Industrial Automation & Control	3	1	-	3
2.	15A02804 15A04702 15A02805	<b>MOOCS – III</b> 1. HVDC Transmission 2. Embedded Systems 3. Energy Resources & Technology	3	1	-	3
3.	15A02806	Comprehensive Viva Voce	-	-	4	2
4.	15A02807	Technical Seminar	-	-	4	2
5.	15A02808	Project Work	-	-	24	12
<b>Total</b>			<b>6</b>	<b>2</b>	<b>32</b>	<b>22</b>

**Minor Discipline in EEE**

S. No.	Course Code	Subject	L	T	P	C
1	15A02303	Control Systems Engineering	3	1	-	3
2	15A02402	Electrical Power Generating Systems	3	1	-	3
3	15A02502	Electrical Power Transmission Systems	3	1	-	3
4	15A02603	Power System Analysis	3	1	-	3
5	15M02101	Minor Discipline Project	-	-	-	8
		<b>Total</b>	<b>12</b>	<b>4</b>	<b>-</b>	<b>20</b>

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B. Tech I-I Sem. (EEE)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**(15A52101) FUNCTIONAL ENGLISH**

**(Common to All Branches)**

**Preamble:**

English is an international language as well as a living and vibrant one. People have found that knowledge of English is a passport for better career, better pay, and advanced knowledge and for communication with the entire world. As it is a language of opportunities in this global age, English is bound to expand its domain of use everywhere. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed book serves the purpose of preparing them for everyday communication and to face the global competitions in future.

The text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

**Objectives:**

- To enable the students to communicate in English for academic and social purpose.
- To enable the students to acquire structure and written expressions required for their profession.
- To develop the listening skills of the students.
- To inculcate the habit of reading and critical thinking skills.
- To enhance the study skills of the students with emphasis on LSRW skills.

**UNIT –I**

**Topics:** Paragraph writing, writing letters, role play, reading graphs, prepositions, designing posters, tenses, making recommendations.

**Text:** ENVIRONMENTAL CONSCIOUSNESS' from *MINDSCAPES*  
Climate Change - Green Cover – Pollution

### **UNIT –II**

**Topics:** Compound nouns, imperatives, writing instructions, interpreting charts and pictures, note making, role play, prefixes, subject-verb agreement.

**Text:** EMERGING TECHNOLOGIES from *MINDSCAPES*  
Solar Thermal Power - Cloud Computing - Nanotechnology

### **UNIT –III**

**Topics:** Making conversations, homonyms and homophones, SMS and use of emotions, past participle for irregular verbs, group discussion, E - mail communication, antonyms, Preparing projects

**Text:** GLOBAL ISSUES from *MINDSCAPES*  
Child Labour - Food Crisis - Genetic Modification - E-Waste - Assistive Technology

### **UNIT –IV**

**Topics:** Group discussion, affixes, double consonants, debates, writing a book / film review, predicting and problem-solving-future tense, adverbs

**Text:** SPACE TREK from *MINDSCAPES*  
Hubble Telescope - Chandrayan-2 - Anusat - Living Quarters - Space Tourism

### **UNIT –V**

**Topics:** Compare and contrast, effective writing, group discussion, writing reports, writing advertisements, tweeting and blogging, types of interviews, framing questions.

**Text:** MEDIA MATTERS from *MINDSCAPES*  
History of Media - Language and Media - Milestone in Media - Manipulation by Media - Entertainment Media - Interviews

**Text Books:**

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1. MINDSCAPES: English for Technologists and Engineers, Orient Blackswan, 2014.

**References:**

1. A Practical Course in Effective English Speaking Skills by J.K.Gangal, PHI Publishers, New Delhi.2012
2. Technical Communication, Meenakshi Raman, Oxford University Press,2011.
3. Spoken English, R.K. Bansal & JB Harrison, Orient Longman,2013, 4<sup>Th</sup> edition.
4. Murphy's English Grammar with CD, Murphy, Cambridge University Press,3<sup>Rd</sup> edition.
5. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO,2008.

**Outcomes:**

- Have improved communication in listening, speaking, reading and writing skills in general.
- Have developed their oral communication and fluency in group discussions and interviews.
- Have improved awareness of English in science and technology context.
- Have achieved familiarity with a variety of technical reports.



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B. Tech I-I Sem. (EEE)**

L	T	P	C
3	1	0	3

**(15A54101) MATHEMATICS – I**

**(Common to All Branches)**

**Objectives:**

- To train the students thoroughly in Mathematical concepts of ordinary differential equations and their applications.
- To prepare students for lifelong learning and successful careers using mathematical concepts of differential and Integral calculus, ordinary differential equations and vector calculus.
- To develop the skill pertinent to the practice of the mathematical concepts including the students abilities to formulate and modeling the problems, to think creatively and to synthesize information.

**UNIT – I**

Exact, linear and Bernoulli equations, Applications to first order equations; Orthogonal trajectories, Simple electric circuits.

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x$ ,  $e^{ax}V(x)$ ,  $xV(x)$ .

**UNIT – II**

Method of variation of parameters, linear equations with variable coefficients: Euler-Cauchy Equations, Legendre's linear equation. Applications of linear differential equations- Mechanical and Electrical oscillatory circuits and Deflection of Beams.

**UNIT – III**

Taylor's and Maclaurin's Series - Functions of several variables – Jacobian – Maxima and Minima of functions of two variables, Lagrange's method of undetermined Multipliers with three variables only. Radius of curvature.

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## UNIT – IV

Multiple integral – Double and triple integrals – Change of Variables – Change of order of integration. Applications to areas and volumes in Cartesian and polar coordinates using double and triple integral.

## UNIT – V

Vector Calculus: Gradient – Divergence – Curl and their properties; Vector integration – Line integral - Potential function – Area – Surface and volume integrals. Vector integral theorems: Green's theorem – Stoke's and Gauss's Divergence Theorem (Without proof). Application of Green's, Stoke's and Gauss's Theorems.

### Text Books:

1. Engineering Mathematics-I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher
2. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.

### References:

1. Engineering Mathematics Volume-I, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publication.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

### Outcomes:

- The students become familiar with the application of differential and integral calculus, ordinary differential equations and vector calculus to engineering problems.
- The students attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

<b>B. Tech I-I Sem. (EEE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**(15A05101) COMPUTER PROGRAMMING**

**(Common to All Branches)**

**Objectives:**

- Understand problem solving techniques
- Understand representation of a solution to a problem
- Understand the syntax and semantics of C programming language
- Understand the significance of Control structures
- Learn the features of C language

**UNIT - I**

Overview of Computers and Programming - Electronic Computers Then and Now - Computer Hardware - Computer Software - Algorithm - Flowcharts - Software Development Method - Applying the Software Development Method.

Types, Operators and Expressions: Variable Names - Data Types and Sizes - Constants - Declarations - Arithmetic Operators - Relational and Logical Operators - Type Conversions - Increment and Decrement Operators - Bitwise Operators - Assignment Operators and Expressions - Conditional Expressions - Precedence and Order of Evaluation.

**UNIT - II**

Selections Statements – Iteration Statements – Jump Statements- Expression Statements - Block Statements.

Single Dimensional Arrays – Generating a Pointer to an Array – Passing Single Dimension Arrays to Functions – Strings – Two Dimensional Arrays – Indexing Pointers – Array Initialization – Variable Length Arrays

**UNIT - III**

Pointer Variables – Pointer Operators - Pointer Expressions – Pointers And Arrays – Multiple Indirection – Initializing Pointers – Pointers to Functions – C’s Dynamic Allocation Functions – Problems with Pointers.

Understanding the scope of Functions – Scope Rules – Type Qualifiers – Storage Class Specifiers- Functions Arguments –The Return Statement.

#### **UNIT - IV**

Command line arguments – Recursion – Function Prototypes – Declaring Variable Length Parameter Lists

Structures – Arrays of Structures – Passing Structures to Functions – Structure Pointers – Arrays and Structures within Structures – Unions – Bit Fields – Enumerations – typedef

#### **UNIT - V**

Reading and Writing Characters – Reading and Writing Strings – Formatted Console I/O – Printf - Scanf – Standard C Vs Unix File I/O – Streams and Files – File System Basics – Fread and Fwrite – Fseek and Random Access I/O – Fprintf ( ) and Fscanf( ) – The Standard Streams – The Preprocessor Directives #define and #include.

#### **Text Books:**

1. “The Complete Reference C”- Fourth Edition- Herbert Schildt- McGrawHill Education.
2. “The C Programming Language” Second Edition- Brian W. Kernighan- Dennis M. Ritchie- Prentice Hall-India. (UNIT- I)

#### **References:**

1. Programming in C, Second Edition – Pradip Dey, Manas Ghosh, Oxford University Press.
2. “C From Theory to Practice”- George S. Tselikis- Nikolaos D. Tselikas- CRC Press.
3. “Programming with C”- R S Bichkar- University Press.
4. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, Pearson Education. (UNIT-I)
5. Computer Fundamentals and C Programming- Second Edition- P.Chenna Reddy- Available at Pothi.com (<http://pothi.com/pothi/book/dr-p-chenna-reddy-computer-fundamentals-and-c-programming>).

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**Outcomes:**

- Apply problem solving techniques in designing the solutions for a wide-range of problems
- Choose appropriate control structure depending on the problem to be solved
- Modularize the problem and also solution

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B. Tech I-I Sem. (EEE)**

L	T	P	C
3	1	0	3

**(15A56101) ENGINEERING PHYSICS****(Common to CSE/EEE/CIVIL)****Objectives:**

- To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
- To enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes, crystal structure determination by X-rays and non-destructive evaluation using ultrasonic techniques.
- To get an insight into the microscopic meaning of conductivity, classical and quantum free electron model, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials and to understand electron transport mechanism in solids.
- To open new avenues of knowledge and understanding semiconductor based electronic devices, basic concepts and applications of semiconductors and magnetic materials have been introduced which find potential in the emerging micro device applications.
- To give an impetus on the subtle mechanism of superconductors in terms of conduction of electron pairs using BCS theory, different properties exhibited by them and their fascinating applications. Considering the significance of microminiaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their synthesis, properties and applications in emerging technologies are elicited.

**UNIT - I****PHYSICAL OPTICS, LASERS AND FIBRE OPTICS**

*Physical Optics:* Interference (Review) – Interference in thin film by reflection – Newton's rings – Diffraction (Review) - Fraunhofer diffraction due to single slit, double slit and diffraction grating.

*Lasers:* Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients — Population inversion – Excitation mechanism and optical

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resonator – Nd:YAG laser - He-Ne laser – Semiconductor Diode laser - Applications of lasers

*Fiber optics:* Introduction - construction and working principle of optical fiber – Numerical aperture and acceptance angle – Types of optical fibers – Attenuation and losses in Optical fibers –Block diagram of Optical fiber communication system – Applications of optical fibers

## **UNIT – II**

### **CRYSTALLOGRAPHY AND ULTRASONICS**

*Crystallography:* Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg’s law – Powder method.

*Ultrasonics:* Introduction – Production of ultrasonics by piezoelectric method – Properties and detection – Applications in non-destructive testing.

## **UNIT – III**

### **QUANTUM MECHANICS AND ELECTRON THEORY**

*Quantum Mechanics:* Matter waves – de’Broglie hypothesis and properties - Schrodinger’s time dependent and independent wave equations – Physical significance of wave function - Particle in one dimensional infinite potential well.

*Electron theory:* Classical free electron theory – Equation for electrical conductivity - Quantum free electron theory – Fermi-Dirac distribution – Source of electrical resistance – Kronig-Penny model (qualitative treatment) – Origin of bands in solids – Classification of solids into conductors, semiconductors and insulators.

## **UNIT – IV**

### **SEMICONDUCTORS AND MAGNETIC MATERIALS**

*Semiconductors:* Intrinsic and extrinsic semiconductors (Qualitative treatment) – Drift & diffusion currents and Einstein’s equation – Hall effect - Direct and indirect band gap semiconductors – Formation of p-n junction.

*Magnetic materials:* Introduction and basic definitions – Origin of magnetic moments – Bohr magnetron – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials (Qualitative treatment) – Hysteresis - Soft and hard magnetic materials, applications of magnetic materials.

## UNIT – V

### SUPERCONDUCTIVITY AND PHYSICS OF NANOMATERIALS

*Superconductivity:* Introduction - Effect of magnetic field - Meissner effect – Type I and Type II superconductors – Flux quantization – Penetration depth - BCS theory (qualitative treatment) — Josephson effects –Applications of superconductors.

*Physics of Nanomaterials:* Introduction - Significance of nanoscale and types of nanomaterials – Physical properties: optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials by Top down and bottom up approaches: ball mill, chemical vapour deposition, and sol gel –Applications of nanomaterials.

#### Text Books:

1. Engineering Physics – K.Thyagarajan, 5<sup>th</sup> Edition, MacGraw Hill Publishers, NewDelhi, 2014.
2. Physics for Engineers - N.K Verma, 1<sup>st</sup> Edition, PHI Learning Private Limited, New Delhi,2014.

#### References:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, 10<sup>th</sup> Edition, S.Chand and Company, New Delhi, 2014.
2. Engineering Physics – D K Pandey, S. Chaturvedi, 2<sup>nd</sup> Edition, Cengage Learning, New Delhi, 2013.
3. Engineering Physics – D.K Bhattacharya, Poonam Tandon, 1<sup>nd</sup> Edition, Oxford University Press, New Delhi, 2015.



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**Outcomes:**

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fibre optics.
- The important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction are focused along with defects in crystals and ultrasonic non-destructive techniques.
- The discrepancies between the classical estimates and laboratory observations of physical properties exhibited by materials would be lifted through the understanding of quantum picture of subatomic world.
- The electronic and magnetic properties of materials were successfully explained by free electron theory and the bases for the band theory are focused.
- The properties and device applications of semiconducting and magnetic materials are illustrated.
- The importance of superconducting materials and nanomaterials along with their engineering applications are well elucidated.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B. Tech I-I Sem. (EEE)**

<b>L</b>	<b>T</b>	<b>Drg</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>6</b>	<b>3</b>

**(15A03101) ENGINEERING DRAWING**

**(Common to CSE/EEE/CIVIL)**

**Objectives:**

- To gain and understanding of the basics of geometrical constructions of various planes and solids, understanding system of graphical representation of various objects and various views to draft and read the products to be designed and eventually for manufacturing applications.
- To learn about various projections, to understand complete dimensions and details of object.
- Ultimately student must get imaginary skill to put an idea of object, circuit, assembly of parts in black & white, to design a product and to understand the composition, which can be understood universally.

**UNIT I**

**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their Significance- Conventions in Drawing-Lettering – BIS Conventions. Curves used in Engineering Practice. a) Conic Sections including the Rectangular Hyperbola- General method only, b) Cycloid, Epicycloid and Hypocycloid

**UNIT II**

**Scales:** Plain, Diagonal and Vernier;

**Projection of Points:** Principles of orthographic projection – Convention – First angle projections, projections of points.

**UNIT III**

**Projections of Lines:** lines inclined to one or both planes, Problems on projections, Finding True lengths.

**Projections of Planes:** Projections of regular plane surfaces- plane surfaces inclined to both planes.

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## UNIT IV

**Projections of Solids:** Projections of Regular Solids with axis inclined to both planes.

**Developments of Solids:** Development of Surfaces of Right Regular Solids-Prism, Cylinder, Pyramid, Cone.

## UNIT V

**Isometric and Orthographic Projections:** Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Isometric projections of spherical parts. Conversion of isometric Views to Orthographic Views.

### **Text Books:**

1. *Engineering Drawing, N.D. Bhatt, Charotar Publishers*
2. *Engineering Drawing, K.L. Narayana & P. Kannaih, Scitech Publishers, Chennai*

### **References:**

1. *Engineering Drawing, Johle, Tata McGraw-Hill Publishers*
2. *Engineering Drawing, Shah and Rana, 2/e, Pearson Education*
3. *Engineering Drawing and Graphics, Venugopal/New age Publishers*
4. *Engineering Graphics, K.C. John, PHI, 2013*
5. *Engineering Drawing, B.V.R. Gupta, J.K. Publishers*

### **Outcomes:**

- Drawing 2D and 3D diagrams of various objects.
- Learning conventions of Drawing, which is an Universal Language of Engineers.
- Drafting projections of points, planes and solids.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B. Tech I-I Sem. (EEE)**

L	T	P	C
0	0	4	2

**(15A52102) ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB**

**(Common to All Branches)**

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

**Objectives:**

- To enable students to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

**UNIT - 1**

1. Phonetics -importance
2. Introduction to Sounds of Speech
3. Vowels and consonants sounds
4. Phonetic Transcription

**UNIT - II**

5. Word Stress
6. Syllabification
7. Rules of word stress
8. Intonation

**UNIT - III**

9. Situational Dialogues
10. Role Plays
11. JAM
12. Describing people/objects/places

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## UNIT - IV

13. Debates
14. Group Discussions
15. Interview skills

## UNIT - V

16. Video speech writing
17. Book reviews -oral and written

### Minimum Requirements for ELCS Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.  
System Requirement (Hardware component):

Computer network with LAN with minimum 60 multimedia systems with the following specifications:

- i) P – IV Processor
  - a) Speed – 2.8 GHZ
  - b) RAM – 512 MB Minimum
  - c) Hard Disk – 80 GB
- ii) Headphones of High quality

### Suggested Software:

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – part II
3. K-Van Advanced Communication Skills
4. Walden InfoTech Software.

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**References:**

1. A Textbook of English Phonetics for Indian Students 2<sup>nd</sup> Ed T. Balasubramanian. (Macmillian),2012.
2. A Course in Phonetics and Spoken English, Dhamija Sethi, Prentice-Hall of India Pvt.Ltd
3. Speaking English Effectively, 2<sup>nd</sup> Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
4. A Hand book for English Laboratories, E.Suresh Kumar, P.Sreehari, Foundation Books,2011
5. Spring Board Succes, Sharada Kouhik, Bindu Bajwa, Orient Blackswan, Hyderabad, 2010.

**Outcomes:**

- Become active participants in the learning process and acquire proficiency in spoken English.
- Speak with clarity and confidence thereby enhance employability skills.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B. Tech I-I Sem. (EEE)**

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**(15A56102) ENGINEERING PHYSICS LABORATORY**

**(Common to CSE/EEE/CIVIL)**

**Objectives:**

- Will recognize the important of optical phenomenon like Interference and diffraction.
- Will understand the role of optical fiber parameters and signal losses in communication.
- Will recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor
- Will understand the applications of B H curve.
- Will acquire a practical knowledge of studying the crystal structure in terms of lattice constant.
- Will recognize the application of laser in finding the particle size and its role in diffraction studies.
- Will learn to synthesis of the nanomaterials and recognize its importance by knowing its nano particle size and its impact on its properties.

**Any 10 of the following experiments has to be performed during the I year I semester**

1. Determination of radius of curvature of a Plano-convex lens by forming Newton's rings.
2. Determination of wavelength of given source using diffraction grating in normal incidence method.
3. Determination of Numerical aperture, acceptance angle of an optical fiber.
4. Energy gap of a Semiconductor diode.
5. Hall effect – Determination of mobility of charge carriers.
6. B-H curve – Determination of hysteresis loss for a given magnetic material.
7. Determination of Crystallite size using X-ray pattern (powder) using debye-scheerer method.
8. Determination of particle size by using laser source.
9. Determination of dispersive power of a prism.
10. Determination of thickness of the thin wire using wedge Method.
11. Laser : Diffraction due to single slit
12. Laser : Diffraction due to double slit
13. Laser: Determination of wavelength using diffraction grating

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14. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
  15. Synthesis of nanomaterial by any suitable method.

**References:**

1. Engineering Physics Practicals – NU Age Publishing House, Hyderabad.
2. Engineering Practical physics – Cengage Learning, Delhi.

**Outcomes:**

- Would recognize the important of optical phenomenon like Interference and diffraction.
- Would have acquired the practical application knowledge of optical fiber, semiconductor, dielectric and magnetic materials, crystal structure and lasers by the study of their relative parameters.
- Would recognize the significant importance of nanomaterials in various engineering fields.



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**B. Tech I-I Sem. (EEE)**

L	T	P	C
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**(15A05102) COMPUTER PROGRAMMING LAB**

**(Common to All branches)**

**Objectives:**

- Learn C Programming language
- To make the student solve problems, implement algorithms using C language.

**List of Experiments/Tasks**

1. Practice DOS and LINUX Commands necessary for design of C Programs.
2. Study of the Editors, Integrated development environments, and Compilers in chosen platform.
3. Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.
4. Practice programs: Finding the sum of three numbers, exchange of two numbers, maximum of two numbers, To read and print variable values of all data types of C language, to find the size of all data types, to understand the priority and associativity of operators using expressions, to use different library functions of C language.
5. Write a program to find the roots of a Quadratic equation.
6. Write a program to compute the factorial of a given number.
7. Write a program to check whether the number is prime or not.
8. Write a program to find the series of prime numbers in the given range.
9. Write a program to generate Fibonacci numbers in the given range.
10. Write a program to find the maximum of a set of numbers.
11. Write a program to reverse the digits of a number.
12. Write a program to find the sum of the digits of a number.
13. Write a program to find the sum of positive and negative numbers in a given set of numbers.
14. Write a program to check for number palindrome.
15. Write a program to evaluate the sum of the following series up to 'n' terms  
$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$$
16. Write a program to generate Pascal Triangle.
17. Write a program to read two matrices and print their sum and product in the matrix form.
18. Write a program to read matrix and perform the following operations.
  - i. Find the sum of Diagonal Elements of a matrix.
  - ii. Print Transpose of a matrix.

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- iii. Print sum of even and odd numbers in a given matrix.
19. Write a program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters.
  20. Write a program to insert a substring in to a given string and delete few characters from the string. Don't use library functions related to strings.
  21. Write a program to perform the operations addition, subtraction, multiplication of complex numbers.
  22. Write a program to split a 'file' in to two files, say file1 and file2. Read lines into the 'file' from standard input. File1 should consist of odd numbered lines and file2 should consist of even numbered lines.
  23. Write a program to merge two files.
  24. Write a program to implement numerical methods Lagrange's interpolation, Trapezoidal rule.
  25. Write a program to read a set of strings and sort them in alphabetical order.
  26. Write a program to read two strings and perform the following operations without using built-in string Library functions and by using your own implementations of functions.
    - i. String length determination
    - ii. Compare Two Strings
    - iii. Concatenate them, if they are not equal
    - iv. String reversing
  27. Write programs using recursion for finding Factorial of a number, GCD, LCM, and solving Towers of Hanoi problem.
  28. Write a program to exchange two numbers using pointers.
  29. Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per JNTUA rules. Write the first class, second class, third class and failed students lists separately to another file.
  30. A file consists of information about employee salary with fields employeeid, name, Basic, HRA, DA, IT, other-deductions, Gross and Net salary. Initially only employeeid, name, and basic have valid values. HRA is taken as 10% of the basic, DA is taken as 80% of basic, IT is 20% of the basic, other deductions is user specified. Compute the Gross and Net salary of the employee and update the file.
  31. Write a program to perform Base (decimal, octal, hexadecimal, etc) conversion.
  32. Write a program to find the square root of a number without using built-in library function.
  33. Write a program to convert from string to number.
  34. Write a program to implement pseudo random generator.
  35. Write a program to generate multiplication tables from 11 to 20.
  36. Write a program to express a four digit number in words. For example 1546 should be written as one thousand five hundred and forty six.

37. Write a program to generate a telephone bill. The contents of it and the rate calculation etc should be as per BSNL rules. Student is expected to gather the required information through the BSNL website.
38. Write a program to find the execution time of a program.
39. Design a file format to store a person's name, address, and other information. Write a program to read this file and produce a set of mailing labels

**Note:**

1. Instructors are advised to conduct the lab in LINUX/UNIX environment also
2. The above list consists of only sample programs. Instructors may choose other programs to illustrate certain concepts, wherever is necessary. Programs should be there on all the concepts studied in Theory. Instructors are advised to change atleast 25% of the programs every year until the next syllabus revision.

**References:**

1. "How to Solve it by Computer", R.G. Dromey, Pearson.
2. "The C Programming Language", Brian W. Kernighan, Dennis M. Ritchie, Pearson.
3. "Let us C", Yeswant Kanetkar, BPB publications
4. "Pointers in C", Yeswant Kanetkar, BPB publications.
5. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, Pearson Education.

**Outcomes:**

- Apply problem solving techniques to find solutions to problems
- Able to use C language features effectively and implement solutions using C language.
- Improve logical skills.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

<b>B. Tech I-II Sem. (EEE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**(15A54201) MATHEMATICS – II**

**(Common to All Branches)**

**Objectives:** Our emphasis will be more on conceptual understanding and application of Fourier series, Fourier, Z and Laplace transforms and solution of partial differential equations.

**UNIT – I**

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac’s delta function – Convolution theorem – Laplace transform of Periodic function.

Differentiation and integration of transform – Application of Laplace transforms to ordinary differential equations of first and second order.

**UNIT – II**

Fourier Series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd periodic continuation – Half-range Fourier sine and cosine expansions- Parseval’s formula- Complex form of Fourier series.

**UNIT – III**

Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

**UNIT – IV**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation, heat equation and two-dimensional Laplace’s equation under initial and boundary conditions.

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**UNIT – V**

z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

**TEXT BOOKS:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.

**REFERENCES:**

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
2. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

**Outcomes:** The student gains the knowledge to tackle the engineering problems using the concepts of Fourier series, various transforms and partial differential equations.

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<b>B. Tech I-II Sem. (EEE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**(15A52201) ENGLISH FOR PROFESSIONAL COMMUNICATION**

**1. INTRODUCTION:**

English is a global language and has international appeal and application. It is widely used in a variety of contexts and for varied purposes. The students would find it useful both for social and professional development. There is every need to help the students acquire skills useful to them in their career as well as workplace. They need to write a variety of documents and letters now extending into professional domain that cuts across business and research also. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed book serves the purpose of preparing them for everyday communication and to face the global competitions in future.

The text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

**2. OBJECTIVES:**

1. To develop confidence in the students to use English in everyday situations.
2. To enable the students to read different discourses so that they appreciate English for science and technologies.
3. To improve familiarity with a variety of technical writings.
4. To enable the students to acquire structure and written expressions required for their profession.
5. To develop the listening skills of the students.

**3. SYLLABUS:**

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### **UNIT -I**

**Topics:** Group discussion, cause and effect, events and perspectives, debate, if conditional, essay writing.

**Text: LESSONS FROM THE PAST** from **MINDSCAPES**

Importance of History - Differing Perspectives - Modern Corporatism - Lessons From The Past

### **UNIT-II**

**Topics:** Idioms, essay writing, power point presentation, modals, listening and rewriting, preparing summary, debate, group discussion, role play, writing a book review, conversation

**Text: 'ENERGY'** from **MINDSCAPES**

Renewable and Non-Renewable Sources - Alternative Sources - Conservation -Nuclear Energy

### **UNIT-III**

**Topics:** Vocabulary, impromptu speech, creative writing, direct and indirect speech, fixed expressions, developing creative writing skills, accents, presentation skills, making posters, report writing

**Text: 'ENGINEERING ETHICS'** from **MINDSCAPES**

Challenger Disaster - Biotechnology - Genetic Engineering - Protection From Natural Calamities

### **UNIT-IV**

**Topics:** Vocabulary, Conversation, Collocation, Group discussion, Note-making, Clauses, Interpreting charts and tables, Report writing.

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**Text: 'TRAVEL AND TOURISM' from *MINDSCAPES***

Advantages and Disadvantages of Travel - Tourism - Atithi Devo Bhava - Tourism in India

**UNIT-V**

**Topics:** Vocabulary, phrasal verbs, writing a profile, connectives, discourse markers, problem-solving, telephone skills, application letters, curriculum vitae, interviews (telephone and personal)

**Text: 'GETTING JOB-READY' from *MINDSCAPES***

SWOT Analysis - Companies And Ways Of Powering Growth - Preparing For Interviews

**Prescribed Text**

***MINDSCAPES***: English for Technologists and Engineers, Orient Blackswan, 2014.

**REFERENCES:**

1. **Effective Tech Communication**, [Rizvi](#), Tata McGraw-Hil

Education, 2007.

2. **Technical Communication**, Meenakshi Raman, Oxford University Press.

3. **English Conversations Prcatice**, Grant Taylor, Tata Mc GrawHill publications,2013.

4.**Practical English Grammar**. Thomson and Martinet, OUP, 2010.

**Expected Outcomes:**

At the end of the course, students would be expected to:

1. Have acquired ability to participate effectively in group discussions.
2. Have developed ability in writing in various contexts.
3. Have acquired a proper level of competence for employability.



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	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**(15A51101) ENGINEERING CHEMISTRY**

**(Common to All Branches)**

**Objectives:**

- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
- The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
- The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.
- After the completion of the course, the student would understand the concepts of chemistry and apply to various materials for engineering applications.

**UNIT – I                      WATER QUALITY AND TREATMENT**

Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching powder, ozonisation)

Industrial Use of water:

For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.

Treatment of Boiler Feed water:

Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.

External Treatment: Ion-Exchange and Permutit processes.

Demineralisation of brackish water: Reverse Osmosis and Electrodialysis

## **UNIT – II            POLYMERS**

i) Introduction: Basic concepts of polymerisation, Types of polymerisation (Chain Growth (Addition), Step growth (Condensation)), Mechanism: cationic, anionic, free radical and coordination covalent.

Plastomers: Thermosetting and Thermoplastics, Preparation, properties and Engineering applications of PVC, Teflon, Bakelite and nylons.

Elastomers

Natural Rubber; Processing of natural rubbers, Compounding of Rubber

Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, Buna-N, Polyurethane, Polysulfide (Thiokol) rubbers

ii) Conducting polymers: Mechanism, synthesis and applications of polyacetylene, polyaniline.

iii) Inorganic Polymers: Basic Introduction, Silicones, Polyphosphazins (- (R)2-P=N-) applications

## **UNIT – III            ELECTROCHEMISTRY**

i) Galvanic cells, Nernst Equation, Numerical calculations, Batteries: Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries), Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen, Solid oxide)

ii) Corrosion: Introduction, type of corrosion (Concentration cell corrosion, Galvanic corrosion), Chemical (Dry) and Electrochemical (Wet) Theory of corrosion. Galvanic series, factors affecting the corrosion (Metal and environment). Prevention: Cathodic protection (Sacrificial anode and impressed current), Inhibitors (Anodic and cathodic), electroplating (Copper, nickel and chromium) and electroless plating (Copper and nickel)

#### **UNIT – IV            FUELS AND COMBUSTION**

Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems.

Solid Fuels: Coal-Classification and Analysis (proximate and ultimate), Coke :Characteristics of metallurgical coke, Manufacture of Metallurgical Coke by Otto Hoffmann's by product oven processes.

Liquid Fuels:

Petroleum: Refining of Petroleum, Gasoline- Octane Number, Diesel - Cetane Number, Synthetic Petrol: Bergius Processes, Fischer Troph's synthesis

Power Alcohol: Manufacture, Advantages and Disadvantages of Power Alcohol

Gaseous Fuels: Natural gas, Producer gas, Water gas, Coal gas and Biogas. Determination calorific value of Gases fuels by Junker's calorimeter.

Combustion: Basic principles and numerical problems, Flue Gas analysis by Orsat's apparatus.

#### **UNIT – V            CHEMISTRY OF ENGINEERING MATERIALS**

i) Cement: Composition, Classification, preparation (Dry and Wet processes), Setting and Hardening (Hydration and Hydrolysis)

- ii) Refractories: Introduction, Classification , properties and applications
- iii) Lubricants: Introduction, classification (Solid, liquid, semi solid, emulsion and synthetic),Theory of lubrication (Thin film, Thick film & Extreme pressure) , properties of lubricants and applications.
- iv) Carbon clusters: Fullerenes and Carbon Nano Tubes (CNT)

**Text Books:**

1. Engineering Chemistry, First Edition, Jayaveera KN, Subba Reddy GVand Ramachandraiah C, McGraw Hill Higher Education, New Delhi, 2013.
2. A Text Book of Enigneering Chemistry, 15<sup>th</sup> Edition, Jain and Jain, Dhanapathi Rai Publications, New Delhi, 2013.

**References:**

1. A Text book of Engineering Chemistry, 12<sup>th</sup> Edition, SS Dhara,Uma, S. Chand Publications, New Delhi, 2010.
2. Engineering Chemistry, First edition, K.B. Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Publications India Pvt Limited, 2010.
3. Engineering Chemistry, First edition, Seshamaheswaramma K and Mridula Chugh, Pearson Education, 2013.

**Outcomes:** The student is expected to:

- Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.
- Understand the electrochemical sources of energy
- Understand industrially based polymers, various engineering materials.

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**B. Tech I-II Sem. (EEE)**

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**(15A01101) ENVIRONMENTAL STUDIES**

**OBJECTIVE:** To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

**UNIT – I**

**MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: –**

Definition, Scope and Importance – Need for Public Awareness.

**NATURAL RESOURCES :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

**UNIT – II**

**ECOSYSTEMS:** Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and

ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**BIODIVERSITY AND ITS CONSERVATION** : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **UNIT – III**

**ENVIRONMENTAL POLLUTION:** Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

**SOLID WASTE MANAGEMENT :** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

#### **UNIT – IV**

**SOCIAL ISSUES AND THE ENVIRONMENT:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

#### **UNIT – V**

**HUMAN POPULATION AND THE ENVIRONMENT:** Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**FIELD WORK :** Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-

Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

**TEXT BOOKS :**

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.

**REFERENCES :**

1. Environmental studies by R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

**Outcomes :**

- (1) Students will get the sufficient information that will clarify modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.
- (2) Students will realize the need to change their approach so as to perceive our own environmental issues correctly, using practical approach based on observation and self learning.
- (3) Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.



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- (4) By studying environmental sciences, students is exposed to the environment that enables one to find out solution of various environmental problems encountered on and often.

At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted. This will enable every human being to live in a more sustainable manner.

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**(15A02201) ELECTRICAL CIRCUITS - I**

**Objectives:**

To make the student learn about

- Basic characteristics of R,L,C parameters
- The concepts of real power, reactive power, complex power, phase angle and phase difference
- How to compute two port network parameters
- Network reduction techniques, star to delta and delta to star transformations
- Series and parallel resonances, bandwidth, current locus diagrams
- Network theorems and their applications

**UNIT- I                      INTRODUCTION TO ELECTRICAL & MAGNETIC CIRCUITS**

**Electrical Circuits:** Circuit Concept, R, L and C Parameters - Independent and Dependent Voltage and Current Sources -Source Transformation, Voltage - Current Relationship for Passive Elements (For Different Input Signals: Square, Ramp, Saw Tooth, Triangular. Kirchhoff's Laws, Network Reduction Techniques: Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. Examples

**Magnetic Circuits:** Faraday's Laws of Electromagnetic Induction, Concept of Self and Mutual Inductance, Dot Convention, Coefficient of Coupling, Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

## **UNIT- II SINGLE PHASE A.C CIRCUITS**

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms: Sinusoidal Alternating Quantities. Phase and Phase Difference, Complex and Polar Forms Of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) With Sinusoidal Excitation, Concept of Power Factor, Concept of Reactance, Impedance, Susceptance and Admittance-Real and Reactive Power and Complex Power. Examples.

## **UNIT- III LOCUS DIAGRAMS & RESONANCE**

Series R-L, R-C, R-L-C and Parallel Combination with Variation of Parameters. Resonance: Series, Parallel Circuits, Concept of Bandwidth and Q Factor.

## **UNIT- IV NETWORK THEOREMS**

Thevenin's, Norton's, Maximum Power Transfer, Millman's Theorems, Tellegen's, Superposition, Reciprocity and Compensation Theorems for D.C And Sinusoidal Excitations.

## **UNIT- V TWO PORT NETWORKS**

Two Port Network Parameters: Impedance, Admittance, Transmission and Hybrid Parameters and their Relations. Concept of Transformed Network, Two Port Network Parameters Using Transformed Variables.

### **Outcome:**

After completing the course, the student should be able to do the following:

- Given a network, find the equivalent impedance by using network reduction techniques
- Given a circuit and the excitation, determine the real power, reactive power, power factor etc.,.
- Determine the current through any element and voltage across any element
- Apply the network theorems suitably

**TEXT BOOKS:**

1. Electrical Circuit Theory and Technology 4th Edition, John Bird, Rvtledge/T&F, 2011.
2. Network Analysis 3<sup>rd</sup> Edition, M.E Van Valkenberg, PHI.

**REFERENCES:**

1. Circuit Theory (Analysis & Synthesis) 6<sup>th</sup> Edition, A. Chakrabarti, Dhanpat Rai & Sons, 2008.
2. Electric Circuits by N.Sreenivasulu, REEM Publications
3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 6<sup>th</sup> edition.
4. Circuits & Networks by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill

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**B. Tech I-II Sem. (EEE)** **L T P C**  
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**(15A51102) ENGINEERING CHEMISTRY LAB**

**(Common to All Branches)**

**Objectives:**

- Will learn practical understanding of the redox reaction
- Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
- Will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology.

**List of Experiments:**

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
5. Determination of Alkalinity of Water
6. Determination of acidity of Water
7. Preparation of Phenol-Formaldehyde (Bakelite)
8. Determination of Viscosity of oils using Redwood Viscometer I
9. Determination of Viscosity of oils using Redwood Viscometer II
10. Determination of calorific value of gaseous fuels by Junker's Calorimeter

11. Conductometric estimation of strong acid using standard sodium hydroxide solution
12. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.
13. Potentio metric determination of iron using standard potassium dichromate
14. Colorometric estimation of manganese.
15. PH meter calibration and measurement of PH of water and various other samples.

(Any 10 experiments from the above list)

**References:**

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – Mendham J et al, Pearson Education, 2012.
2. Chemistry Practical- Lab Manual, First edition, Chandra Sekhar KB, Subba Reddy GV and Jayaveera KN, SM Enterprises, Hyderabad, 2014.

**Outcomes:**

- Would be confident in handling energy storage systems and would be able combat chemical corrosion
- Would have acquired the practical skill to handle the analytical methods with confidence.
- Would feel comfortable to think of design materials with the requisite properties
- Would be in a position to technically address the water related problems.

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<b>B. Tech I-II Sem. (EEE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**(15A02202) ELECTRICAL CIRCUITS LAB**

**OBJECTIVES:**

To make the student learn about:

- Experimental verification of theorems
- Experimental verification of Resonance phenomenon
- Drawing current locus diagrams
- Practical determination of two port network parameters
- Practical implementation of active and reactive power measurement techniques

**List of Experiments:**

- 1) Verification of Thevenin's and Norton's Theorems
- 2) Verification of Superposition Theorem and Maximum Power Transfer Theorem
- 3) Verification of Compensation Theorem
- 4) Verification of Reciprocity , Millmann's Theorems
- 5) Locus Diagrams of RL and RC Series Circuits
- 6) Series and Parallel Resonance
- 7) Determination of Self, Mutual Inductances and Coefficient of Coupling
- 8) Z and Y Parameters
- 9) Transmission and Hybrid Parameters
- 10) Measurement of Active Power for Star and Delta Connected Balanced Loads
- 11) Measurement of Reactive Power for Star and Delta Connected Balanced Loads
- 12) Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads

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**OUTCOMES:**

After completing the course, the student should be able to do the following:

- Apply suitable theorems for circuit analysis and verify the results theoretically
- Experimental determination of two port network parameters and theoretical verification
- Measure active and reactive power experimentally and verify the theoretical values
- Experimentally determine self inductance, mutual inductance and coefficient of coupling
- Practically determine band width, Q-factor and verify with theoretical values.



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	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**(15A99201) ENGINEERING & I.T. WORKSHOP****ENGINEERING WORKSHOP****Course Objective:**

*The budding Engineer may turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering work shop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.*

**1. TRADES FOR EXERCISES:**

- a. Carpentry shop– Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, cross lap joint, mortise and tenon T joint, Bridle T joint from out of 300 x 40 x 25 mm soft wood stock
- b. Fitting shop– Two joints (exercises) from: square joint, V joint, half round joint or dove tail joint out of 100 x 50 x 5 mm M.S. stock
- c. Sheet metal shop– Two jobs (exercises) from: Tray, cylinder, hopper or funnel from out of 22 or 20 guage G.I. sheet
- d. House-wiring– Two jobs (exercises) from: wiring for ceiling rose and two lamps (bulbs) with independent switch controls with or without looping, wiring for stair case lamp, wiring for a water pump with single phase starter.
- e. Foundry– Preparation of two moulds (exercises): for a single pattern and a double pattern.
- f. Welding – Preparation of two welds (exercises): single V butt joint, lap joint, double V butt joint or T fillet joint.

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## 2. TRADES FOR DEMONSTRATION:

- a. Plumbing
- b. Machine Shop
- c. Metal Cutting

Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, First aid, shop safety etc. (though they may not be used for the exercises but they give valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.

### **References:**

1. *Engineering Work shop practice for JNTU*, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009
2. *Work shop Manual* / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. *Engineering Practices Lab Manual*, Jeyapooan, SaravanaPandian, 4/e Vikas
4. *Dictionary of Mechanical Engineering*, GHF Nayler, Jaico Publishing House.

## I.T. WORKSHOP

### **Course Objective:**

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- To learn about Networking of computers and use Internet facility for Browsing and Searching.

### **Learning Outcome:**

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors

- Prepare Slide presentations using the presentation tool
- Interconnect two or more computers for information sharing
- Access the Internet and Browse it to obtain the required information
- Install single or dual operating systems on computer

### **Preparing your Computer ( 5 weeks)**

**Task 1: Learn about Computer:** Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

**Task 2: Assembling a Computer:** Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

**Task 3: Install Operating system:** Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

**Task 4: Operating system features:** Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

### **Networking and Internet (4 weeks)**

**Task 5: Networking:** Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share

information. Crimpling activity, logical configuration etc should be done by the student. The entire process has to be documented.

**Task 6: Browsing Internet:** Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc.

If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

**Task 7: Antivirus:** Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

### **Productivity tools (6 weeks)**

**Task 8: Word Processor:** Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

**Task 9: Spreadsheet:** Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing

charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

**Task 10: Presentations :** creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

**Optional Tasks:**

**Task 11: Laboratory Equipment:** Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop computer
- Server computer
- Switch (computer science related)
- Microprocessor kit
- Micro controller kit
- Lathe machine
- Generators
- Construction material
- Air conditioner
- UPS and Inverter
- RO system
- Electrical Rectifier
- CRO
- Function Generator
- Microwave benches

**Task 12: Software:** Students may submit a report on specifications of various software that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. The software may be

proprietary software or Free and Open source software. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop operating system
- Server operating system
- Antivirus software
- MATLAB
- CAD/CAM software
- AUTOCAD

**References:**

1. Introduction to Computers, Peter Norton, Mc Graw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams”, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs”, Bigelows, TMH

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**B. Tech II-I Sem. (EEE)**

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**(15A54301) MATHEMATICS-III**

**(Common to All Branches)**

**Objectives:**

- This course aims at providing the student with the concepts of Matrices, Numerical Techniques and Curve fitting.

**UNIT – I**

Elementary row transformations-Rank – Echelon form, normal form – Consistency of System of Linear equations. Linear transformations. Hermitian, Skew-Hermitian and Unitary matrices and their properties. Eigen Values, Eigen vectors for both real and complex matrices. Cayley – Hamilton Theorem and its applications – Diagonalization of matrix. Calculation of powers of matrix and inverse of a matrix. Quadratic forms – Reduction of quadratic form to canonical form and their nature.

**UNIT – II**

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation: Crout’s triangularisation method, Gauss - Seidal iteration method.

**UNIT – III**

**Interpolation:** Newton’s forward and backward interpolation formulae – Lagrange’s formulae. Gauss forward and backward formula, Stirling’s formula, Bessel’s formula.

**UNIT – IV**

Curve fitting: Fitting of a straight line – Second degree curve – Exponential curve-Power curve by method of least squares. Numerical Differentiation for Newton’s interpolation formula. Numerical Integration: Trapezoidal rule – Simpson’s 1/3 Rule – Simpson’s 3/8 Rule.

**UNIT – V**

R15

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods. Numerical solutions of Laplace equation using finite difference approximation.

**TEXT BOOKS:**

3. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
4. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

**REFERENCES:**

3. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
4. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S. Chand publication.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

**Outcomes:** The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods.



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**(15A02301) ELECTRICAL CIRCUITS- II**

**OBJECTIVES:**

To make the students learn about:

- How to determine the transient response of R-L, R-C, R-L-C series circuits for D.C. and A.C. excitations
- The analysis of three phase balanced and unbalanced circuits
- How to measure active and reactive power in three phase circuits
- Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources
- Study of Network topology, Analysis of Electrical Networks, Duality and Dual Networks
- Different types of filters and equalizers

**UNIT- I TRANSIENT RESPONSE ANALYSIS**

**D.C Transient Analysis:** Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms, Response of R-L & R-C Networks to Pulse Excitation.

**A.C Transient Analysis:** Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms

**UNIT- II THREE PHASE A.C CIRCUITS**

Phase Sequence- Star and Delta Connection-Relation between Line and Phase Voltages and Currents in Balanced Systems-Analysis of Balanced and unbalanced Three Phase Circuits- Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Loop Method- Application of Millman's Theorem- Star Delta Transformation Technique – for balanced and unbalanced circuits, Measurement of Active and reactive Power.

**UNIT- III FOURIER TRANSFORMS**

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Fourier Theorem- Trigonometric Form and Exponential Form of Fourier Series – Conditions of Symmetry- Line Spectra and Phase Angle Spectra- Analysis of Electrical Circuits excited by Non Sinusoidal sources of Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

#### **UNIT- IV NETWORK TOPOLOGY**

Definitions – Graph – Tree, Basic Cut set and Basic Tie set Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks with Dependent & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis, Super Node and Super Mesh for D.C Excitations.

#### **UNIT - V FILTER DESIGN & CIRCUIT SIMULATION**

Filters – Low Pass – High Pass and Band Pass – RC, RL filters– derived filters and composite filters design.

Circuit simulation – Description of Circuit elements, nodes, and sources, Input and Output variables – Modeling of the above elements – DC analysis.

#### **OUTCOMES:**

After completing the course, the student should be able to do the following:

- Determine the transient response of R-L, R-C, R-L-C circuits for D.C. and A.C. excitations
- Analyze three phase balanced and unbalanced circuits and determine line voltages, line currents, phase voltages and phase currents
- Measure active and reactive power consumed by a given three phase circuit
- Apply Fourier transforms to electrical circuits excited by non-sinusoidal sources
- Analysis of electrical networks, duality and dual networks
- Design different types of filters
- Simulate D.C. Circuits

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**TEXT BOOKS:**

1. Electrical Circuit Theory and Technology, John Bird, ELSEVIER, 4th Edition, 2010.
2. Network Analysis, M.E Van Valkenburg, Pearson Education, 3<sup>rd</sup> Edition, 2015.

**REFERENCES:**

1. Circuit Theory (Analysis & Synthesis), A. Chakrabarti, Dhanpat Rai & Co., 6<sup>th</sup> Edition, 2008.
2. Electric Circuits by N.Sreenivasulu, REEM Publications Pvt. Ltd., 2012
3. Engineering circuit analysis by William Hayt, Jack E. Kemmerly and Steven M. Durbin, Mc Graw Hill Education (India) Pvt. Ltd., 6<sup>th</sup> Edition, 2013.

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**B. Tech II-I Sem. (EEE)**

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**(15A02302) ELECTRICAL MACHINES - I**

**OBJECTIVES:** To make the students learn about:

- The constructional features of DC machines and different types of windings employed in DC machines
- The phenomena of armature reaction and commutation
- Characteristics of generators and parallel operation of generators
- Methods for speed control of DC motors and applications of DC motors
- Various types of losses that occur in DC machines and how to calculate efficiency
- Testing of DC motors

**UNIT – I PRINCIPLES OF ELECTROMECHANICAL ENERGY CONVERSION**

Electromechanical Energy Conversion – Forces and Torque In Magnetic Field Systems – Energy Balance – Energy and Force in a Singly Excited Magnetic Field System, Determination of Magnetic Force - Co-Energy – Multi Excited Magnetic Field Systems.

**UNIT – II D.C. GENERATORS - I**

D.C. Generators – Principle of Operation – Constructional Features – Armature Windings – Lap and Wave Windings – Simplex and Multiplex Windings – Use of Laminated Armature – E. M.F Equation– Numerical Problems – Parallel Paths-Armature Reaction – Cross Magnetizing and De-Magnetizing AT/Pole – Compensating Winding – Commutation – Reactance Voltage – Methods of Improving Commutation.

**UNIT-III D.C GENERATORS – II**

Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F - Critical Field Resistance and Critical Speed - Causes for Failure to Self Excite and

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Remedial Measures-Load Characteristics of Shunt, Series and Compound Generators – Parallel Operation of D.C Series Generators – Use of Equalizer Bar and Cross Connection of Field Windings – Load Sharing.

**UNIT – IV            D.C. MOTORS**

D.C Motors – Principle of Operation – Back E.M.F. – Circuit Model – Torque Equation – Characteristics and Applications of Shunt, Series and Compound Motors – Armature Reaction and Commutation.

Speed Control of D.C. Shunt and Series Motors. Motor Starters (3 Point and 4 Point Starters) – Protective Devices-Calculation of Starter Steps for D.C Shunt Motors.

**UNIT – V            TESTING OF DC MACHINES**

Losses – Constant & Variable Losses – Calculation of Efficiency – Condition for Maximum Efficiency.

Methods of Testing – Direct, Indirect – Brake Test – Swinburne’s Test – Hopkinson’s Test – Field’s Test – Retardation Test

**OUTCOMES:**

After completing the course, the student should be able to do the following:

- Calculate the e.m.f. generated on open circuit and find terminal voltage on load
- Diagonise the failure of DC generator to build up voltage
- Compute the load shared by each generator when several generators operate in parallel
- Determine the gross torque and useful torque developed by DC motor
- Identify suitable method and conditions for obtaining the required speed of DC motor
- Calculate the losses and efficiency of DC generators and motors

**TEXT BOOKS:**

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7<sup>th</sup> Edition, 2011.
2. Electrical Machines, S K Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4<sup>th</sup> Edition, 2014, 3<sup>rd</sup> Reprint 2015.

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**REFERENCES:**

1. The Performance and Design of Direct Current Machines, A.E. Clayton and N. N. Hancock, ELBS Publishers, First published 1927, First Edition of e-book 2012.
2. Electric Machinery, A.E.Fitzgerald, C.Kingsley and S. Umans, Mc Graw Hill Education (India) Pvt. Ltd., 6<sup>th</sup> Edition, 2005.
3. Electric Machines 4<sup>th</sup> edition, D.P.Kothari and I.J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 4<sup>th</sup> Edition, 2010, 16<sup>th</sup> Reprint 2015.

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<b>B. Tech II-I Sem. (EEE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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**(15A02303) CONTROL SYSTEMS ENGINEERING**

**OBJECTIVES:**

To make the students learn about:

- Merits and demerits of open loop and closed loop systems; the effects of feedback
- The use of block diagram algebra and Mason's gain formula to find the effective transfer function between two nodes
- Transient and steady state responses , time domain specifications
- The concept of Root loci
- Frequency domain specifications, Bode diagrams and Nyquist plots
- The fundamental aspects of modern control

**UNIT – I INTRODUCTION**

Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback Characteristics, Effects of positive and negative feedback. Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor - AC Servo motor - Synchro transmitter and Receiver

**UNIT-II TIME RESPONSE ANALYSIS**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants

**UNIT – III STABILITY**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci-effects of adding poles and zeros to  $G(s)H(s)$  on the root loci.

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#### **UNIT – IV                      FREQUENCY RESPONSE ANALYSIS**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis.

Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

#### **UNIT – V                      STATE SPACE ANALYSIS**

Concepts of state, state variables and state model, derivation of state models from differential equations. Transfer function models. Block diagrams. Diagonalization. Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability.

#### **OUTCOMES:**

After completing the course, the student should be able to do the following:

- Evaluate the effective transfer function of a system from input to output using (i) block diagram reduction techniques (ii) Mason's gain formula
- Compute the steady state errors and transient response characteristics for a given system and excitation
- Determine the absolute stability and relative stability of a system
- Draw root loci
- Design a compensator to accomplish desired performance
- Derive state space model of a given physical system and solve the state equation

#### **TEXT BOOKS:**

1. Modern Control Engineering, Katsuhiko Ogata, PEARSON, 1<sup>st</sup> Impression 2015.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, New Age International Publishers, 5<sup>th</sup> edition, 2007, Reprint 2012.



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**REFERENCE BOOKS:**

1. Automatic Control Systems, Farid Golnaraghi and Benjamin. C. Kuo, WILEY, 9<sup>th</sup> Edition, 2010.
2. Control Systems, Dhanesh N. Manik, CENGAGE Learning, 2012.
3. John J D' Azzo and C. H. Houpis , "Linear Control System Analysis and Design: Conventional and Modern", McGraw - Hill Book Company, 1988.

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**(15A04301) ELECTRONIC DEVICES AND CIRCUITS****Course Objectives:**

To give understanding on semiconductor physics of the intrinsic, p and n materials, characteristics of the p-n junction diode, diode's application in electronic circuits, Characteristics of BJT, FET, MOSFET, characteristics of special purpose electronic devices. To familiarize students with dc biasing circuits of BJT, FET and analyzing basic transistor amplifier circuits.

**Course Outcomes:**

Upon completion of the course, students will:

- Analyze the operating principles of major electronic devices, its characteristics and applications.
- Design and analyze the DC bias circuitry of BJT and FET.
- Design and analyze basic transistor amplifier circuits using BJT and FET.

**UNIT- I**

**Junction Diode Characteristics** : Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

**Special Semiconductor Diodes:** Zener Diode, Breakdown mechanisms, Zener diode applications, LED, LCD, Photo diode, Varactor diode, Tunnel Diode, DIAC, TRIAC, SCR, UJT. Construction, operation and characteristics of all the diodes is required to be considered.

**UNIT- II**

**Rectifiers and Filters:** Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, L- section filter,  $\Pi$ -section filter, Multiple L- section and Multiple  $\Pi$  section filter, comparison of various filter circuits in terms of ripple factors.

**UNIT- III****Transistor Characteristics:**

**BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a

transistor,punch through/ reach through, Photo transistor, typical transistor junction voltage values.

**FET:**FETtypes, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

#### UNIT- IV

**Transistor Biasing and Thermal Stabilization :** Need for biasing,operating point, load line analysis, BJT biasing- methods,basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in  $V_{BE}$ ,  $I_c$ , and  $\beta$ , Stability factors, ( $S$ ,  $S'$ ,  $S''$ ), Bias compensation, Thermal runaway, Thermal stability.

FET Biasing- methods and stabilization.

#### UNIT- V

##### **Small Signal Low Frequency Transistor Amplifier Models:**

**BJT:** Two port network, Transistor hybrid model, determination of h-parameters,conversion of h-parameters,generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

**FET:** Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

##### **TEXT BOOKS:**

1. J. Millman, C. Halkias, "Electronic Devices and Circuits", Tata Mc-Graw Hill, 4<sup>th</sup>Edition,2010.
2. David A.Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2009.
3. Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", Tata Mc-Graw Hill, Second Edition

##### **REFERENCES:**

1. Jacob Millman, C. Halkies, C.D.Parikh, "Integrated Electronics", Tata Mc-Graw Hill, 2009.
2. R.L. Boylestad and Louis Nashelsky,"Electronic Devices and Circuits",Pearson Publications,,9thEdition,2006.
3. BV Rao, KBR Murty, K Raja Rajeswari, PCR Pantulu, "Electronic Devices and Circuits", Pearson, 2<sup>nd</sup> edition.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

<b>B. Tech II-I Sem. (EEE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**(15A05201) DATA STRUCTURES**  
**(Common to all branches of Engineering)**

**Objectives:**

- Understand different Data Structures
- Understand Searching and Sorting techniques

**Unit-1**

**Introduction and overview:** Asymptotic Notations, One Dimensional array- Multi Dimensional array- pointer arrays.

**Linked lists:** Definition- Single linked list- Circular linked list- Double linked list- Circular Double linked list- Application of linked lists.

**Unit-2**

**Stacks:** Introduction-Definition-Representation of Stack-Operations on Stacks- Applications of Stacks.

**Queues:** Introduction, Definition- Representations of Queues- Various Queue Structures- Applications of Queues. **Tables:** Hash tables.

**Unit-3**

**Trees:** Basic Terminologies- Definition and Concepts- Representations of Binary Tree- Operation on a Binary Tree- Types of Binary Trees-Binary Search Tree, Heap Trees, Height Balanced Trees, B. Trees, Red Black Trees.

**Graphs:** Introduction- Graph terminologies- Representation of graphs- Operations on Graphs- Application of Graph Structures: Shortest path problem- topological sorting.

**Unit-4**

**Sorting :** Sorting Techniques- Sorting by Insertion: Straight Insertion sort- List insertion sort- Binary insertion sort- Sorting by selection: Straight selection sort- Heap Sort- Sorting by Exchange- Bubble Sort- Shell Sort-Quick Sort-External Sorts: Merging Order Files-Merging Unorder Files- Sorting Process.

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**Unit-5**

**Searching:** List Searches- Sequential Search- Variations on Sequential Searches- Binary Search- Analyzing Search Algorithm- Hashed List Searches- Basic Concepts- Hashing Methods- Collision Resolutions- Open Addressing- Linked List Collision Resolution- Bucket Hashing.

**Text Books:**

1. “Classic Data Structures”, Second Edition by Debasis Samanta, PHI.
2. “Data Structures A Pseudo code Approach with C”, Second Edition by Richard F. Gilberg, Behrouz A. Forouzan, Cengage Learning.

**Reference Books:**

1. Fundamentals of Data Structures in C – Horowitz, Sahni, Anderson- Freed, Universities Press, Second Edition.
2. Schaum’ Outlines – Data Structures – Seymour Lipschutz – McGrawHill-Revised First Edition.
3. Data structures and Algorithms using C++, Ananda Rao Akepogu and Radhika Raju Palagiri, Pearson Education.

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**(15A02305) ELECTRIC CIRCUITS SIMULATION LABORATORY**

**Objectives:**

- To understand the various electric circuit concepts through circuit simulation using PSPICE software
- To know performance of RLC series and parallel circuits through simulation studies
- To know the analysis of 3-phase balanced and unbalanced circuits by simulation
- To understand the occurrence of transients in electric circuits with both DC and AC excitations

**List of Experiments**

- 1) Simulation of DC Circuits
- 2) DC Transient Response
- 3) Mesh Analysis
- 4) Nodal Analysis
- 5) Frequency response of RLC Series Circuits
- 6) Analysis of RL and RC Series circuits for DC Excitation
- 7) Analysis of RL and RC Series circuits for AC Excitation
- 8) Analysis of Three Phase balanced systems
- 9) Analysis of Three Phase unbalanced systems
- 10) Verification of the maximum power dissipation (plot the power dissipated versus the load).

**Outcomes:**

The student should be able to do the following at the end of the lab course:

- Explain electric circuit concepts by interpreting the simulation results
- Design RLC series circuit for specified frequency response
- Analyze three phase balanced and unbalanced circuits
- Design RL, RC and RLC circuits for specified transient response

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**REFERENCES:**

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.
2. Public Domain Simulator: [http:// www.ee.iitb.ac.in/~sequel](http://www.ee.iitb.ac.in/~sequel)
3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA.

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**(15A04305) ELECTRONIC DEVICES AND CIRCUITS LABORATORY**

**Course Outcomes:**

- Students able to learn electrical model for various semiconductor devices and learns the practical applications of the semiconductor devices

**PART A: Electronic Workshop Practice**

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter,

Function Generator, Regulated Power Supply and CRO.

**PART B: List of Experiments**

(For Laboratory Examination-Minimum of Ten Experiments)

1. P-N Junction Diode Characteristics

Part A: Germanium Diode (Forward bias & Reverse bias)

Part B: Silicon Diode (Forward bias only)

2. Zener Diode Characteristics

Part A: V-I Characteristics

Part B: Zener Diode act as a Voltage Regulator



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3. Rectifiers (without and with c-filter)

Part A: Half-wave Rectifier

Part B: Full-wave Rectifier

4. BJT Characteristics(CE Configuration)

Part A: Input Characteristics

Part B: Output Characteristics

5. FET Characteristics(CS Configuration)

Part A: Drain (Output) Characteristics

Part B: Transfer Characteristics

6. SCR Characteristics

7. UJT Characteristics

8. Transistor Biasing

9. CRO Operation and its Measurements

10. BJT-CE Amplifier

11. Emitter Follower-CC Amplifier

12. FET-CS Amplifier

PART C: Equipment required for Laboratory

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components
10. Bread Boards

**11. Connecting Wires**

CRO Probes etc.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B. Tech II-II Sem. (EEE)**

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**(15A54402) MATHEMATICS –IV**  
**(Common to ECE, EEE)**

**Objectives:** To enable the students to understand the mathematical concepts of special functions & complex variables and their applications in science and engineering.

**UNIT – I: Special Functions:** Gamma and Beta Functions – their properties – Evaluation of improper integrals. Series Solutions of ordinary differential equations (Power series and Frobenius Method).

**UNIT – II:** Bessel functions – Properties – Recurrence relations – Orthogonality. Legendre polynomials – Properties – Rodrigue’s formula – Recurrence relations – Orthogonality.

**UNIT – III**

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thomson method.

Conformal mapping: Transformation of  $e^z$ ,  $\ln z$ ,  $z^2$ ,  $\sin z$ ,  $\cos z$ , Bilinear transformation - Translation, rotation, magnification and inversion – Fixed point – Cross ratio – Determination of bilinear transformation.

**UNIT – IV**

Complex integration: Line integral – Evaluation along a path and by indefinite integration – Cauchy’s integral theorem – Cauchy’s integral formula – Generalized integral formula.

Complex power series: Radius of convergence – Expansion in Taylor’s series, Maclaurin’s series and Laurent series. Singular point – Isolated singular point – Pole of order m – Essential singularity.

**UNIT – V**

Residue – Evaluation of residue by formula and by Laurent’s series – Residue theorem.

Evaluation of integrals of the type

(a) Improper real integrals  $\int_{-\infty}^{\infty} f(x)dx$  (b)  $\int_c^{c+2\pi} f(c + \theta + i0) d\theta$  (c)  $\int_{-\infty}^{\infty} e^{imx} f(x)dx$

**TEXT BOOKS:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics, Volume - III, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher

**REFERENCES:**

1. Mathematics III by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Advanced Engineering Mathematics, Peter V.O’Neil, CENGAGE publisher.
3. Advanced Engineering Mathematics by M.C. Potter, J.L. Goldberg, Edward F.Aboufadel, Oxford.

**Outcomes:** The student achieves the knowledge to analyse the problems using the methods of special functions and complex variables

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<b>(15A52301) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS</b>				

**Course Objectives:** The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

**Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS**

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Relationship of Managerial Economics with Financial Accounting and Management. **Demand Analysis:** Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting.

**UNIT II: THEORY OF PRODUCTION AND COST ANALYSIS**

**Production Function-** Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis:** Cost concepts and cost behavior- Break-Even Analysis (BEA) -Determination of Break Even Point (Simple Problems)-Managerial significance and limitations of Break- Even Point.

**UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT**

**Market structures:** Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole

Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

#### **UNIT IV: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS**

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

#### **UNIT V: CAPITAL AND CAPITAL BUDGETING**

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Short term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

**Learning Outcome:** After completion of this course, the student will be able to understand various aspects of Managerial Economics and analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.

#### **TEXT BOOKS:**

1. Managerial Economics 3/e, Ahuja H.L, S.Chand, 2013.
2. Financial Management, I.M.Pandey, Vikas Publications, 2013.

#### **REFERENCES**

1. Managerial Economics and Financial Analysis, 1/e, Aryasri, TMH, 2013.
2. Managerial Economics and Financial Analysis, S.A. Siddiqui and A.S. Siddiqui, New Age International, 2013.
3. Accounting and Financial Management, T.S.Reddy & Y. Hariprasad Reddy, Margham Publishers.

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**(15A02401) ELECTRICAL MACHINES – II**

**OBJECTIVES:**

To make the student learn about:

- Constructional details of transformer and its operation (i) on no load (ii) on load
- Predetermination of regulation and efficiency of transformer from OC and SC test results
- Parallel operation of transformers
- Constructional details, principle of operation and the importance of slip in Induction motor operation
- The slip-torque characteristics and torque calculations of Induction motor
- Methods of starting and speed control of Induction motor

**UNIT-I SINGLE PHASE TRANSFORMERS**

Single Phase Transformers- Constructional Details- Hysteresis and Eddy Current Losses- Emf Equation - Operation on No Load and on Load - Phasor Diagrams.

Equivalent Circuit - Losses and Efficiency-Regulation. All Day Efficiency - Effect of Variations of Frequency & Supply Voltage on Iron Losses.

**UNIT-II TESTING OF TRANSFORMERS, THREE PHASE TRANSFORMERS**

OC and SC Tests - Sumpner's Test - Predetermination of Efficiency and Regulation- Separation of Losses Test-Parallel Operation with Equal and Unequal Voltage Ratios - Auto Transformers-Equivalent Circuit - Comparison with Two Winding Transformers.

Three Phase Transformers - Connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and Open Δ, Third Harmonics in Phase Voltages-Three Winding Transformers-Tertiary Windings- Scott Connection.

**UNIT-III THREE-PHASE INDUCTION MOTORS**

Polyphase Induction Motors-Constructional Details of Cage and Wound Rotor Machines-Production of Rotating Magnetic Field - Principle of Operation – Slip - Rotor Emf and Rotor Frequency - Rotor Reactance, Rotor Current and Power factor at

Standstill and under running conditions - Rotor Power Input, Rotor Copper Loss and Mechanical Power Developed and Their Inter Relationship.

#### **UNIT-IV 3-PHASE INDUCTION MOTOR CHARACTERISTICS**

Torque Equation - Expressions for Maximum Torque and Starting Torque - Torque Slip Characteristic – Load characteristics - Equivalent Circuit - Phasor Diagram - Crawling and Cogging -Circle Diagram-No Load and Blocked Rotor Tests-Predetermination of Performance.

#### **UNIT-V STARTING AND SPEED CONTROL OF INDUCTION MOTORS**

Starting Methods and Starting Current and Torque Calculations, Speed Control-Change of Frequency; Pole Changing and Methods of Consequent Poles; Cascade Connection. Injection of an Emf.

#### **OUTCOMES:**

After completing the course, the student should be able to do the following:

- Draw the equivalent circuit of transformer
- Conduct O.C, S.C tests and predetermine the regulation and efficiency of transformer
- Compute the load shared by each transformer when several transformers operate in parallel
- Draw the circle diagram of a three phase Induction motor and predetermine the performance characteristics
- Determine the starting torque, maximum torque, slip at maximum torque using given data

#### **TEXT BOOKS:**

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7<sup>th</sup> Edition, 2011.
2. Electric Machines 4<sup>th</sup> edition, D.P.Kothari and I.J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 4<sup>th</sup> Edition, 2010, 16<sup>th</sup> Reprint 2015.

#### **REFERENCE BOOKS:**

1. The Performance and Design of Alternating Current Machines, M. G. Say, CBS Publishers, 3<sup>rd</sup> Edition, 2002.
2. Theory of Alternating Current Machinery, Alexander S. Langsdorf, Tata McGraw-Hill, 2<sup>nd</sup> edition, 1999, 35<sup>th</sup> Reprint.
3. A Textbook of Electrical Machines, K R Siddhapura and D B Raval, Vikas Publishing House Pvt. Ltd., 2014.



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**B. Tech II-II Sem. (EEE)** **L T P C**  
**3 1 0 3**

**(15A02402) ELECTRICAL POWER GENERATING SYSTEMS**

**OBJECTIVES:**

To make the student learn about:

- Structure, essential components and their layout in thermal power station
- Selection of site for thermal power station
- Selection of site for hydro power generation
- Various aspects and issues involved in Nuclear power generation
- Electric power generation from renewable energy sources as sun, wind and ocean
- Cost of generation and tariff methods

**UNIT-I: THERMAL POWER GENERATING SYSTEMS**

Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers.

**UNIT-II: HYDRO & NUCLEAR POWER GENERATING SYSTEMS**

**Hydro Power:** Selection of Site, Classification, Layout, Description of Main Components.

**Nuclear Power:** Nuclear Fission and Chain Reaction.- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

**UNIT –III: SOLAR & WIND POWER GENERATING SYSTEMS**

**Solar Power Generation:** Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

**Wind Power Generation:** Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills- Performance Characteristics- Power- Speed & Torque- Speed Characteristics-Pitch & Yaw Controls – Power Electronics Application – Economic Aspects.

#### **UNIT-IV: BIOGAS & GEOTHERMAL POWER GENERATING SYSTEMS**

**Biogas Power Generation:** Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.

**Geothermal and Ocean Power Generation:** Principle of Geothermal Energy Methods of Harnessing-Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants- Economic Aspects.

#### **UNIT-V: ECONOMIC ASPECTS OF POWER GENERATION**

Load Curve, Load Duration and Integrated Load Duration Curves-Load Demand, Diversity, Capacity, Utilization and Plant Use Factors- Numerical Problems. Costs Of Generation and their Division Into Fixed, Semi-Fixed and Running Costs. Tariff Methods: Desirable Characteristics of a Tariff Method.- Flat Rate, Block-Rate, Two-Part, Three –Part, and Power Factor Tariff Methods and Numerical Problems.

**OUTCOMES:** After completing the course, the student should be able to do the following:

- Estimate the coal requirement, cost per kWh generation and number of units generated for thermal power station
- Estimate the required flow of river water, cost of generation and number of units generated in hydel power generation
- Compute various factors like load factor, plant factor
- Evaluate the tariffs to be charged for the consumers
- Plot the load curve, load duration curve and hence determine the load capacity of the plant

#### **TEXT BOOKS:**

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.
3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.

**REFERENCE BOOKS:**

1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004.
4. Wind Electrical Systems by S. N. Bhadra, D. Kastha & S. Banerjee – Oxford University Press, 2013.

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**(15A02403) ELECTROMAGNETIC FIELDS**

**OBJECTIVES:**

To make the student learn about:

- The laws concerning static electric fields: Coulomb’s law, Gauss law; the laws concerning static magnetic fields: Biot-savart law, Ampere circuital law
- The equations concerned with static electric fields
- The equations concerned with static magnetic fields
- The difference between the behaviors of conductors and dielectrics in electric fields
- The energy stored and energy density in (i) static electric field (ii) magnetic field
- Electric dipole and dipole moment, magnetic dipole and dipole moment

**UNIT-I ELECTROSTATICS**

Electrostatic Fields - Coulomb’s Law - Electric Field Intensity(EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss’s Law-Application of Gauss’s Law-Maxwell’s First Law – Numerical Problems.

Laplace’s Equation and Poisson’s Equations - Solution of Laplace’s Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

**UNIT- II CONDUCTORS AND DIELECTRICS**

Behavior of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm’s Law in Point Form – Equation of Continuity – Numerical Problems.

**UNIT-III MAGNETO STATICS**

Static Magnetic Fields – Biot-Savart Law – Oerstead’s experiment – Magnetic Field Intensity(MFI) due to a Straight, Circular & Solenoid Current Carrying Wire – Maxwell’s Second Equation. Ampere’s Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current

Carrying Filament – Point Form of Ampere’s Circuital Law – Maxwell’s Third Equation – Numerical Problems.

Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

#### **UNIT – IV MAGNETIC POTENTIAL**

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson’s Equations.

Self and Mutual Inductances – Neumann’s Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.

#### **UNIT-V TIME VARYING FIELDS**

Faraday’s Law of Electromagnetic Induction – It’s Integral and Point Forms – Maxwell’s Fourth Equation. Statically and Dynamically Induced E.M.F’s – Simple Problems – Modified Maxwell’s Equations for Time Varying Fields – Displacement Current.

Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.

**OUTCOMES:** After going through this course the student acquires:

- Knowledge on basic principles, concepts and fundamental laws of electromagnetic fields.
- The knowledge to understand 3-dimensional co-ordinate systems, electrostatics, magneto statics, time-varying fields and interaction between electricity and magnetism.
- The knowledge to calculate the quantities associated with uniform plane wave motion in different media of transmission.

#### **TEXT BOOKS:**

1. Engineering Electromagnetics, William.H.Hayt, Mc.Graw Hill, 2010.
2. Principles of Electromagnetics, 6<sup>th</sup> Edition, Sadiku, Kulkarni, OXFORD University Press, 2015.

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**REFERENCE BOOKS:**

1. Field Theory, K.A.Gangadhar, Khanna Publications, 2003.
2. Electromagnetics 5<sup>th</sup> edition, J.D.Kraus,Mc.Graw – Hill Inc, 1999.
3. Electromagnetics, Joseph Edminister, Tata Mc Graw Hill, 2006.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B. Tech II-II Sem. (EEE)** **L T P C**  
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**(15A04409) ANALOG ELECTRONIC CIRCUITS**

**Course Objective**

The aim of this course is to familiarize the student with the analysis and design of basic transistor amplifier circuits, Oscillators, Multi-vibrators and wave shaping.

**Course Outcomes**

On completion of this course the student will be able to understand the

- Methods of biasing transistors & Design of simple amplifier circuits.
- Mid – band analysis of amplifier circuits using small - signal equivalent circuits to determine gain, input impedance and output impedance.
- Method of calculating cutoff frequencies and to determine bandwidth.
- Design and analyse different Oscillator circuits.
- Design of circuits for linear wave shaping and Multi-vibrators.

**UNIT I**

**Multistage Amplifiers**

BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

**UNIT II**

**Feedback Amplifiers**

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Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

### **UNIT III**

#### **Sinusoidal Oscillators**

Condition for oscillations – LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators -- RC Phase Shift and Weinbridge Oscillators.

### **UNIT IV**

#### **Large Signal Amplifiers**

Class A power Amplifier, Maximum Value of Efficiency of Class A Amplifier, Transformer coupled amplifier – Push-Pull Amplifier – Complimentary Symmetry Circuits (Transformer Less Class B Power Amplifier) – Phase Inverters, Transistor Power Dissipation, Thermal Runaway, Heat Sinks.

### **UNIT V**

**Linear wave shaping:** High pass, Low pass RC circuits-response for sinusoidal, Step, Pulse, Square and Ramp inputs, Clippers and Clampers

**Multi-Vibrators:** Analysis of Diode and transistor switching times, Analysis and Design of Bistable, Monostable and Astable Multi-vibrators, Schmitt trigger Using Transistors.

#### **Text Books :**

1. Integrated Electronics – Millman and Halkias
2. Pulse, Digital & Switching Waveforms by Jacob Milliman, Harbert Taub and Mothiki S Prakash Rao, 2<sup>nd</sup> edition 2008, Tata McGraw Hill Companies



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**References:**

1. K.Lal Kishore, “Electronic Circuit Analysis”, Second Edition, BSP
2. Electronic Devices and Circuits, G.S.N. Raju, IK International Publications, New Delhi, 2006
3. Electronic Devices and Circuits – Mottershead
4. A. Anand Kumar, “Pulse and Digital Circuits”, PHI, 2005.
5. David A. Bell, “Solid State Pulse Circuits”, 4<sup>th</sup> edition, 2002 PHI.

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**(15A02404) ELECTRICAL MACHINES LABORATORY - I**

**OBJECTIVES:** The student has to learn about:

- No load and load characteristics of DC generators
- Various tests on DC motors
- The speed control techniques of DC motors

**The following experiments are required to be conducted as compulsory experiments:**

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
6. Fields test on DC series machines. Determination of efficiency.
7. Swinburne's test and speed control of DC shunt motor. Predetermination of efficiencies.
8. Brake test on DC compound motor. Determination of performance curves.

**In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted.**

9. Load test on DC series generator. Determination of characteristics.
10. Retardation test on DC shunt motor. Determination of losses at rated speed.
11. Separation of losses in DC shunt motor.

**OUTCOMES:** The student should be able to do the following:

- Conduct experiments to obtain the no-load and load characteristics of D.C. Generators
- Conduct tests on D.C. motors for predetermination of efficiency
- Conduct tests on D.C. motors for determination of efficiency
- Control the speed of D.C. motor in a given range using appropriate method
- Identify the reason as to why D.C. Generator is not building up voltage

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**B. Tech II-II Sem. (EEE)**

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**(15A02405) CONTROL SYSTEMS AND SIMULATION LABORATORY**

The objectives of this lab course are to make the student practically learn about

- The effects of feedback on system performance
- Determination of transfer function of DC Machine.
- The design of controllers/compensators to achieve desired specifications.
- The characteristics of servo mechanisms used in automatic control applications.

**Any Eight of the following experiments are to be conducted:**

1. Time Response of Second Order System
2. Characteristics of Synchros
3. Programmable Logic Controller – Study and Verification of Truth Tables of Logic Gates, Simple Boolean Expressions and Application of Speed Control of Motor.
4. Effect of Feedback on DC Servo Motor
5. Transfer Function of DC Machine
6. Effect of P, PD, PI, PID Controller on a Second Order System.
7. Lag and Lead Compensation – Magnitude and Phase Plot
8. Temperature Controller Using PID
9. Characteristics of Magnetic Amplifiers
10. Characteristics of AC Servo Motor

**Any two simulation experiments are to be conducted:**

1. PSPICE Simulation of Op-Amp Based Integrator and Differentiator Circuits.
2. Linear System Analysis (Time Domain Analysis, Error Analysis) Using MATLAB.
3. Stability Analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant System Using MATLAB
4. State Space Model for Classical Transfer Function Using MATLAB – Verification.

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**OUTCOMES:** At the end of the course the student should be able to

- Design the controllers/compensators to achieve desired specifications.
- Understand the effect of location of poles and zeros on transient and steady state behavior of systems.
- Assess the performance, in terms of time domain specifications, of first and second order systems.
- Use MATLAB/SIMULINK software for control system analysis and design.

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B. Tech III-I Sem. (EEE)	L	T	P	C
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15A02501	ELECTRICAL MEASUREMENTS			

**Course Objectives:**

The objectives of the course are to make the student learn about

- The basic principles of different types of electrical instruments for the Measurement of voltage, current, power factor, power and energy.
- The measurement of R, L, and C parameters using bridge circuits.
- The principles of magnetic measurements.
- The principle of working of CRO and its applications.
- The use of Current Transformers, Potential Transformers, and Potentiometers.

**UNIT - I**

**MEASURING INSTRUMENTS**

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Type Instruments – Expression for the Deflecting Torque and Control Torque – Errors and Compensations, Range Extension.

Cathode Ray Oscilloscope- Cathode Ray tube-Time base generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase , Frequency, Current & Voltage- Lissajous Patterns

**UNIT – II**

**D.C & A.C BRIDGES**

Methods of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle - Desauty Bridge. Wien's Bridge – Schering Bridge.

**UNIT – III**

**MEASUREMENT OF POWER AND ENERGY**

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Element Dynamometer Wattmeter, Expression for Deflecting and Control Torques. Types of P.F. Meters – Dynamometer and Moving Iron Type – 1-ph and 3-ph Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and Compensations. Three Phase Energy Meter.

## UNIT –IV

### INSTRUMENT TRANSFORMERS AND POTENTIOMETERS

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations.

Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer – Standardization – Measurement of unknown Resistance, Current, Voltage.

A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.

## UNIT – V

### MAGNETIC MEASUREMENTS

Ballistic Galvanometer – Equation of Motion – Flux Meter – Constructional Details, Comparison with Ballistic Galvanometer. Determination of B-H Loop - Methods of Reversals - Six Point Method – A.C. Testing – Iron Loss of Bar Samples.

**OUTCOMES:** The student should have learnt how to

- Use wattmeters, pf meters, and energy meters in a given circuit.
- Extend the range of ammeters and voltmeters
- Measure active power, reactive power, power factor, and energy in both 1-phase and 3-phase circuits
- Determine the resistance values of various ranges, L and C values using appropriate bridges.
- Analyze the different characteristic features of periodic, and aperiodic signals using CRO.
- Use CTs and PTs for measurement of very large currents and high voltages

### TEXT BOOKS:

1. Electrical & Electronic Measurement & Instruments, A.K.Sawhney and Dhanpat Rai & Co. Publications, 2011, Reprint 2014.
2. Electrical Measurements and measuring Instruments 5<sup>th</sup> Edition, E.W. Golding and F.C. Widdis, Reem Publications, 5<sup>th</sup> Edition, 2011.

### REFERENCE BOOKS:

1. Electronic Instrumentation, 3<sup>rd</sup> Edition, H. S. Kalsi, Tata Mcgrawhill, 2011.
2. Electrical Measurements, Buckingham and Price, Prentice Hall, 1970.
3. Electrical Measurements: Fundamentals, Concepts, Applications, Reissland, M.U., New Age International (P) Limited, 2010.

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B. Tech III-I Sem. (EEE)	L	T	P	C
	3	1	0	3

15A04509 LINEAR & DIGITAL IC APPLICATIONS

**Course Objective:**

- To make the student understand the basic concepts in the design of electronic circuits using linear integrated circuits and their applications. To introduce some special function ICs.
- To be able to use computer-aided design tools for development of complex digital logic circuits
- To be able to model, simulate, verify, analyze, and synthesize with hardware description languages
- To be able to design and prototype with standard cell technology and programmable logic
- To be able to design tests for digital logic circuits, and design for testability

**Learning Outcome:**

- Upon completion of the course, students will be able to:
- Understand the basic building blocks of linear integrated circuits and its characteristics.
- Analyze the linear, non-linear and specialized applications of operational amplifiers.
- Understand the theory of ADC and DAC.
- Able to use computer-aided design tools for development of complex digital logic circuits.
- Able to model, simulate, verify, analyze, and synthesize with hardware description languages.
- Able to design and prototype with standard cell technology and programmable logic.
- Able to design tests for digital logic circuits, and design for testability.

**UNIT I**

**OP-AMP CHARACTERISTICS:**

Basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics - DC and AC characteristics, 741 Op-amp and its features, modes of operation-inverting, non-inverting, differential. Basic applications of Op-amp, instrumentation amplifier, AC amplifier, V to I and I to V converters, sample & Hold circuits, multiplier and divider, Differentiator and Integrator, Comparators, Schmitt trigger, Multivibrators, Introduction to voltage regulators, features of 723 General

purpose regulator.

## UNIT II

### TIMERS, PHASE LOCKED LOOPS & D-A AND A-D CONVERTERS:

Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger, PLL – Introduction, block schematic, principles and description of individual blocks of 565. Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC specifications.

## UNIT III

### ACTIVE FILTERS & OSCILLATORS:

Introduction, 1<sup>st</sup> order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation- RC, Wien, and quadrature type, waveform generators- triangular, sawtooth, square wave and VCO.

## UNIT IV

### INTEGRATED CIRCUITS:

Classification, Chip size and circuit complexity, Classification of integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector o/p/s, Tristate TTL, MOS & CMOS open drain and tri-state outputs, CMOS transmission gate, IC interfacing-TTL driving CMOS & CMOS driving TTL.

## UNIT V

### COMBINATIONAL & SEQUENTIAL CIRCUITS

**COMBINATIONAL:** Code converters, Decoders, Demultiplexers, decoders & drives for LED & LCD display. Encoder, priority Encoder, Multiplexers & their applications, priority generators/checker circuits. Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2's Complement system. Digital comparator circuits.

**SEQUENTIAL:** Latches, Flip-flops & their conversions. Design of synchronous counters, Decade counter, shift registers & applications, familiarities with commonly available 74XX and CMOS 40XX series of IC counters.

### Text Books:

1. *Linear Integrated Circuits – D.RoyChowdhury, New Age International (p) Ltd, 2<sup>nd</sup> Edition., 2003.*
2. *Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3<sup>rd</sup> Ed., 2005.*



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**Reference Books:**

1. *Operational Amplifiers & Linear Integrated Circuits* – R.F.Coughlin & Fredric F.Driscoll, PHI.
2. *Operational Amplifiers & Linear Integrated Circuits: Theory & Applications* – Denton J.Daibey, TMH.
3. *Design with Operational amplifiers & Analog Integrated circuits*-Sergio Franco, Mc Graw Hill, 3<sup>rd</sup> Edition , 2002.
4. *Digital Fundamentals* – Floyd and Jain, Pearson Education, 8<sup>th</sup> Edition 2005.
5. *A VHDL Primer* – J. Bhasker, Pearson Education/ PHI, 3<sup>rd</sup> Edition.
6. *Op-amps & Linear ICs* – RamakanthA.Gayakwad, PHI, 1987.

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15A02502 ELECTRICAL POWER TRANSMISSION SYSTEMS

Course Objectives :

The objectives of the course are to make the student learn about

- The computation of the parameters of a Transmission line.
- Classification of transmission lines and representation by suitable equivalent circuits
- the various factors that affect the performance of Transmission lines
- The Travelling wave phenomenon on transmission lines.
- Underground cables: construction, types, and grading

**UNIT- I**

**TRANSMISSION LINE PARAMETERS**

Types of Conductors – ACSR, Bundled and Stranded Conductors- Resistance For Solid Conductors – Skin Effect- Calculation of Inductance for Single Phase and Three Phase, Single and Double Circuit Lines, Concept of GMR & GMD, Symmetrical and Asymmetrical Conductor Configuration with and without Transposition, Numerical Problems, Capacitance Calculations for Symmetrical and Asymmetrical Single and Three Phase, Single and Double Circuit Lines, Effect of Ground on Capacitance, Numerical Problems.

**UNIT- II**

**PERFORMANCE OF TRANSMISSION LINES:**

Classification of Transmission Lines - Short, Medium and Long Lines and Their Exact Equivalent Circuits- Nominal-T, Nominal- $\pi$ . Mathematical Solutions to Estimate Regulation and Efficiency of All Types of Lines. Long Transmission Line-Rigorous Solution, Evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Surge Impedance and Surge Impedance Loading - Wavelengths and Velocity of Propagation – Ferranti Effect , Charging Current-Numerical Problems.

**UNIT- III**

**MECHANICAL DESIGN OF TRANSMISSION LINES**

Overhead Line Insulators: Types of Insulators, String Efficiency and Methods for Improvement, Capacitance Grading and Static Shielding.

Corona: Corona Phenomenon, Factors Affecting Corona, Critical Voltages and Power Loss, Radio Interference.

Sag and Tension Calculations: Sag and Tension Calculations with Equal and Unequal Heights of Towers, Effect of Wind and Ice on Weight of Conductor, Stringing Chart and Sag Template and Its Applications, Numerical Problems.

#### UNIT – IV

##### POWER SYSTEM TRANSIENTS & TRAVELLING WAVES

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of Lines with Different Types of Conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

#### UNIT-V

##### CABLES

Types of Cables, Construction, Types of Insulating Materials, Calculations of Insulation Resistance and Stress in Insulation, Numerical Problems. Capacitance of Single and 3-Core Belted Cables, Numerical Problems. Grading of Cables - Capacitance Grading, Numerical Problems, Description of Inter-Sheath Grading.

Course **Outcomes:** At the end of the course the student will be able to

- Compute the transmission line parameters.
- Model a given transmission line.
- Estimate the performance of a given transmission line.
- Analyze the effect of over voltages on transmission lines.
- Explain the construction, types and grading of underground cables and analyze cable performance.

#### TEXT BOOKS:

1. Electrical power systems, C.L.Wadhwa, New Age International (P) Limited, 6<sup>th</sup> Edition, 2010, Reprint 2014.
2. A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd., 1999.

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**REFERENCE BOOKS:**

1. Power system Analysis 4th edition, John J Grainger and William D Stevenson, JR, Mc Graw Hill Education, 2003, Reprint 2015.
2. Power System Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 2<sup>nd</sup> Edition, 2008, 23<sup>rd</sup> Reprint 2015.
3. Electric Power Transmission System Engineering: Analysis and Design, Turan Gonen, 2<sup>nd</sup> Edition, CRC Press, Taylor & Francis group, 2009, 1<sup>st</sup> Indian Reprint 2010.

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15A02503 POWER ELECTRONICS

Course Objectives:

The objectives of the course are to make the student learn about

- the basic power semiconductor switching devices and their principles of operation.
- the various power conversion methods, controlling and designing of power converters.
- the applications of Power electronic conversion to domestic, industrial, aerospace, commercial and utility systems etc.
- the equipment used for DC to AC, AC to DC, DC to Variable DC, and AC to Variable frequency AC conversions.

UNIT I

POWER SEMI CONDUCTOR DEVICES

Semiconductor Power Diodes, Thyristors – Silicon Controlled Rectifiers (SCR's) – TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors – Classification of Switching Devices Based on Frequency and Power Handling Capacity- BJT – Power Transistor - Power MOSFET – Power IGBT -- Basic Theory of Operation of SCR – Static Characteristics – Turn On and Turn Off Methods- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits--- Series and Parallel Connections of SCR's – Snubber Circuits – Specifications and Ratings of SCR's, BJT, IGBT.

UNIT II

PHASE CONTROLLED CONVERTERS

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL Loads and RLE Load– Derivation of Average Load Voltage and Current – Line Commutated Inverters -Active and Reactive Power Inputs to the Converters without and with Free Wheeling Diode, Effect of Source Inductance – Numerical Problems. Three Phase Line Commutated Converters – Three Pulse and Six Pulse Converters – Mid Point and Bridge Connections - Average Load Voltage with R and RL Loads – Effect of Source Inductance–Dual Converters (Both Single Phase and Three Phase) - Waveforms –Numerical Problems.

### UNIT III

#### CHOPPERS AND REGULATORS

Commutation Circuits – Time Ratio Control and Current Limit Control Strategies – Step Down and Step up Choppers Derivation of Load Voltage and Currents with R, RL and RLE Loads- Step Up Chopper – Load Voltage Expression– Problems. Study of Buck, Boost and Buck-Boost regulators, buck regulator e.g. TPS54160, hysteretic buck regulator e.g. LM3475, Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210, TPS 7A4901, TPS7A8300

### UNIT IV

#### INVERTERS

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms – Simple Forced Commutation Circuits for Bridge Inverters – Single Phase Half and Full Bridge Inverters-Pulse Width Modulation Control-Harmonic Reduction Techniques-Voltage Control Techniques for Inverters – Numerical Problems, Three Phase VSI in  $120^\circ$  And  $180^\circ$  Modes of Conduction.

### UNIT V

#### AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS

**AC Voltage Controllers** – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of TRIAC – TRIAC with R and RL Loads – Derivation of RMS Load Voltage, Current and Power Factor Wave Forms – Firing Circuits -Numerical Problems - Thyristor Controlled Reactors; Switched Capacitor Networks.

**Cyclo Converters** – Single Phase Mid Point Cycloconverters with Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration of Single Phase Cycloconverter (Principle of Operation only) – Waveforms

#### Course Outcomes:

After going through this course, the student acquires knowledge about:

- Basic operating principles of power semiconductor switching devices.
- the operation of power electronic converters, choppers, inverters, AC voltage controllers, and cycloconverters, and their control.
- How to apply the learnt principles and methods to practical applications.

#### TEXT BOOKS:

1. Power Electronics, M. D. Singh and K. B. Khanchandani, Mc Graw Hill Education (India) Pvt. Ltd., 2<sup>nd</sup> Edition, 2007, 23<sup>rd</sup> Reprint 2015.
2. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson, 3<sup>rd</sup> Edition, 2014, 2<sup>nd</sup> Impression 2015.

**REFERENCE BOOKS:**

1. Power Electronics, K. R. Varmah, Chikku Abraham, CENGAGE Learning, 1<sup>st</sup> Edition, 2016.
2. Power Electronics, P. S. Bimbhra, Khanna Publishers, 2012.
3. Power Electronics: Devices, Circuits, and Industrial Applications, V. R. Moorthi, OXFORD University Press, 1<sup>st</sup> Edition, 2005, 12<sup>th</sup> Impression 2012.

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**15A02504 ELECTRICAL MACHINES – III**

**Course Objectives:**

The objectives of the course are to make the student learn about

- the construction and principle of working of synchronous machines
- different methods of predetermining the regulation of alternators
- the concepts and computation of load sharing among alternators in parallel.
- the performance characteristics of synchronous motors and their use as synchronous condensers for power factor improvement.
- different types of single phase motors and special motors used in house hold appliances and control systems.
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**UNIT – I**

**SYNCHRONOUS GENERATORS**

Principle and Constructional Features of Salient Pole and Round Rotor Machines – Armature Windings, Concentrated and Distributed Windings, Integral Slot and Fractional Slot Windings – Pitch, Distribution, and Winding Factors – E.M.F Equation-Harmonics in Generated E.M.F – Space and Slot Harmonics – Elimination of Harmonics- Armature Reaction – Synchronous Reactance and Impedance – Load Characteristics - Phasor Diagram.

**UNIT – II**

**REGULATION OF SYNCHRONOUS GENERATORS**

Regulation of Salient Pole Alternator – Voltage Regulation Methods – E.M.F Method-MMF Method – ZPF Method – ASA Method – Short Circuit Ratio (SCR) – Two Reaction Theory –Determination of  $X_d$  and  $X_q$  (Slip Test) – Phasor Diagrams.

**UNIT –III**

**PARALLEL OPERATION OF SYNCHRONOUS GENERATORS**

Power Flow Equation in Alternators (Cylindrical and Salient Pole Machines) – Synchronizing Power and Torque – Parallel Operation and Load Sharing – Effect of Change of Excitation and Mechanical Power Input – Synchronizing Alternators with Infinite Bus Bars – Determination of Sub-Transient, Transient and Steady State Reactances.



## UNIT – IV

### SYNCHRONOUS MOTORS

Theory of Operation – Phasor Diagram – Power Flow Equations in Synchronous Motors- Variation of Current and Power Factor with Excitation – V and Inverted V Curves – Synchronous Condensers – Hunting, and Methods to Eliminate Hunting – Starting Methods of Synchronous Motor – Synchronous Induction Motor - Construction, Principle of operation and control of Brushless DC motor.

## UNIT – V

### SINGLE PHASE AND SPECIAL MOTORS

Single Phase Induction Motors - Constructional Features – Double Revolving Field Theory- Elementary Idea of Cross Field Theory – Split Phase Motors – Capacitor Start and Run Motors – Shaded Pole Motor. Principle and Performance of A.C Series Motor - Universal Motor – Single Phase Synchronous Motors – Reluctance Motor – Hysteresis Motor – Stepper Motor.

Course **Outcomes:** At the end of the course the student will be able to

- predetermine the regulation of synchronous generators using different methods.
- Determine how several alternators running in parallel share the load on the system.
- Analyze the performance characteristics of synchronous motors.
- Make necessary calculations for power factor improvement using synchronous condenser.
- Choose specific 1-phase motor and/or special motors for a given application.

### TEXT BOOKS:

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7<sup>th</sup> Edition, 2011.
2. Electric Machinery Fundamentals, Stephen J Chapman, Mc Graw Hill Series in Electrical and Computer Engineering, 4<sup>th</sup> Edition, 2010, 10<sup>th</sup> Reprint 2015.

### REFERENCE BOOKS:

1. Electric Machines 4<sup>th</sup> edition, D.P.Kothari and I.J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 4<sup>th</sup> Edition, 2010, 16<sup>th</sup> Reprint 2015.
2. Electric Machinery, A.E.Fitzgerald, C.Kingsley and S. Umans, Mc Graw Hill Education (India) Pvt. Ltd., 6<sup>th</sup> Edition, 2005.
3. Electrical Machines, S K Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4<sup>th</sup> Edition, 2014, 3<sup>rd</sup> Reprint 2015.

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15A04510 DIGITAL CIRCUITS AND SYSTEMS  
(MOOCS-I)

**Course Outcomes:**

Upon completion of the course, students should possess the following skills:

- Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
- Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

**UNIT-I**

Number System and Boolean Algebra And Switching Functions: Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Alpha Numeric Codes, Error Detecting and Correcting Codes. Boolean algebra: Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR

**UNIT -II:**

Minimization and Design of Combinational Circuits: Introduction, The Minimization with theorem, The Karnaugh Map Method, Five and Six Variable Maps, Prime and Essential Implications, Don't Care Map Entries, Using the Maps for Simplifying, Tabular Method, Partially Specified Expressions, Multi-output Minimization, Minimization and Combinational Design, Arithmetic Circuits, Comparator, Multiplexers, Code Converters, Wired Logic, Tristate Bus System, Practical Aspects related to Combinational Logic Design, Hazards and Hazard Free Relations.

### UNIT III

#### SEQUENTIAL CIRCUITS

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation – Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table – State minimization – State assignment - Excitation table and maps-Circuit implementation - Modulo-n counter, Registers

– shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

### UNIT IV

#### MEMORY DEVICES

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

### UNIT V

#### SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS

Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits. Design of Combinational and Sequential circuits using VERILOG

#### TEXT BOOKS:

1. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3<sup>rd</sup> Edition, Cambridge.
2. Digital Design- Morris Mano, PHI, 4th Edition. Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
3. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd.

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**REFERENCE BOOKS:**

1. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3<sup>rd</sup> Ed, John Wiley & Sons Inc.
2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013.
3. Digital Logic Design - Ye Brian and HoldsWorth, Elsevier
4. Fundamentals of Logic Design- Charles H. Roth, Cengage LEarning, 5<sup>th</sup>, Edition, 2004.
5. John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
6. John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
7. William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
8. Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003

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15A02505 NETWORKS SIGNALS AND SYSTEMS  
(MOOCS-I)

**Course Objectives:** The objectives of the course are to make the students learn about

- Basic characteristics of circuit elements
- How to compute two port parameters
- Study of graph theory and analysis of electrical networks
- Application of Laplace transforms to analyse the frequency response
- Application of Fourier transforms to electrical circuits excited by non-sinusoidal sources.

**Unit – I Introduction**

Network elements and sources – linearity and nonlinearity – Distributed and lumped parameters – Analysis of resistive networks

**Unit – II Two port networks**

Two port parameters short and open circuit – Problems – locus diagrams – Driving point immittance functions – Two element synthesis- Problems

**Unit – III Introduction to signals**

Types of signals – Laplace transforms – problems – Frequency response – bode plot – poles and zeros

**Unit – IV – Graph Theory**

Introduction – Concepts of Graph theory – image impedance and iterative impedance – Computer aided analysis of resistive networks – RLC two terminal network

**Unit – V Synthesis of Network functions**

Parts of Network functions – Problems – Synthesis of two port network – Fourier series – Fourier Transforms

**Outcomes: After completion of Course, the student should be able to**

- Given network, find the equivalent impedance by the concept of two port network
- Analyse the frequency response of electrical network using Laplace transform
- Apply concepts of Fourier series to simplify the electrical network
- Synthesize the network using network functions

**References:**

1. Electrical circuit theory and Technology, Jhon Bird, Elsevier, 4<sup>th</sup> Edition, 2010
2. Network Analysis, M.E. Van Valkenburg, Pearson Education, 3<sup>rd</sup> Edition, 2015
3. Circuit Theory (Analysis & Synthesis), A. Charabarthi, Dhanpat Rai & Co., 6<sup>th</sup> Edition, 2008.

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15A02506 ELECTRICAL MACHINES LABORATORY – II

**Course Objective:**

- To experiment in detail on Transformers, Induction Motors, Alternators and Synchronous Motors, and evaluate their performance characteristics.

**The following experiments are required to be conducted as compulsory experiments:**

1. O.C. & S.C. Tests on Single phase Transformer.
2. Sumpner's Test on a Pair of identical Single Phase Transformers
3. Scott Connection of Transformers
4. No-Load & Blocked Rotor Tests on Three Phase Induction Motor
5. Regulation of Three –Phase Alternator by Synchronous Impedance & M.M.F. Methods
6. V and Inverted V Curves of 3 Phase Synchronous Motor.
7. Equivalent Circuit of Single Phase Induction Motor
8. Determination of  $X_d$  and  $X_q$  of Salient Pole Synchronous Machine

**In addition to the above eight experiments, at least any two of the following experiments are required to be conducted:**

1. Parallel Operation of Single Phase Transformers
2. Separation of Core Losses of Single Phase Transformer
3. Brake Test on Three Phase Induction Motor
4. Regulation of Three-Phase Alternator by Z.P.F. and A.S.A Methods

**Course Outcomes:**

- After going through this laboratory course, the student acquires sufficiently good practical knowledge about the operation, testing, and characteristics of important A.C equipment like transformers, Induction Motors, Alternators and Synchronous Motors.
- The student should also have acquired the knowledge about the fixation of the rating of transformers, induction motors and synchronous machines.

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15A02507 ELECTRICAL MEASUREMENTS LABORATORY

**Course Objective:** The objectives of the course are to make the students learn about:

- Calibration of various electrical measuring/recording instruments.
- Accurate determination of resistance, inductance and capacitance using D.C and A.C Bridges.
- Measurement of parameters of choke coil

**The following experiments are required to be conducted as compulsory experiments:**

1. Calibration of Single Phase Energy Meter using Phantom loading method with RSS meter as standard
2. Calibration of Dynamometer Power Factor Meter
3. Crompton D.C. Potentiometer – Calibration of PMMC Ammeter and PMMC Voltmeter
4. Kelvin's Double Bridge – Measurement of very low Resistance values – Determination of Tolerance.
5. Measurement of % Ratio Error and Phase Angle of Given C.T. by Comparison.
6. Schering Bridge & Anderson Bridge for measurement of Capacitance and Inductance values.
7. Measurement of 3 Phase Reactive Power with Single-Phase Wattmeter.
8. Measurement of Parameters of a Choke Coil Using 3 Voltmeter and 3 Ammeter Methods.

**In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:**

9. Optical Bench – Determination of Polar Curve, Measurement of MHCP of Filament Lamps
10. Calibration of LPF Wattmeter – by Phantom Testing
11. Measurement of 3 Phase Power with Two Watt Meter Method (Balanced & Un balanced).
12. Dielectric Oil Testing Using H.T. Testing Kit
13. LVDT and Capacitance Pickup – Characteristics and Calibration
14. Resistance Strain Gauge – Strain Measurement and Calibration
15. Transformer Turns Ratio Measurement Using A.C. Bridge.



**Course Outcomes:** At the end of the course, the student will be able to

- Calibrate various electrical measuring/recording instruments.
- Accurately determine the values of inductance and capacitance using a.c bridges
- Accurately determine the values of very low resistances
- Measure reactive power in 3-phase circuit using single wattmeter
- Determine ratio error and phase angle error of CT

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15A99501 SOCIAL VALUES & ETHICS (AUDIT COURSE)  
(Common to all Branches)

**UNIT - I**

**Introduction and Basic Concepts of Society: Family and Society:** Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

**Channels of Youth Moments for National Building: NSS & NCC:** History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries. **Nehru Yuva Kendra (NYK):** Activities – Socio Cultural and Sports.

**UNIT – II**

Activities of NSS, NCC, NYK:

**Citizenship:** Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

**Youth and Crime:** Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

**Social Harmony and National Integration:** Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

**UNIT – III**

**Environment Issues:** Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

**Health, Hygiene & Sanitation:** Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

**Disaster Management:** Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

**Civil/ Self Defense:** Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

**UNIT – IV**

**Gender Sensitization:** Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic

Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

### UNIT - V

**Physical Education** : Games & Sports: Health and Recreation – Biological basis of Physical activity – benefits of exercise – Physical, Psychological, Social; Physiology of Muscular Activity, Respiration, Blood Circulation.

**Yoga**: Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

### TEXT BOOKS:

1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6<sup>th</sup> Edition, 2006
3. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
4. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
5. HUMAN SOCIETY: Kingsley Davis, Macmillan
6. SOCIETY: Mac Iver D Page, Macmillan
7. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
8. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
9. National Youth Policy 2014 (available on [www.yas.nic.in](http://www.yas.nic.in))
10. TOWARDS A WORLD OF EQUALS: A.Suneetha, Uma Bhrugudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu
11. LIGHT ON YOGA : B.K.S.Iyengar, Penguin Random House Publishers

[www.un.org](http://www.un.org)

[www.india.gov.in](http://www.india.gov.in)

[www.yas.nic.in](http://www.yas.nic.in)

<http://www.who.int/countries/ind/en/>

<http://www.ndma.gov.in>

<http://ayush.gov.in/event/common-yoga-protocol-2016-0>

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	3	1	0	3

15A52601 MANAGEMENT SCIENCE

*Course Objective: The objective of the course is to equip the student the fundamental knowledge of management science and its application for effective management of human resource, materials and operation of an organization. It also aims to expose the students about the latest and contemporary developments in the field of management.*

**UNIT –I:**

**Introduction to Management:** Concept-Nature and Importance of Management, Functions-Evaluation of Scientific Management, Modern management-Motivation Theories-Leadership Styles-Decision Making-Process-Designing Organization Structure-Principles and Types of Organization.

**UNIT- II:**

**Operations Management:** Plant location and Layout, Methods of production, Work-Study-Statistical Quality Control through Control Charts, Objectives of Inventory Management, Need for Inventory Control-EOQ&ABC Analysis(Simple Problems)**Marketing Management:** Meaning,Nature, Functions of Marketing, Marketing Mix, Channels of distribution- Advertisement and sales promotion-Marketing strategies-Product Life Cycle.

**UNIT -III:**

**Human Resource Management(HRM):** Significant and Basic functions of HRM- Human Resource Planning(HRP), Job evaluation, Recruitment and Selection, Placement and Induction-Wage and Salary administration. Employee Training and development-Methods-Performance Appraisal-Employee Grievances-techniques of handling Grievances.

**UNIT –IV:**

**Strategic Management:** Vision, Mission, Goals and Strategy- Corporate Planning Process-Environmental Scanning-SWOT analysis-Different Steps in Strateg Formulation, Implementation and Evaluation. **Project Management:** Network Analysis- PERT, CPM, Identifying Critical Path-Probability-Project Cost Analysis, Project Crashing (Simple Problems).

**UNIT-V:**

**Contemporary Management Practices:** Basic concepts of MIS-Materials Requirement Planning(MRP),Just-In-Time(JIT)System, Total Quality Management(TQM)-Six Sigma

and Capability Maturity Models(CMM) evies, Supply Chain Management, Enterprise Resource Planning(ERP),Performance Management, Business Process Outsourcing(BPO), Business Process Re-Engineering and Bench Marking, Balance Score Card.

**Course Outcome:** This course enables the student to know the principles and applications of management knowledge and exposure to the latest developments in the field. This helps to take effective and efficient management decisions on physical and human resources of an organization. Beside the knowledge of Management Science facilitates for his/her personal and professional development.

**TEXT BOOKS:**

1. A.R Aryasri: Management Science, TMH, 2013
2. Kumar /Rao/Chalill 'Introduction to Management Science' Cengage, Delhi, 2012.

**REFERENCE BOOKS:**

1. A.K.Gupta "Engineering Management",S.CHAND, New Delhi, 2016.
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.
3. Kotler Philip & Keller Kevin Lane: Marketing Mangement , PHI,2013.
5. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005.
6. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
7. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
8. Parnell: Strategic Management, Biztantra, 2003.
9. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2005.

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	3	1	0	3

15A02601 POWER SEMICONDUCTOR DRIVES

**Course Objectives:** The objectives of the course are to make the students learn about:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

**UNIT – I**

**CONVERTER FED DC MOTORS**

Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase, Three Phase Semi and Fully Controlled Converters Connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics- Problems.

**UNIT – II**

**FOUR QUADRANT OPERATION OF DC DRIVES**

Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only)

**UNIT – III**

**CHOPPER FED DC MOTORS**

Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics – Problems on Chopper Fed D.C Motors

## UNIT – IV

### CONTROL OF INDUCTION MOTOR

Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers – Waveforms – Speed Torque Characteristics - Stator Frequency Control and Characteristics. Voltage Source and Current Source Inverter - PWM Control – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Numerical Problems on Induction Motor Drives – Closed Loop Operation of Induction Motor Drives (Block Diagram Only) – Principles of Vector Control

Static Rotor Resistance Control – Slip Power Recovery – V/f control of Induction Motor – Their Performance and Speed Torque Characteristics – Advantages- Applications – Problems

## UNIT – V

### CONTROL OF SYNCHRONOUS MOTORS

Separate Control & Self Control of Synchronous Motors – Operation of Self Controlled Synchronous Motors by VSI and CSI Cycloconverters. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages and Numerical Problems – Closed Loop Control Operation of Synchronous Motor Drives (Block Diagram Only), Introduction to variable frequency control.

**Course Outcomes:** The student should be able to:

- Identify the choice of the electric drive system based on their applications
- Explain the operation of single and multi quadrant electric drives
- Analyze single phase and three phase rectifiers fed DC motors as well as chopper fed DC motors
- Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors and Synchronous motors with closed loop, and open loop operations.

### TEXT BOOKS:

1. Power semiconductor controlled drives, G K Dubey, Prentice Hall, 1995.
2. Modern Power Electronics and AC Drives, B.K. Bose, PHI, 2002.

### REFERENCE BOOKS:

1. Power Electronics, MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. Power Electronic Circuits, Devices and applications, M.H.Rashid, PHI, 2005.
3. Electric drives Concepts and Applications, Vedam Subramanyam, Tata McGraw Hill Publications, 2<sup>nd</sup> Edition, 2011.

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15A02602 POWER SYSTEM PROTECTION

**Course Objectives:** The objectives of the course are to make the students learn about:

- The different types of electromagnetic relays and microprocessor based relays
- The protection of Generators
- The protection of Transformers
- The protection of feeders and lines
- The technical aspects involved in the operation of circuit breakers
- Generation of over voltages and protection from over voltages

**UNIT – I**

**RELAYS**

Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays and Their Flow Charts.

**UNIT – II**

**PROTECTION OF GENERATORS & TRANSFORMERS**

Protection of Generators Against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection. Numerical Problems on percentage winding unprotected. Protection of Transformers: Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholtz Relay Protection, Numerical Problems.

**UNIT – III**

**PROTECTION OF FEEDERS & LINES**

Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.



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## UNIT – IV

### CIRCUIT BREAKERS

Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB Ratings and Specifications: Types and Numerical Problems. – Auto Reclosures. Description and Operation of Following Types of Circuit Breakers: Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers.

## UNIT – V

### OVER VOLTAGES IN POWER SYSTEMS

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve Type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL.

**Course Outcomes:** At the end of the course the student should be able to:

- Explain the principles of operation of various types of electromagnetic relays, Static relays as well as Microprocessor based relays
- Understanding the protection of generators and determination of what % generator winding is unprotected under fault occurrence
- Understanding the protection of transformers and make design calculations to determine the required CT ratio for transformer protection
- Explain the use of relays in protecting Feeders, lines and bus bars
- Solve numerical problems concerning the arc interruption and recovery in circuit breakers
- Understand why over voltages occur in power system and how to protect the system

### TEXT BOOKS:

1. Power System Protection and Switchgear, Badri Ram, D.N Viswakarma, TMH Publications, 2011.
2. Switchgear and Protection, Sunil S Rao, Khanna Publishers, 1992.

### REFERENCE BOOKS:

1. Electrical Power Systems, C.L.Wadhwa, New Age international (P) Limited, Publishers, 2012.
2. Transmission network Protection, Y.G. Paithankar ,Taylor and Francis,2009.
3. Power system protection and switch gear, Bhuvanesh Oza, TMH, 2010.

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**15A04601 MICROPROCESSORS AND MICROCONTROLLERS**

**Course Outcomes:**

**After completion of this subject the students will be able to :**

1. Do programming with 8086 microprocessors
2. Understand concepts of Intel x86 series of processors
3. Program MSP 430 for designing any basic Embedded System
4. Design and implement some specific real time applications  
Using MSP 430 low power microcontroller.

**UNIT I**

Introduction-8086 Architecture-Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table. Memory organization and memory banks accessing.

**UNIT II**

Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives-Macros and Procedures.- Sorting, Multiplication, Division and multi byte arithmetic code conversion. String Manipulation instructions-Simple ALPs.

**UNIT III**

Low power RISC MSP430 – block diagram, features and architecture,Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, MSP430x5x series block diagram, Addressing modes, Instruction set Memory address space, on-chip peripherals (analog and digital), and Register sets.Sample embedded system on MSP430 microcontroller.

**UNIT-IV**

I/O ports pull up/down resistors concepts, Interrupts and interrupt programming. Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability. Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.

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## UNIT-V

Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices. Implementing Embedded Wi-Fi using CC3100

### **Text Books:**

1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. 1 st Edition, 2010
2. "The X86 Microprocessors , Architecture, Programming and Inerfacing" , Lyla B. Das, Pearson Publications, 2010
3. MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008

### **References:**

[http://processors.wiki.ti.com/index.php/MSP430\\_LaunchPad\\_Low\\_Power\\_Mode](http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode)  
[http://processors.wiki.ti.com/index.php/MSP430\\_16-Bit\\_Ultra-Low\\_Power\\_MCU\\_Training](http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training)

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15A02603	POWER SYSTEM ANALYSIS			

**Course Objectives:** The objectives of the course are to make the students learn about:

- Y bus and Z bus of a Power System network
- Power flow studies by various methods.
- Short circuit analysis of power systems.
- Swing equation and its solution
- Equal area criterion and its applications

**UNIT - I**

**POWER SYSTEM NETWORK MATRICES**

Representation of Power System Elements, Graph Theory: Definitions, Bus Incidence Matrix,  $Y_{bus}$  Formation by Direct and Singular Transformation Methods, Numerical Problems. Formation of  $Z_{Bus}$ : Partial Network, Algorithm for the Modification of  $Z_{Bus}$  Matrix for Addition Element for the Following Cases: Addition of Element from a New Bus to Reference, Addition of Element from a New Bus to an Old Bus, Addition of Element Between an Old Bus to Reference and Addition of Element Between Two Old Busses (Derivations and Numerical Problems).- Modification of  $Z_{Bus}$  for the Changes in Network ( Problems )

**UNIT – II**

**SHORT CIRCUIT ANALYSIS**

Per-Unit System of Representation. Per-Unit Equivalent Reactance Network of a Three Phase Power System, Numerical Problems. Symmetrical Fault Analysis: Short Circuit Current and MVA Calculations, Fault Levels, Application of Series Reactors, Numerical Problems. Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero Sequence Components: Voltages, Currents and Impedances. Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems. Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without Fault Impedance, Numerical Problems.

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### UNIT – III

#### POWER FLOW STUDIES-I

Necessity of Power Flow Studies – Data for Power Flow Studies – Derivation of Static Load Flow Equations – Load Flow Solutions using Gauss Seidel Method: Acceleration Factor, Load Flow Solution with and without P-V Buses, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and Finding Line Flows/Losses for the given Bus Voltages.

### UNIT – IV

#### POWER FLOW STUDIES-II

Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Buses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods – DC Load Flow

### UNIT – V

#### POWER SYSTEM STABILITY ANALYSIS

Elementary Concepts of Steady State, Dynamic and Transient Stabilities - Description of: Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to Improve Steady State Stability - Derivation of Swing Equation - Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Solution of Swing Equation by 4<sup>th</sup> Order Runge Kutta Method (up to 2 iterations) - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

**Course Outcomes:** At the end of the course the student should be able to:

- Form the  $Z_{bus}$  and  $Y_{bus}$  of a given power system network
- Compare different methods used for obtaining load flow solution
- Conduct load flow studies on a given system
- Make fault calculations for various types of faults
- Determine the transient stability by equal area criterion
- Determine steady state stability power limit
- Distinguish between different types of buses used in load flow solution

**TEXT BOOKS:**

1. Power Systems Analysis, Grainger and Stevenson, Tata Mc Graw-hill, 2005.
2. Modern Power system Analysis 2<sup>nd</sup> edition, I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing Company, 2003.

**REFERENCE BOOKS:**

1. Computer Techniques in Power System Analysis 2<sup>nd</sup> Edition,, M A Pai, TMH, 2005.
2. Computer Techniques and Models in Power Systems, K. Uma Rao, I. K. International, 2007.
3. Electric Power Systems 1<sup>st</sup> Edition, S. A. Nasar, Schaum's Outline Series, TMH, 1997.
4. Computer Methods in Power System Analysis, E. I. Stagg and El-Abiad, Tata Mc Graw Hill, 1969.

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15A02604 NEURAL NETWORKS & FUZZY LOGIC  
(CBCC-I)

**Course Objective:** The objectives of the course are to make the students learn about:

- Importance of AI techniques in engineering applications
- Artificial Neural network and Biological Neural Network concepts
- ANN approach in various Electrical Engineering problems
- Fuzzy Logic and Its use in various Electrical Engineering Applications

**UNIT – I**

**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**

Introduction and motivation – Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems – Knowledge Representation – Expert Systems.

**UNIT – II**

**ARTIFICIAL NEURAL NETWORKS**

Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories.

**UNIT – III**

**ANN APPLICATIONS TO ELECTRICAL SYSTEMS**

ANN approach to: Electrical Load Forecasting Problem – System Identification – Control Systems – Pattern Recognition.

**UNIT – IV**

**FUZZY LOGIC**

Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

**UNIT – V**

**FUZZY LOGIC APPLICATIONS TO ELECTRICAL SYSTEMS**

Fuzzy Logic Implementation for Induction Motor Control – Switched Reluctance Motor Control – Fuzzy Excitation Control Systems in Automatic Voltage Regulator – Fuzzy Logic Controller in an 18 Bus Bar System.

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**Course Outcomes:** The students should acquire awareness about:

- Approaches and architectures of Artificial Intelligence
- Artificial Neural Networks terminologies and techniques
- Application of ANN to Electrical Load Forecasting problem, Control system problem
- Application of ANN to System Identification and Pattern recognition
- The development of Fuzzy Logic concept
- Use of Fuzzy Logic for motor control and AVR operation
- Use of Fuzzy Logic controller in an 18 bus bar system

**Text Books:**

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLAB", McGraw Hill Edition, 2006.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY India Edition, 2012.

**References:**

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2. Yung C. Shin and Chengying Xu, "Intelligent System – Modeling, Optimization & Control, CRC Press, 2009.



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15A02605	PROGRAMMABLE LOGIC CONTROLLER AND ITS APPLICATIONS (CBCC-1)			

**Course Objectives:** The objectives of the course are to make the students learn about:

- PLC and its basics, architecture, connecting devices and programming
- Implementation of Ladder logic for various Industrial applications
- Designing of control circuits for various applications
- PLC logic and arithmetic operations

#### UNIT-I

PLC Basics: PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment, Programming Formats, Construction of PLC Ladder Diagrams, Devices Connected To I/O Modules. PLC Programming: Input Instructions, Outputs, Operational Procedures, Programming Examples Using Contacts and Coils. Drill Press Operation.

#### UNIT-II

Digital Logic Gates, Programming in the Boolean Algebra System, Conversion Examples. Ladder Diagrams for Process Control: Ladder Diagrams & Sequence Listings, Ladder Diagram Construction and Flowchart for Spray Process System.

#### UNIT-III

PLC Registers: Characteristics of Registers, Module Addressing, Holding Registers, Input Registers, Output Registers. PLC Functions: Timer Functions & Industrial Applications, Counter Function & Industrial Applications, Arithmetic Functions, Number Comparison Functions, Number Conversion Functions

#### UNIT-IV

Data Handling Functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit Shift Register, Sequence Functions and Applications, Controlling of Two-Axis & Three Axis Robots With PLC, Matrix Functions.

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**UNIT-V**

Analog PLC Operation, Types of PLC Analog Modules and Systems, PLC Analog Signal Processing, BCD or Multibit data Processing, Analog output application examples, PID Modules, PID Tuning, Typical PID Functions, PLC Installation, Troubleshooting and Maintenance.

**Course Outcomes:** The student should be able to:

- Program a PLC for a given application
- Implement Ladder logic for various Industrial applications
- Design control circuits for various applications

**TEXT BOOKS:**

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, ELSEVIER Ltd., 2009.
2. Programmable Logic Controllers 5th Edition, William Bolton, Newnes, ELSEVIER Ltd., 2009.

**REFERENCES:**

1. Programmable Logic Controllers: An Emphasis on design & application, Kelvin T. Erickson, Dogwood Valley Press, 2011.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (EEE)	L	T	P	C
	3	1	0	3

15A02606 OPTIMIZATION TECHNIQUES  
(CBCC-I)

**Course Objectives :**

The objectives of the course are to make the students learn about:

- The basic concepts of optimization and classification of optimization problems.
- Different classical Optimization techniques, linear programming, unconstrained and constrained nonlinear programming.
- Soft Computing methods – GA & PSO

**UNIT-I**

**INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUE**

Statement of an Optimization Problem- Design Vector- Design Constraints- Constraints Surface – Objective Function- Objective Function Surfaces- Classification of Optimization Problems. Classical Optimization Techniques- Single Variable Optimization- Multi Variable Optimization Without Constraints- Necessary and Sufficient Conditions for Minimum/Maximum- Multi Variable Optimization With Equality Constraints Solution by Method of Lagrange Multipliers- Multi Variable Optimization with Inequality Constraints – Kuhn- Tucker Conditions

**UNIT-II**

**LINEAR PROGRAMMING**

Standard Form of Linear Programming Problem- Geometry of Linear Programming Problems- Definitions and Theorems- Solution of a System of Linear Simultaneous Equations- Pivotal Reduction of a General System of Equations- Motivation to The Simplex Method- Simplex Algorithm – Revised Simplex Method – Two Phase Simplex Method - Initial Basic Feasible Solution by North- West Corner Rule, Approximation Method.

**UNIT-III**

**UNCONSTRAINED NONLINEAR PROGRAMMING**

One-Dimensional Minimization Methods: Classification, Fibonacci Method and Quadratic Interpolation Method- Unconstrained Optimization Techniques- Univariate Method, Powell's Method, Steepest Descent Method, Newtons Method.

## UNIT-IV

### CONSTRAINED NONLINEAR PROGRAMMING

Characteristics of a Constrained Problem, Classification, Basic Approach of Penalty Function Method; Basic Approaches of Interior and Exterior Penalty Function Methods, Introduction to Convex Programming Problem

## UNIT-V

### SOFT COMPUTING METHODS

Evolutionary programming methods - Introduction to Genetic Algorithms (GA)– Control parameters –Number of generation, population size, selection, reproduction, crossover and mutation – Operator selection criteria – Simple mapping of objective function to fitness function – constraints – Genetic algorithm steps – Stopping criteria –Simple examples.

Swarm intelligence programming methods - Basic Partial Swarm Optimization – Method – Characteristic features of PSO procedure of the global version – Parameters of PSO (Simple PSO algorithm – Operators selection criteria – Fitness function constraints)

### Course Outcomes:

The student should be able to:

- Develop an objective function and obtain solution for multivariable optimization problem with equality/Inequality constraints
- Apply linear programming techniques for problem solving
- Apply nonlinear programming techniques for unconstrained/constrained optimization
- Use soft computing techniques to solve optimization problems

### TEXT BOOKS:

1. Engineering optimization: Theory and practice 3<sup>rd</sup> edition, S.S.Rao, New Age International (P) Limited, 1998.
2. Optimization Methods in Operations Research and systems Analysis 3<sup>rd</sup> edition, K.V.Mital and C.Mohan, New Age International (P) Limited, 1996.
3. Soft Computing with Matlab Programming by N.P.Padhy&S.P.Simson, Oxford University Press – 2015

### REFERENCE BOOKS:

1. Operations Research, Dr.S.D.Sharma, S.Chand & Sons, 2001.
2. Operation Research: An Introduction 6<sup>th</sup> edition, H.A.Taha, PHI , 2003.
3. Optimization for Engineering Design – Algorithms and Examples, Kalyanmoy Deb, 2<sup>nd</sup> Edition, PHI, 2014.
4. Soft Computing Advances and Applications, B. K. Tripathy and J. Anuradha, CENGAGE Learning, 2015.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (EEE)	L	T	P	C
	3	1	0	3
15A01608	INTELLECTUAL PROPERTY RIGHTS ( CBCC-I)			

**COURSE OBJECTIVE:**

*This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.*

**UNIT – I**

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

**UNIT – II**

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

**UNIT – III**

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.  
Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

**UNIT – IV**

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.  
Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

**UNIT – V**

New Developments Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.  
International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

**TEXT BOOKS & REFERENCES:**

1. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learning.
2. Intellectual Property Rights– Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,

**Course Outcomes:**

*On completion of this course, the student will have an understanding of the following:*

- a) *Intellectual Property Rights and what they mean*
- b) *Trade Marks and Patents and how to register them*
- c) *Laws Protecting the Trade Marks and Patents*
- d) *Copy Right and laws related to it.*

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (EEE)	L	T	P	C
15A04607	0	0	4	2
MICROPROCESSORS AND MICROCONTROLLERS LABORATORY				

**Part A : 8086 Microprocessor Programs using NASM/8086 microprocessor kit.**

1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations
3. Programs using string operations and Instruction prefix: Move Block, Reverse string, Sorting, String comparison
4. Programs for code conversion
5. Multiplication and Division programs
6. Sorting and multi byte arithmetic
7. Programs using CALL and RET instructions

**Part B Embedded C Experiments using MSP430 Microcontroller**

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs , push buttons)
2. Usage of Low Power Modes: ( Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current)
3. Interrupt programming examples through GPIOs
4. PWM generation using Timer on MSP430 GPIO
5. Interfacing potentiometer with MSP430
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO
7. Using ULP advisor in Code Composer Studio on MSP430
8. Low Power modes and Energy trace++:
  - a. Enable Energy Trace and Energy Trace ++ modes in CCS
  - b. Compute Total Energy, and Estimated lifetime of an AA battery.

**Note : Any six experiment from Part A and Six experiments from Part B are to be conducted**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

B. Tech III-II Sem. (EEE)	L	T	P	C
15A02607 POWER ELECTRONICS AND SIMULATION LABORATORY	0	0	4	2

**Course Objectives:** The student will understand:

- The characteristics of power electronic devices with gate firing circuits
- Various forced commutation techniques
- The operation of single-phase voltage controller, converters and Inverters circuits with R and RL loads
- Analyze the TPS7A4901, TPS7A8300 and TPS54160 buck regulators

**Any Eight of the Experiments in Power Electronics Lab**

1. Gate Firing Circuits for SCRs
2. Single Phase AC Voltage Controller with R and RL Loads
3. DC Jones Chopper with R and RL Loads
4. Forced Commutation Circuits (Class A, Class B, Class C, Class D and Class E)
5. Three phase fully controlled Bridge converter with R- load
6. Single Phase Parallel, Inverter with R and RL Loads
7. Single phase Cycloconverter with R and RL loads
8. Single Phase Series Inverter with R and RL Loads
9. Single Phase Dual Converter with RL Loads
10. Illumination control / Fan control using TRIAC

**Any Four Experiments of the following (1, 2, 3, A, B, C):**

1. Using TPS7A4901 and TPS7A8300, study-
  - a. Impact of line and load conditions on drop out voltage
  - b. Impact of line and load conditions on efficiency
  - c. Impact of capacitor on PSRR
  - d. Impact of output capacitor on load-transient response
2. Study of DC-DC Buck converter
  - a) Investigate how the efficiency of a TPS54160 buck regulator depends on the line and load conditions and on the switching frequency.
  - b) Analyze the influence of switching frequency  $f_s$  and of capacitance C and resistance ESR of the input and output capacitors on steady-state waveforms of TPS54160 buck regulator.



3. Analyze how the switching frequency  $f_s$ , the DC accuracy and the line noise rejection of the hysteretic buck regulator LM3475 depend on line voltage, the load current, the characteristics of the output capacitor and the impact of speed-up capacitor.

**WEBENCH EXPERIMENTS:**

- A. Design of a Low cost Boost Converter to derive 12V, 100mA from 5V USB
- B. Design of a low cost and power efficient Buck Converter that could be used as a USB charger for mobile devices deriving its power from an automotive battery.
- C. Design of a low cost synchronous buck converter.

**Course Outcomes:** Student should be able to:

- Test the turn on –turn off characteristics of various power electronic devices.
- Test and analyze firing circuits for SCRs
- Test different types of voltage controllers, converters and Inverters with R and RL loads
- Analyze the TPS7A4901, TPS7A8300 and TPS54160 buck regulators

**REFERENCES:**

1. PMLK BUCK Lab manual - <http://www.ti.com/lit/ug/ssqu007/ssqu007.pdf>
2. PMLK LDO Lab manual - <http://www.ti.com/lit/ug/ssqu006/ssqu006.pdf>
3. WEBENCH – [www.ti.com/webench](http://www.ti.com/webench)

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (EEE)	L	T	P	C
	0	0	2	0

15A52602    **ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS  
(AELCS) LAB (Audit Course)**

### 1. INTRODUCTION

With increased globalization and rapidly changing industry expectations, employers are looking for the wide cluster of skills to cater to the changing demand. The introduction of the Advanced Communication Skills Lab is considered essential at 3<sup>rd</sup> year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information and to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Taking part in social and professional communication.

### 2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

### 3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

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**UNIT-I: COMMUNICATION SKILLS**

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary Development
4. Common Errors

**UNIT-II: WRITING SKILLS**

1. Report writing
2. Resume Preparation
3. E-mail Writing

**UNIT-III: PRESENTATION SKILLS**

1. Oral presentation
2. Power point presentation
3. Poster presentation

**UNIT-IV: GETTING READY FOR JOB**

1. Debates
2. Group discussions
3. Job Interviews

**UNIT-V: INTERPERSONAL SKILLS**

1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

**4. LEARNING OUTCOMES:**

- Accomplishment of sound vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

**5. MINIMUM REQUIREMENT:**

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

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#### 6. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and G

1. Walden Infotech: Advanced English Communication Skills Lab
2. K-VAN SOLUTIONS-Advanced English Language Communication Skills lab
3. DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.
4. TOEFL & GRE( KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. Train2success.com

#### 7. BOOKS RECOMMENDED:

1. Objective English for Competitive Exams, Hari Mohana Prasad, 4<sup>th</sup> edition, Tata Mc Graw Hill.
2. Technical Communication by Meenakshi Raman & Sangeeta Sharma, O U Press 3<sup>rd</sup> Edn. 2015.
3. Essay Writing for Exams, Audrone Raskauskiene, Irena Ragaisience & Ramute Zemaitience, OUP, 2016
4. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.
5. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Campus to Corporate, Gangadhar Joshi, Sage Publications, 2015
7. Communicative English, E Suresh Kumar & P.Sreehari, Orient Blackswan, 2009.
8. English for Success in Competitive Exams, Philip Sunil Solomon OUP, 2015

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

B. Tech IV-I Sem. (EEE)

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3	1	0	3

**15A02701 ELECTRICAL DISTRIBUTION SYSTEMS**

**Course Objectives:** The student has to acquire knowledge about:

- The classification of distribution systems
- The technical aspects and design considerations in DC and AC distribution systems and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

**UNIT – I**

**LOAD MODELING AND CHARACTERISTICS**

Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

**UNIT – II**

**CLASSIFICATION OF DISTRIBUTION SYSTEMS**

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System. Voltage Drop Calculations (Numerical Problems) In A.C. Distributors for The Following Cases: Power Factors Referred to Receiving End Voltage and With Respect to Respective Load Voltages.

**UNIT – III**

**SUBSTATIONS**

Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations.

Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment.

Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar, Sectionalized Single Bus Bar, Main and Transfer Bus Bar Double Breaker – One and Half Breaker System With Relevant Diagrams.

## **UNIT – IV**

### **POWER FACTOR IMPROVEMENT**

Voltage Drop and Power-Loss Calculations: Derivation for Voltage Drop and Power Loss in Lines, Manual Methods of Solution for Radial Networks, Three Phase Balanced Primary Lines.

Causes of Low P.F -Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems.

Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction- Economic Justification - Procedure to Determine the Best Capacitor Location.

## **UNIT – V**

### **DISTRIBUTION AUTOMATION**

Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

**Course Outcomes:** Student should be able to:

- Compute the various factors associated with power distribution
- Make voltage drop calculations in given distribution networks
- Learn principles of substation maintenance
- Compute power factor improvement for a given system and load
- Understand implementation of SCADA for distribution automation

### **TEXT BOOKS:**

1. Electric Power Distribution Engineering, Turan Gonen, CRC Press, 3<sup>rd</sup> Edition, 2014.
2. Electric Power Distribution, A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6<sup>th</sup> Edition, 2011.

### **REFERENCE BOOKS:**

1. Electric Power Distribution Automation, Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. Electrical Power Distribution Systems, V. Kamaraju, Jain Book Depot. 2012.
3. Electrical Power Systems for Industrial Plants, Kamalesh Das, JAICO Publishing House, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (EEE)

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3	1	0	3

15A04603 DIGITAL SIGNAL PROCESSING

**Course Outcomes:**

At the end of the course, the student should be able to:

- Formulate engineering problems in terms of DSP tasks.
- Apply engineering problems solving strategies to DSP problems.
- Design and test DSP algorithms.
- Analyze digital and analog signals and systems.
- Encode information into signals.
- Design digital signal processing algorithms.
- Design and simulate digital filters.
- Analyze and compare different signal processing strategies.

**UNIT-I**

Review of discrete-time signals and systems – Time domain analysis of discrete-time signals & systems, Frequency domain analysis of discrete-time signals and systems.

**Discrete Fourier Transform:** Frequency-domain sampling and reconstruction of discrete-time signals, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

**UNIT-II**

Efficient computation of the DFT – Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix-2, Radix-4, and Split radix FFT algorithms, Implementation of FFT algorithms, Applications of FFT algorithms – Efficient computation of the DFT of two real sequences,  $2N$  point real sequences, Use of the FFT algorithm in linear filtering and correlation, A linear filtering approach to computation of the DFT- the Goertzel, and the Chirp-z transform algorithms, Quantization errors in the computation of DFT.

**UNIT-III**

Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice – Ladder structure.

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#### **UNIT-IV**

General considerations – Causality and its implications, Characteristics of practical Frequency Selective Filters, Design of Finite Impulse Response (FIR) filters – Symmetric and asymmetric FIR filters, Design of linear phase FIR filters using windows, Design of linear phase FIR filters by the frequency sampling method, Design of optimum equi-ripple linear phase FIR filters, Comparison of design methods for linear phase FIR filters, Design of Impulse Invariance Response (IIR) filters from analog filters – IIR filter design by approximation of derivatives, by Impulse invariance, and by bilinear transformation methods, Characteristics of commonly used analog filters, Design examples of both FIR and IIR filters, Frequency transformation in the analog and digital domains, Illustrative problems.

#### **UNIT-V**

Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

#### **TEXT BOOKS:**

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," Pearson Education/PHI, 4<sup>th</sup> ed., 2007.
2. Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3<sup>rd</sup> edition, 2009.

#### **REFERENCES:**

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2<sup>nd</sup> ed., Pearson Education, 2012.
2. B. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. Li Tan, Jean Jiang, "Digital Signal Processing, Fundamentals and Applications," Academic Press, Second Edition, 2013.



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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (EEE)	L	T	P	C
	3	1	0	3

15A02702 POWER SYSTEM OPERATION AND CONTROL

**Course Objectives:** The objectives of the course are to make the students learn about:

- Optimum generation allocation
- Hydrothermal scheduling
- Modeling of turbines and generators
- Load frequency control in single area and two area systems
- Reactive power compensation in power systems
- Power system operation in competitive environment

**UNIT – I**

**ECONOMIC OPERATION**

Optimal Operation of Thermal Power Units, - Heat Rate Curve – Cost Curve – Incremental Fuel and Production Costs, Input-Output Characteristics, Optimum Generation Allocation with Line Losses Neglected. Optimum Generation Allocation Including the Effect of Transmission Line Losses – Loss Coefficients, General Transmission Line Loss Formula.

**UNIT-II**

**HYDROTHERMAL SCHEDULING**

Optimal Scheduling of Hydrothermal System: Hydroelectric Power Plant Models, Scheduling Problems-Short Term Hydrothermal Scheduling Problem. Modeling of Turbine: First Order Turbine Model, Block Diagram Representation of Steam Turbines and Approximate Linear Models. Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of Small Signal Transfer Function – Block Diagram.

**UNIT – III**

**LOAD FREQUENCY CONTROL**

Necessity of Keeping Frequency Constant. Definitions of Control Area – Single Area Control – Block Diagram Representation of an Isolated Power System – Steady State Analysis – Dynamic Response – Uncontrolled Case. Load Frequency Control of 2-Area System – Uncontrolled Case and Controlled Case, Tie-Line Bias Control. Proportional Plus Integral Control of Single Area and Its Block Diagram Representation, Steady State Response – Load Frequency Control and Economic Dispatch Control.

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## UNIT – IV

### REACTIVE POWER CONTROL

Overview of Reactive Power Control – Reactive Power Compensation in Transmission Systems – Advantages and Disadvantages of Different Types of Compensating Equipment for Transmission Systems; Load Compensation – Specifications of Load Compensator, Uncompensated and Compensated Transmission Lines: Shunt and Series Compensation.

## UNIT – V

### POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion - Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting

**Course Outcomes:** After completion of the course, the student will able to:

- Develop the mathematical models of turbines and governors
- Address the Load Frequency Control problem
- Explain how shunt and series compensation helps in reactive power control
- Explain the issues concerned with power system operation in competitive environment

### TEXT BOOKS:

1. Power System Analysis Operation and Control, Abhijit Chakrabarti and Sunita Halder, PHI Learning Pvt. Ltd., 3<sup>rd</sup> Edition, 2010.
2. Modern Power System Analysis, D.P.Kothari and I.J.Nagrath, Tata McGraw Hill Publishing Company Ltd., 3<sup>rd</sup> Edition, 2003, Ninth Reprint 2007.

### REFERENCE BOOKS:

1. Power System Analysis and Design, J. Duncan Glover and M.S.Sharma, Thomson, 3<sup>rd</sup> Edition, 2008.
2. Electric Energy System Theory: An Introduction, Olle Ingemar Elgerd, Tata McGraw Hill, 2<sup>nd</sup> Edition, 1982.
3. Power System Stability and Control, P Kundur, Tata McGraw Hill, 1994, 5<sup>th</sup> Reprint, 2008.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (EEE)	L	T	P	C
	3	1	0	3

15A02703 UTILIZATION OF ELECTRICAL ENERGY

**Course Objectives:** The objectives of the course are to make the students learn about:

- The laws of illumination and their application for various lighting schemes
- Principles and methods for electric heating and welding.
- Systems of electric traction, study of traction equipment, mechanics of train movement and associated calculations.

**UNIT-I**

**ILLUMINATION**

Definition –Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Lamps: Incandescent Lamp, Sodium Vapour Lamp, Fluorescent Lamp, CFL and LED. Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination. Street Lighting and Factory Lighting – Numerical Problems – Energy Conservation methods.

**UNIT-II**

**ELECTRIC HEATING & WELDING**

Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Arc, Induction and Dielectric Heating – Energy conservation methods.

Electric Welding: Types – Resistance, Electric Arc, Gas Welding. Ultrasonic, Welding Electrodes of Various Metals, Defects in Welding.

Electrolysis - Faraday's Laws, Applications of Electrolysis, Power Supply for Electrolysis.

**UNIT-III**

**ELECTRIC TRACTION – I**

Introduction – Systems of Electric Traction. Comparison Between A. C. and D. C. Traction – Special Features of Traction Motors - The Locomotive – Wheel arrangement and Riding Qualities – Transmission of Drive – Characteristics and Control of Locomotives and Motor Coaches for Track Electrification – DC Equipment – AC Equipment – Electric Braking with DC Motors and with AC Motors – Control Gear – Auxilliary Equipment – Track Equipment and Collector Gear – Conductor-Rail Equipment – Overhead Equipment – Calculation of Sags and Tensions – Collector Gear for Overhead Equipment.

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#### **UNIT-IV**

##### **ELECTRIC TRACTION - II**

Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and Quadrilateral Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems.

#### **UNIT-V**

##### **ECONOMIC ASPECTS OF UTILISING ELECTRICAL ENERGY**

Power Factor Improvement, Load Factor improvement, Off Peak Loads- Use of Exhaust Steam, Waste Heat recovery, Pit Head Generation, Diesel Plant, General Comparison of Private Plant and Public Supply- Initial Cost and Efficiency, Capitalization of Losses, Choice of Voltage.

**Course Outcomes:** Student should be able to:

- Develop a lighting scheme for a given practical case.
- Analyze the performance of Heating and Welding methods
- Make all numerical calculations associated with electric traction.
- Assess the economic aspects in utilisation of electrical energy

#### **TEXT BOOKS:**

1. Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004.

#### **REFERENCE BOOKS:**

1. Generation, distribution and utilization of electrical energy, C.L Wadhwa, Wiley Eastern Limited, 1993
2. Electrical Power, S. L. Uppal, Khanna publishers, 1988.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (EEE)	L	T	P	C
	3	1	0	3

15A02704 MODERN CONTROL THEORY  
(CBCC-II)

**Course Objective :** The objectives of the course are to make the students learn about:

- Concepts of state vector, State transition matrix and solution of state equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance

**UNIT – I**

**STATE VARIABLE DESCRIPTION AND SOLUTION OF STATE EQUATION**

Concept of State – Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transition matrix. Complete response of continuous time systems.

**UNIT – II**

**CONTROLLABILITY, OBSERVABILITY,**

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

**UNIT – III**

**STATE FEEDBACK CONTROLLERS AND OBSERVERS**

Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters.

**UNIT – IV**

**ANALYSIS OF NONLINEAR SYSTEMS**

Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems.

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## **UNIT- V**

### **STABILITY ANALYSIS**

Stability in the sense of Lyapunov. Lyapunov's stability and Lyapunov's instability theorems. Direct method of Lyapunov for Linear and Nonlinear continuous time autonomous systems.

#### **TEXT BOOKS:**

1. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5<sup>th</sup> Edition, 2010.
2. Modern Control System Theory, M. Gopal, New Age International Publishers, Revised 2<sup>nd</sup> edition, 2005.

#### **REFERENCE BOOKS:**

1. Control Systems Engineering, I.J. Nagarath and M.Gopal, New Age International Publishers, 5<sup>th</sup> Edition, 2007, Reprint 2012.
2. Modern Control Engineering, D. Roy Choudhury, PHI Learning Private Limited, 9<sup>th</sup> Printing, January 2015.

**Course Outcomes:** At the end of studying the course, the student should be able to:

- Model a given dynamic system in state space and obtain the solution for the state equation
- Test whether a given system is controllable and/or observable
- Design a state feedback controller for pole placement
- Design an observer for state estimation
- Apply Lyapunov criterion and determine stability of a given system
- Analyze nonlinear systems

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (EEE)	L	T	P	C
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15A02705 SWITCHED MODE POWER CONVERTERS  
(CBCC-II)

**Course Objectives:** The objectives of the course are to make the students learn about:

- The concepts of modern power electronic converters and their applications in electric power utility.
- Analyzing and control of various power converter circuits

**UNIT – I**

**NON-ISOLATED DC-DC CONVERTERS**

Basic Types of Switching Power Supplies – Volt-Sec balance – Non-Isolated Switched-Mode DC-to-DC Converters – Buck Converter – Boost Converter – Buck-Boost Converter – Cuk Converter – SEPIC and Zeta Converters – Comparison of Non-Isolated Switched mode DC-to-DC Converters.

**UNIT – II**

**ISOLATED DC-DC CONVERTERS**

Need of Transformer Isolations in high frequency Power conversion - Isolated Switched Mode DC-to-DC Converters – Single Switch Isolated DC-to-DC Converters – Forward, Flyback, Push-Pull, Flux Weakening Phenomena, Half and Full Bridge Converters – Multi Switch Isolated DC-to-DC Converters – Comparison of Isolated and Non-Isolated Switched Mode DC-to-DC Converters.

**UNIT-III**

**RESONANT CONVERTERS**

Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits- Resonant switches, Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Resonant Buck and boost Converters.

**UNIT-IV**

**DYNAMIC ANALYSIS OF DC-DC CONVERTERS**

Formulation of dynamic equations of buck and boost converters, State-Space Models, Averaged Models, linearization technique, small-signal model and converter transfer functions, Significance of Small Signal Models, Dynamical Characterization.

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## UNIT-V

### CONTROLLER DESIGN

Review of frequency-domain analysis of linear time-invariant systems, controller specifications, Proportional (P), Proportional plus Integral (PI), Proportional, Integral plus Derivative controller (PID), selection of controller parameters for Isolated and Non-Isolated DC -DC Converters.

**Course Outcomes:** Upon completion of this course,

- The student learns the fundamental concepts of DC - DC Converters
- Student can explain the operation of different topologies of DC to DC converters and their differences
- Student will be able to model various converters as per state space, time average etc.
- Student can analyse in frequency domain with different P, PI and PID converters

### TEXT BOOKS:

1. Issa Batarseh, Fundamentals of Power Electronics, John Wiley Publications, 2009.
2. Robert Erickson and Dragomir Maksimovic, Fundamentals of Power Electronics, Springer Publications., 2<sup>nd</sup> Edition, 2001.

### REFERENCE BOOKS:

1. Switched Mode Power Supplies design and construction 2<sup>nd</sup> Edition, H W Whittington, B W Flynn and D E Macpherson, Universities Press, 2009.
2. Philip T.Krein Elements of Power Electronics - Oxford University Press, 1997.
3. L. Umanand Power Electronics, Tata Mc-Graw Hill, 2004.



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15A02706 ENERGY AUDITING & DEMAND SIDE MANAGEMENT  
(CBCC-II)

**Course Objectives:** The objectives of this course include

- To learn about energy consumption and situation in India
- To learn about Energy Auditing.
- To learn about Energy Measuring Instruments.
- To understand the Demand Side Management.

**UNI -I**

**INTRODUCTION TO ENERGY AUDITING**

Energy Situation – World and India, Energy Consumption, Conservation, Codes, Standards and Legislation. Energy Audit- Definitions, Concept, Types of Audit, Energy Index, Cost Index, Pie Charts, Sankey Diagrams, Load Profiles, Energy Conservation Schemes. Measurements in Energy Audits, Presentation of Energy Audit Results.

**UNIT -II**

**ENERGY EFFICIENT MOTORS AND POWER FACTOR IMPROVEMENT**

Energy Efficient Motors , Factors Affecting Efficiency, Loss Distribution , Constructional Details , Characteristics - Variable Speed , Variable Duty Cycle Systems, RMS Hp-Voltage Variation-Voltage Unbalance- Over Motoring- Motor Energy Audit.Power Factor – Methods of Improvement, Power factor With Non Linear Loads

**UNIT –III**

**LIGHTING AND ENERGY INSTRUMENTS FOR AUDIT**

Good Lighting System Design and Practice, Lighting Control, Lighting Energy Audit - Energy Instruments- Watt Meter, Data Loggers, Thermocouples, Pyrometers, Lux Meters, Tong Testers, Application of PLC's

**UNIT –IV**

**INTRODUCTION TO DEMAND SIDE MANAGEMENT**

Introduction to DSM, Concept of DSM, Benefits of DSM, Different Techniques of DSM – Time of Day Pricing, Multi-Utility Power Exchange Model, Time of Day Models for Planning. Load Management, Load Priority Technique, Peak Clipping, Peak Shifting, Valley Filling, Strategic Conservation, Energy Efficient Equipment. Management and Organization of Energy Conservation Awareness Programs.

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## UNIT –V

### ECONOMICS AND COST EFFECTIVENESS TESTS OF DSM PROGRAMS

Basic payback calculations, Depreciation, Net present value calculations. Taxes and Tax Credit – Numerical Problems. Importance of evaluation, measurement and verification of demand side management programs. Cost effectiveness test for demand side management programs - Ratepayer Impact Measure Test, Total Resource Cost, Participant Cost Test, Program Administrator Cost Test

Numerical problems: Participant cost test, Total Resource Cost test and Ratepayer impact measure test.

**Course Outcomes:** After completion of the course the student should be able to:

- Conduct energy auditing and evaluate energy audit results
- Carry out motor energy audit
- Analyze demand side management concepts through case study

### TEXT BOOKS:

1. **Industrial Energy Management Systems**, Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York, 1994.
2. **Fundamentals of Energy Engineering** - Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey, 1984.

### REFERENCES:

1. Economic Analysis of Demand Side Programs and Projects - California Standard Practice Manual, June 2002 – Free download available online [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)
2. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications, 2007.
3. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
4. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995.

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15A02707 SMART GRID  
(CBCC-III)

**Course Objectives:** The objectives of the course are to make the students learn about:

- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering, and protocols for smart metering
- Management systems for Transmission and distribution

**UNIT – I**

**THE SMART GRID**

Introduction, Ageing Assets and Lack of Circuit Capacity, Thermal Constraints, Operational Constraints, Security of Supply, National Initiatives, Early Smart Grid Initiatives, Active Distribution Networks, Virtual Power Plant, Other Initiatives and Demonstrations, Overview of The Technologies Required for The Smart Grid.

**UNIT – II**

**COMMUNICATION TECHNOLOGIES**

**Data Communications:** Introduction, Dedicated and Shared Communication Channels, Switching Techniques, Circuit Switching, Message Switching, Packet Switching, Communication Channels, Wired Communication, Optical Fibre, Radio Communication, Cellular Mobile Communication, Layered Architecture and Protocols, The ISO/OSI Model, TCP/IP

**Communication Technologies:** IEEE 802 Series, Mobile Communications, Multi Protocol Label Switching, Power line Communication, Standards for Information Exchange, Standards For Smart Metering, Modbus, DNP3, IEC61850

**UNIT – III**

**INFORMATION SECURITY FOR THE SMART GRID**

Introduction, Encryption and Decryption, Symmetric Key Encryption, Public Key Encryption, Authentication, Authentication Based on Shared Secret Key, Authentication Based on Key Distribution Center, Digital Signatures, Secret Key Signature, Public Key Signature, Message Digest, Cyber Security Standards, IEEE 1686: IEEE Standard for

Substation Intelligent Electronic Devices(IEDs) Cyber Security Capabilities, IEC 62351: Power Systems Management And Association Information Exchange – Data and Communication Security.

#### **UNIT – IV**

##### **SMART METERING AND DEMAND SIDE INTEGRATION**

Introduction, smart metering – evolution of electricity metering, key components of smart metering, smart meters: an overview of the hardware used – signal acquisition, signal conditioning, analogue to digital conversion, computation, input/output, communication.

Communication infrastructure and protocols for smart metering- Home area network, Neighbourhood Area Network, Data Concentrator, meter data management system, Protocols for communication. Demand Side Integration- Services Provided by DSI, Implementation of DSI, Hardware Support, Flexibility Delivered by Prosumers from the Demand Side, System Support from DSI.

#### **UNIT – V**

##### **TRANSMISSION AND DISTRIBUTION MANAGEMENT SYSTEMS**

Data Sources, Energy Management System, Wide Area Applications, Visualization Techniques, Data Sources and Associated External Systems, SCADA, Customer Information System, Modelling and Analysis Tools, Distribution System Modelling, Topology Analysis, Load Forecasting, Power Flow Analysis, Fault Calculations, State Estimation, Applications, System Monitoring, Operation, Management, Outage Management System, Energy Storage Technologies, Batteries, Flow Battery, Fuel Cell and Hydrogen Electrolyser, Flywheels, Superconducting Magnetic Energy Storage Systems, Supercapacitors.

**Course Outcomes:** The student should have learnt about:

- How to meet the standards for information exchange and for smart metering
- How to preserve data and Communication security by adopting encryption and decryption procedures.
- Monitoring, operating, and managing the transmission and distribution tasks under smart grid environment

#### **TEXT BOOKS:**

1. Smart Grid, Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.
2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

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**REFERENCES:**

1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Iniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003.

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B. Tech IV-I Sem. (EEE)	L	T	P	C
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15A02708 FLEXIBLE AC TRANSMISSION SYSTEMS  
(CBCC-III)

**Course Objectives:** The objectives of the course are to make the students learn about:

- The basic concepts, different types, and applications of FACTS controllers in power transmission.
- The basic concepts of static shunt and series converters
- The working principle, structure and control of UPFC.

**UNIT-I**

**CONCEPTS OF FLEXIBLE AC TRANSMISSION SYSTEMS**

Transmission line Interconnections, Power flow in parallel lines, Mesh systems, Stability considerations, Relative importance of controllable parameters, Basic types of FACTS controllers, Shunt controllers, Series controllers, Combined shunt and series controllers, Benefits of FACTS.

**UNIT-II**

**VOLTAGE AND CURRENT SOURCED CONVERTERS**

Concept of Voltage Sourced Converters, Single Phase Full Wave Bridge Converter, Three Phase Full Wave Bridge Converter, Transformer Connections for 12-Pulse Operation, 24 and 48-Pulse Operation, Three Level Voltage Sourced Converter, Pulse Width Modulation (PWM) Converter, Converter Rating, Concept of Current Sourced Converters, Thyristor based converters, Current Sourced Converter with Turn off Devices, Current Sourced –vs- Voltage Sourced Converters.

**UNIT-III**

**STATIC SHUNT COMPENSATORS**

Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability, Power Oscillation Damping, Methods of Controllable VAR Generation, Variable Impedance Type Static VAR Generators, Switching Converter Type VAR Generators, Hybrid VAR Generators, SVC and STATCOM, Transient Stability Enhancement and Power Oscillation Damping, Comparison Between STATCOM and SVC, V-I, V-Q Characteristics, Response Time.

## UNIT-IV

### STATIC SERIES COMPENSATORS

Objectives of Series Compensation, Voltage Stability, Improvement of Transient Stability, Power Oscillation Damping, Subsynchronous Oscillation Damping, Variable Impedance Type Series Compensators, GTO Thyristor Controlled Type Series Capacitor (GCSC), Thyristor Switched Series Capacitor (TSSC), Thyristor-Controlled Series Capacitor(TCSC), Basic Operating Control Schemes for GCSC, TSSC, and TCSC, Switching Converter Type Series Compensators, The Static Synchronous Series Capacitor(SSSC), Transmitted Power Versus Transmission Angle Characteristic, Control Range and VA Rating, Capability to Provide Real Power Compensation.

## UNIT-V

### POWER FLOW CONTROLLERS

The Unified Power Flow Controller-Basic Operating Principles, Conventional Transmission Control Capabilities, Independent Real and Reactive Power Flow Control. Control Structure, Basic Control System for P and Q Control, Dynamic Performance, The Interline Power Flow Controller (IPFC), Basic Operating Principles and Characteristics, Generalized and Multifunctional FACTS Controllers.

**Course Outcomes:** After completing this course the student will be able to:

- Understand various control issues, for the purpose of identifying the scope and for selection of specific FACTS controllers.
- Apply the concepts in solving problems of simple power systems with FACTS controllers.
- Design simple FACTS controllers and converters for better transmission of electric power.

### TEXT BOOKS:

1. Understanding FACTS – Concepts and technology of Flexible AC Transmission systems, Narain G. Hingorani, Laszlo Gyugyi, IEEE Press, WILEY, 1st Edition, 2000, Reprint 2015.
2. FACTS Controllers in Power Transmission and Distribution, Padiyar K.R., New Age International Publishers, 1<sup>st</sup> Edition, 2007.

### REFERENCE BOOKS:

1. Flexible AC Transmission Systems: Modelling and Control, Xiao – Ping Zhang, Christian Rehtanz, Bikash Pal, Springer, 2012, First Indian Reprint, 2015.
2. FACTS – Modelling and Simulation in Power Networks, Enrigue Acha, Claudio R. Fuerte – Esquivel, Hugu Ambriz – perez, Cesar Angeles – Camacho, WILEY India Private Ltd., 2004, Reprint 2012.

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15A02709 POWER QUALITY  
(CBCC-III)

**Course Objectives:** The objectives of the course are to make the students learn about:

- Power quality issues and standards.
- The sources of power quality disturbances and power transients that occur in power systems.
- The sources of harmonics, harmonic indices, Devices for controlling harmonic distortion.
- The principle of operation of DVR and UPQC.

**UNIT I**

**INTRODUCTION**

Definition of Power Quality- Power Quality Terminology – Classification of Power Quality Issues-Magnitude Versus Duration Plot - Power Quality Standards - Responsibilities of Suppliers and Users of Electric Power-CBEMA and ITI Curves.

**UNIT II**

**TRANSIENTS, SHORT DURATION AND LONG DURATION VARIATIONS**

Categories and Characteristics of Electromagnetic Phenomena in Power Systems-Impulsive and Oscillatory Transients- Interruption - Sag-Swell-Sustained Interruption - Under Voltage – Over Voltage-Outage. Sources of Different Power Quality Disturbances- Principles of Regulating the Voltage- Conventional Devices for Voltage Regulation.

**UNIT III**

**FUNDAMENTALS OF HARMONICS & APPLIED HARMONICS**

Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quality Under Non Sinusoidal Conditions, Harmonic Indices, Harmonic Sources from Commercial Loads, Harmonic Sources from Industrial Loads. Applied Harmonics: Effects Of Harmonics, Harmonic Distortion Evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion.

**UNIT-IV**

**POWER QUALITY MONITORING**

Power Quality Benchmarking-Monitoring Considerations- Choosing Monitoring Locations- Permanent Power Quality Monitoring Equipment-Historical Perspective of Power Quality Measuring Instruments- Power Quality Measurement Equipment-Types



of Instruments- Assessment of Power Quality Measurement Data- Power Quality Monitoring Standards.

## UNIT V

### POWER QUALITY ENHANCEMENT USING CUSTOM POWER DEVICES

Introduction to Custom Power Devices-Network Reconfiguring Type: Solid State Current Limiter (SSCL)-Solid State Breaker (SSB) -Solid State Transfer Switch (SSTS) - Compensating Type: Dynamic Voltage Restorer (DVR)-Unified Power Quality Conditioner(UPOC)-Principle of Operation Only.

**Course Outcomes:** After completion of the course the student should be able to:

- Address power quality issues to ensure meeting of standards
- Apply the concepts of compensation for sags and swells using voltage regulating devices
- Assess harmonic distortion and its mitigation.
- Explain the power measurement data according to standards

### TEXT BOOKS:

1. Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H.Wayne Beaty, Mc Graw Hill Education (India) Pvt. Ltd., 3<sup>rd</sup> Edition, 2012.
2. Power quality, C. Sankaran, CRC Press, 2001.

### REFERENCE BOOKS:

1. Understanding Power quality problems – Voltage Sags and Interruptions, Math H. J. Bollen IEEE Press Series on Power Engineering, WILEY, 2007.
2. Power quality – VAR Compensation in Power Systems, R. Sastry Vedam, Mulukutla S. Sarma, CRC Press, 2009, First Indian Reprint 2013.
3. Fundamentals of Electric Power Quality, Surya Santoso, Create Space, 2012.

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B. Tech IV-I Sem. (EEE)	L	T	P	C
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15A04608 DIGITAL SIGNAL PROCESSING LABORATORY

**Course Outcomes:**

- Able to design real time DSP systems and real world applications.
- Able to implement DSP algorithms using both fixed and floating point processors.

**List of Experiments: (Minimum of 5 experiments are to be conducted from each part) Software Experiments (PART – A)**

1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.

**Using DSP Processor kits (Floating point) and Code Composer Studio (CCS) (PART – B)**

1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.

**Equipment/Software Required:**

1. Licensed MATLAB software with required tool boxes for 30 users.
2. DSP floating Processor Kits with Code Composer Studio (8 nos.)
3. Function generators
4. CROs
5. Regulated Power Supplies.

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B. Tech IV-I Sem. (EEE)	L	T	P	C
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15A02710	POWER SYSTEMS AND SIMULATION LABORATORY			

**Course Objectives:** The objectives of this course include:

- Experimental determination (in machines lab) of sequence impedance and subtransient reactances of synchronous machine
- Conducting experiments to analyze LG, LL, LLG, LLLG faults
- The equivalent circuit of three winding transformer by conducting a suitable experiment.
- Developing MATLAB program for formation of Y and Z buses.
- Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
- Developing the SIMULINK model for single area load frequency control problem.

**List of Experiments:**

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine.
2. Fault Analysis – I  
LG Fault  
LL Fault
3. Fault Analysis – II  
LLG Fault  
LLL Fault
4. Determination of Subtransient reactances of salient pole synchronous machine.
5. Equivalent circuit of three winding transformer.
6.  $Y_{bus}$  formation using MATLAB
7.  $Z_{bus}$  formation using MATLAB
8. Gauss-Seidel load flow analysis using MATLAB
9. Fast decoupled load flow analysis using MATLAB
10. Develop a Simulink model for a single area load frequency control problem

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**Course Outcomes:**

At the end of the lab course, the student should be able to do the following:

- Experimental determination (in machines lab) of sequence impedance and subtransient reactances of synchronous machine
- Conducting experiments to analyze LG, LL, LLG, LLLG faults
- The equivalent circuit of three winding transformer by conducting a suitable experiment.
- Developing MATLAB program for formation of Y and Z buses.
- Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
- Developing the SIMULINK model for single area load frequency control problem.

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15A02801 INSTRUMENTATION  
(MOOCS-II)

**Course Objectives:** The objectives of the course are to make the students learn about:

- Common errors that occur in measurement systems, and their classification
- Characteristics of signals, their representation, and signal modulation techniques
- Methods of Data transmission, telemetry, and Data acquisition.
- Working principles of different signal analyzers and Digital meters.
- Several types of transducers and their use for measurement of non-electrical quantities.

**UNIT-I**

**CHARACTERISTICS OF SIGNALS AND THEIR REPRESENTATION**

Measuring Systems, Performance Characteristics, - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation.

**UNIT-II**

**DATA TRANSMISSION , TELEMETRY AND DAS**

Methods of Data Transmission – General Telemetry System. Frequency Modulation (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Data Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram – Modern Digital DAS (Block Diagram)

**UNIT-III**

**SIGNAL ANALYZERS, DIGITAL METERS**

Wave Analysers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters, Digital Voltmeters - Successive Approximation, Ramp and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer

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#### **UNIT-IV TRANSDUCERS**

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle of Operation of Resistive, Inductive, Capacitive Transducers, LVDT, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Synchros, Piezoelectric Transducers, Photovoltaic, Photo Conductive Cells, Photo Diodes.

#### **UNIT-V MEASUREMENT OF NON-ELECTRICAL QUANTITIES**

Measurement of strain, Gauge Sensitivity, Measurement of Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

#### **Course Outcomes:**

The student should be able to:

- Identify and explain the types of errors occurring in measurement systems
- Differentiate among the types of data transmission and modulation techniques
- Apply digital techniques to measure voltage, frequency and speed
- Choose suitable transducers for the measurement of non-electrical quantities

#### **TEXT BOOKS:**

1. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co., 2012.
2. Transducers and Instrumentation, D.V.S Murty, Prentice Hall of India, 2<sup>nd</sup> Edition, 2004.

#### **REFERENCE BOOKS:**

1. Modern Electronic Instrumentation and Measurement technique, A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India., 1990.
2. Electronic Instrumentation, H.S.Kalsi Tata MCGraw-Hill Edition, 2010.
3. Industrial Instrumentation – Principles and Design, T. R. Padmanabhan, Springer, 3<sup>rd</sup> re print, 2009.

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15A02802 POWER SYSTEM DYNAMICS AND CONTROL  
(MOOCS-II)

**Course Objectives:** The objectives of the course are to make the students learn about:

- The kinds of power stability problems
- The basic concepts of modelling and analysis of dynamical systems.
- Modelling of power system components - generators, transmission lines, excitation and prime mover controllers.
- Stability of single machine and multi-machine systems is analyzed using digital simulation and small-signal analysis techniques.
- The impact of stability problems on power system planning and operation.

**Unit – I** Introduction to Power System Stability

Power System Operation and Control - Stability Problems faced by Power Systems - Impact on Power System Operation and Control - Analysis of Dynamical Systems - Concept of Equilibria, Small and Large Disturbance Stability - Example: Single Machine Infinite Bus System - Modal Analysis of Linear Systems - Analysis using Numerical Integration Techniques - Issues in Modelling: Slow and Fast Transients, Stiff Systems

**Unit – II** Modelling of a Synchronous Machine

Physical Characteristics - Rotor Position Dependent model - D-Q Transformation - Model with Standard Parameters - Steady State Analysis of Synchronous Machine - Short Circuit Transient Analysis of a Synchronous Machine - Synchronous Machine Connected to Infinite Bus.

**Unit – III** Modelling of power system components

Physical Characteristics and Models - Control system components - Excitation System Controllers - Prime Mover Control Systems - Transmission Line Physical Characteristics - Transmission Line Modeling - Load Models - induction machine model - Other Subsystems - HVDC, protection systems.

**Unit – IV** Stability Issues in Interconnected Power Systems

Single Machine Infinite Bus System - Multi-machine Systems - Stability of Relative Motion - Frequency Stability: Centre of Inertia Motion - Concept of Load Sharing: Governors - Single Machine Load Bus System: Voltage Stability - Torsional Oscillations



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### Unit – V Enhancing System Stability

Planning Measures - Stabilizing Controllers (Power System Stabilizers) - Operational Measures- Preventive Control - Emergency Control - Power System Stability Analysis Tools: Small Signal Analysis Program - Transient Stability Program - Real-Time Simulators.

**Course Outcomes:** After completion of Course, the student should be able to

- Understand the power stability problems
- Understand the basic concepts of modelling of synchronous machine and power system components
- Analyse the stability issues in interconnected systems
- Understand the power system stability analysis tools and enhancement of power system stability

Reference Books:

1. K.R.Padiyar, Power System Dynamics, Stability & Control, 2nd Edition, B.S. Publications, Hyderabad, 2002.
2. P.Kundur, Power System Stability and Control, McGraw Hill Inc, New York, 1995.
3. P.Sauer & M.A.Pai, Power System Dynamics & Stability, Prentice Hall, 1997.
4. [Jan Machowski](#), [Janusz Bialek](#), [James Richard Bumby](#), Power system dynamics and control , John Wiley & Sons, 1997.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-II Sem. (EEE)	L	T	P	C
	3	1	0	3

15A02803 INDUSTRIAL AUTOMATION & CONTROL  
(MOOCS-II)

**Course Objectives:** The objectives of the course are to make the students learn about

- Sensors and types of measurement systems
- Process control and sequence control of different controllers
- Operation of actuators
- Types of electric drives and their principles

**Unit – I** Introduction to sensors and measurement systems

Introduction to Industrial Automation and Control - Architecture of Industrial Automation Systems - Introduction to sensors and measurement systems - Temperature measurement - Pressure and Force measurements - Displacement and speed measurement - Flow measurement techniques - Measurement of level, humidity, pH etc - Signal Conditioning and Processing - Estimation of errors and Calibration.

**Unit – II** Introduction to Process Control

P-- I -- D Control - Controller Tuning - Implementation of PID Controllers - Special Control Structures : Feed forward and Ratio Control - Special Control Structures : Predictive Control, Control of Systems with Inverse Response - Special Control Structures : Cascade Control, Overriding Control, Selective Control, Split Range Control.

**Unit – III** Introduction to Sequence Control

PLCs and Relay Ladder Logic - Sequence Control: Scan Cycle, RLL Syntax - Sequence Control: Structured Design Approach - Sequence Control: Advanced RLL Programming - Sequence Control: The Hardware environment

**Unit – IV** Introduction to Actuators

Flow Control Valves - Hydraulic Actuator Systems: Principles, Components and Symbols - Hydraulic Actuator Systems: Pumps and Motors- Proportional and Servo Valves - Pneumatic Control Systems: System Components - Pneumatic Control Systems: Controllers and Integrated Control Systems - Networking of Sensors, Actuators and Controllers: The Fieldbus - The Field bus Communication Protocol

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**Unit – V Electric Drives**

Introduction, Energy Saving with Adjustable Speed Drives - Step motors: Principles, Construction and Drives - DC Motor Drives: Introduction, DC--DC Converters, Adjustable Speed Drives - Induction Motor Drives: Introduction, Characteristics, Adjustable Speed Drives - Synchronous Motor Drives: Motor Principles, Adjustable Speed and Servo Drives.

**Course Outcomes:** After completion of Course, the student should be able to

- Understand the measurement of different quantities
- Apply principles of electric drives for different applications like speed control
- Understand the principles of process control and sequence control in relay ladder logic.
- Understand the operation of controller in integrated control systems

Reference Books:

1. S. Mukhopadhyay, S. Sen & A. K. Deb, Industrial instrumentation, control and automation, Jaico Publishing House, 2012
2. Madhuchhanda Mitra and Samarjit Sen Gupta, Programmable Logic Controllers And Industrial Automation An ntroduction,2008
3. David W. Pessen, Industrial Automation: Circuit Design and Components
4. Wiley India Publication, 2011
5. Rajput R.K, Robotics and Industrial Automation, S. Chand publications, 2008

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-II Sem. (EEE)	L	T	P	C
	3	1	0	3

15A02804 HVDC TRANSMISSION  
(MOOCS-III)

**Course Objectives:** The objectives of the course are to make the students learn about:

- Technical and economic aspects of HVAC and HVDC transmission and their comparison.
- Static power converters
- Control of HVDC converter systems
- Origin, effects, classification and elimination of harmonics
- The occurrence of faults, and transients in HVDC system and their protection.

**UNIT-I**

**INTRODUCTION TO HVDC TRANSMISSION**

HVDC Transmission: Technical And Economical Comparison of HVAC and HVDC Transmission, Types of DC Links, Power Handling Capabilities of HVDC Lines, static Conversion Principles, Static Converter Configuration.

**UNIT-II**

**STATIC POWER CONVERTER ANALYSIS**

Static Power Converters: 3-Pulse, 6-Pulse & 12-Pulse Converters, Converter Station and Terminal Equipment, Commutation Process, Rectifier and Inverter Operation, Equivalent Circuit for Rectifier, Inverter and HVDC Link- Special Features of Converters.

**UNIT-III**

**CONTROL OF HVDC CONVERTER SYSTEMS**

Control of HVDC Converter Systems: Principle of DC Link Control – Constant Current, Constant Extinction Angle and Constant Ignition Angle Control and Voltage Dependent Current Control. Individual Phase Control and Equidistant Firing Angle Control

**UNIT-IV**

**HARMONICS AND FILTERS**

Origin of Harmonics in HVDC Systems, Classification of Harmonics, Elimination of Harmonics, Suppression Methods, Harmonic Instability Problems, Design of HVDC AC & DC Filters.

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## **UNIT-V**

### **TRANSIENTS, FAULTS AND PROTECTION OF HVDC SYSTEMS**

Origin of over Voltages in HVDC Systems, Over Voltages due to DC and AC Side Line Faults - Converter Faults, Over Current Protection- Valve Group and DC Line Protection. Over Voltage Protection of Converters, Surge Arresters etc.

**Course Outcomes:** After Completion of Course, the student should be able to:

- Compare HVDC and HVAC transmission systems
- Understand the operation of various converters used in HVDC transmission systems
- Devise means to suppress / eliminate harmonics.
- Design HVDC and AC Filters

### **TEXT BOOKS:**

1. HVDC Power Transmission Systems, K.R.Padiyar, 3<sup>rd</sup> Edition, New Age International publishers, 2015.
2. HVDC Transmission, S.Kamakshaiah, V.Kamaraju, Mc Graw Hill Education (India) Pvt. Ltd., 2011.

### **REFERENCES:**

1. Direct Current Transmission, Vol. 1, E. W. Kimbark, Wiley, 1971
2. High Voltage Direct Current Transmission, Jos Arrillaga, IEE Power and Energy series 29, 2<sup>nd</sup> Edition, 1998
3. EHV-AC, HVDC Transmission & Distribution Engineering, S Rao, Khanna Publishers, 4<sup>th</sup> Edition, 2008.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-II Sem. (EEE)

L	T	P	C
3	1	0	3

15A04702 EMBEDDED SYSTEMS  
(MOOCS-III)

**Course Outcomes:**

After completion the students will be able to

- Design of embedded systems leading to 32-bit application development.
- Understand hardware-interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
- Review and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
- Understand Embedded Networking and IoT concepts based upon connected MCUs

**UNIT-I**

**Introduction to Embedded Systems**

Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

**UNIT-II**

**Embedded processor architecture**

CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

**UNIT- III**

**Overview of Microcontroller and Embedded Systems**

Embedded hardware and various building blocks, Processor Selection for an Embedded System , Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices.

Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System

Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.

#### UNIT-IV

##### Microcontroller fundamentals for basic programming

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

#### Unit-V

##### Embedded communications protocols and Internet of things

Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices "Sensor Hub BoosterPack"

Embedded Networking fundamentals, IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API.

Case Study: Tiva based Embedded Networking Application: "Smart Plug with Remote Disconnect and Wi-Fi Connectivity"

#### Text Books:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition  
Jonathan W Valvano, Createspace publications ISBN-13: 978-1477508992
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-4.
4. 0070667640, 9780070667648

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**References:**

1. [http://processors.wiki.ti.com/index.php/Hands-On\\_Training\\_for\\_TI\\_Embedded\\_Processors](http://processors.wiki.ti.com/index.php/Hands-On_Training_for_TI_Embedded_Processors)
2. [http://processors.wiki.ti.com/index.php/MCU\\_Day\\_Internet\\_of\\_Things\\_2013\\_Workshop](http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop)
3. [http://www.ti.com/ww/en/simplelink\\_embedded\\_wi-fi/home.html](http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html)
4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.



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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-II Sem. (EEE)	L	T	P	C
	3	1	0	3

15A02805 ENERGY RESOURCES & TECHNOLOGY  
(MOOCS-III)

Course Objectives: The objectives of the course are to make the students learn about:

- Production of quality of energy
- Types of generation plants and their principle of operation
- Methods of energy storage
- Economics of generation

**Unit – I: Fundamentals principles of energy**

Fundamentals of energy- Quality of energy- Complete Cycle Analysis of Fossil Fuels - Other Fossil Fuels - Energy Economics : Input-Output Analysis.

**Unit – II: Thermal, Hydro and Nuclear power sources**

Thermal Power Plants - Hydroelectric Power plants - Nuclear Power Generation- Nuclear Fusion Reactors - Environmental Effects of Conventional Power

**Unit – III: Solar, wind and photo voltaic power sources**

Solar Thermal Energy Conversion - Solar Concentrating Collectors - Photovoltaic Power Generation- Wind Energy - Wind Electrical Conversion

**Unit – IV: Other sources of energy**

Tidal Energy - Ocean Thermal Energy Conversion - Solar Pond and Wave Power - Geothermal Energy - Solar Distillation and Biomass Energy

**Unit – V: Energy storage and Economy**

Energy Storage - Energy in Transportation - Magneto hydrodynamic Power Generation - Hydrogen Economy.

Course Outcomes: After completion of Course, the student should be able to:

- Understand different types of sources of energy
- Analyse the generation principles and operation of variety of sources of energy
- Understand energy storage and economy

**Reference Books:**

1. Renewable energy Resources – Jhon Twidell and tony Weir, Second edition, Taylor and Francis Group, 2006
2. Non- conventional energy sources by G. D. Rai, Khanna Publishers, 2000
3. Electrical power generation, Transmission and distribution by S. N. Singh, PHI, 2003
4. Wind electrical systems by S. N. Bhadra, D. Kastha & S. Banerjee – Oxford University Press, 2013



# **Jawaharlal Nehru Technological University Anantapur**

*(Established by Govt. of A.P., Act. No. 30 of 2008)*

**Ananthapuramu-515 002 (A.P) India**

## **B.Tech. in Electrical & Electronics Engineering Course Structures and Syllabi under R19 Regulations**

<b>JNTUA Curriculum</b>
<b>Electrical &amp; Electronics Engineering B. Tech Course Structure</b>

<b>S.No.</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P-C</b>
1.	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2.	Career Counselling	MC	2-0-2-0
3.	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4.	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5.	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6.	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7.	Remedial Training in Foundation Courses	MC	2-1-2-0
8.	Human Values & Professional Ethics	MC	3-0-0-0
9.	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10.	Concepts of Programming	ES	2-0-2-0

<b>Semester - I (Theory - 4, Lab - 4)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.	19A54101	Algebra & Calculus	BS	3-1-0	4
2.	19A56101T	Applied Physics	BS	3-0-0	3
3.	19A05101T	Problem Solving & Programming	ES	3-1-0	4
4.	19A52101T	Communicative English 1	HS	2-0-0	2
5.	19A02101	Electrical & Electronics Engineering Workshop	LC	0-0-2	1
6.	19A56101P	Applied Physics Lab	BS	0-0-3	1.5
7.	19A05101P	Problem Solving & Programming Lab	ES	0-0-3	1.5
8.	19A52101P	Communicative English 1 Lab	HS	0-0-2	1
<b>Total</b>					<b>18</b>

<b>Semester - II (Theory - 4, Lab - 5)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.	19A01201T	Basic Civil & Mechanical Engineering	ES	3-0-0	3
2.	19A54201	Differential Equations and Vector Calculus	BS	3-1-0	4
3.	19A51102T	Chemistry	BS	3-0-0	3
4.	19A05201T	Data Structures	ES	3-0-0	3
5.	19A03101	Engineering Workshop	LC	0-0-2	1
6.	19A03102	Engineering Graphics Lab	ES	1-0-4	3
7.	19A01201P	Basic Civil & Mechanical Engineering Lab	ES	0-0-3	1.5
8.	19A51102P	Chemistry Lab	BS	0-0-3	1.5
9.	19A05201P	Data Structures Lab	ES	0-0-3	1.5
<b>Total</b>					<b>21.5</b>

<b>Semester – III (Theory - 6, Lab – 3, MC-1)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.	19A54302	Complex Variables & Transforms	BS	2-1-0	3
2.	19A02301T	Basic Electrical Circuits	PC	2-1-0	3
3.	19A02302	Power System Architecture	PC	2-1-0	3
4.	19A02303T	DC Machines & Transformers	PC	2-1-0	3
5.	19A04306T	Semiconductor Devices and Circuits	PC	1-1-0	2
6.	19A04304	Digital Electronics and Logic Design	PC	2-1-0	3
7.	19A02303P	DC Machines & Transformers Lab	PC	0-0-3	1.5
8.	19A04306P	Semiconductor Devices and Circuits Lab	PC	0-0-3	1.5
9.	19A02301P	Basic Electrical Circuits Lab	PC	0-0-3	1.5
10.	19A99302	Biology For Engineers	MC	3-0-0	0
<b>Total</b>					<b>21.5</b>

<b>Semester - IV (Theory - 7, Lab – 2, MC-1)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.	19A54304	Numerical Methods & Probability Theory	BS	2-1-0	3
2.	19A02401T	Electrical Circuit Analysis	PC	2-1-0	3
3.	19A02402	Engineering Electromagnetics	PC	2-1-0	3
4.	19A02403	Power Electronics	PC	2-1-0	3
5.	19A04405	Analog Electronic Circuits	PC	2-1-0	3
6.	19A05304T	Python Programming	ES	2-1-0	3
7.	19A52301	Universal Human Values	HS	2-0-0	2
8.	19A02401P	Electrical Circuit Analysis Lab	PC	0-0-3	1.5
9.	19A04406	Electronic Circuits Lab	PC	0-0-3	1.5
10.	19A99301	Environmental Science	MC	3-0-0	0
<b>Total</b>					<b>23</b>

Semester – V (Theory - 6, Lab – 3, MC-1)					
S.No	Course No	Course Name	Category	L-T-P	Credits
1.	19A02501T	AC Machines	PCC	2-1-0	3
2.	19A02502	Control Systems	PCC	2-1-0	3
3.	19A52601T	English Language Skills	PCC	3-0-0	3
4.	19A02504	Electrical Machine Design	PCC	1-1-0	2
5.	19A02503a 19A02503b 19A02503c 19A04508 19A02503d	Professional Elective-I HVDC and FACTS DC Drives Programmable Logic Controllers Analog and digital IC applications Wind Energy Systems	PEC-I	2-1-0	3
6.	19A01506a 19A01506b 19A03506a  19A03506b 19A04506a 19A04506b 19A05506a 19A05506b  19A27506a 19A27506b  19A54506a 19A52506a  19A51506a	Open Elective-I Experimental stress analysis. Building Technology Introduction to Hybrid and Electric Vehicles Rapid Prototyping Analog Electronics Digital Electronics Free and Open Sources Systems Computer Graphics and Multimedia Animation Brewing Technology Computer Applications in Food Industry Optimization Techniques Technical Communication and Presentation Skills Chemistry of Energy Materials	OEC-I	2-1-0	3
7.	19A02501P	AC Machines Lab	PCC	0-0-3	1.5
8.	19A52601P	English Language Skills Lab	PCC	0-0-3	1.5
9.	19A02506	Power Electronics & Simulation Lab	PCC	0-0-2	1
10.	19A02507	Socially Relevant Project	PR	0-0-0.5	0.5
11.	19A99601	Research Methodology	MC	3-0-0	0
				<b>Total</b>	<b>21.5</b>

Semester – VI (Theory - 6, Lab – 2)					
S.No	Course No	Course Name	Category	L-T-P	Credits
1.	19A04301	Signals & Systems	PCC	2-1-0	3
2.	19A02601T	Digital Computer Platforms	PCC	2-1-0	3
3.	19A02602	Power System Analysis	PCC	2-1-0	3
4.	19A02603a	Professional Elective-II (MOOC) Power Quality	PEC-II	2-1-0	3
	19A02603b	Fundamentals of Semiconductor Devices			
	19A02603c	Nonlinear System Analysis			
	19A04703c	Introduction to Embedded System Design			
	19A02603d	Design of Photovoltaic Systems			
5.	19A01604a	Open Elective-II Industrial waste and wastewater management.	OEC-II	2-1-0	3
	19A01604b	Building Services & Maintenance			
	19A03604a	Introduction to Mechatronics			
	19A03604b	Optimization techniques through MATLAB			
	19A04604a	Basics of VLSI			
	19A04604b	Principles of Communication Systems			
	19A05604a	Fundamentals of VR/AR/MR			
	19A05604b	Data Science			
	19A27604a	Food Toxicology			
	19A27604b	Food Plant Equipment Design			
	19A54604a	Wavelet Transforms & its applications			
	19A52604a	Soft Skills			
	19A51604a	Chemistry of Polymers and Its Applications			
6.	19A52602a	Humanities Elective-I Entrepreneurship & Incubation	HSMC	3-0-0	3
	19A52602b	Managerial Economics And Financial Analysis			
	19A52602c	Business Ethics and Corporate Governance			
	19A52602d	Enterprise Resource Planning			
	19A52602e	Supply Chain Management			
7.	19A02605	Control Systems & Simulation Lab	PCC	0-0-3	1.5
8.	19A02601P	Digital Computer Platforms Lab	PCC	0-0-3	1.5
9.	19A02606	Socially Relevant Project	PR	0-0-0.5	0.5
10.	19A99501	Constitution of India	MC	3-0-0	0
11	19A02607	Comprehensive online examination		-	0
				<b>Total</b>	<b>21.5</b>



<b>Semester – VII (Theory - 5 Lab – 2)</b>					
<b>S.No</b>	<b>Course No</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
<b>1.</b>	19A02701	Measurements & Sensors	PCC	2-1-0	3
<b>2.</b>	19A02702	Power System Protection	PCC	2-1-0	3
<b>3.</b>	19A02703a 19A02703b 19A02703c 19A04602T 19A02703d	Professional Elective-III Power System Operation & Control Switched mode Power Converters Instrumentation Digital Signal Processing Applications of Power Electronics to Renewable Energy Sources	PEC-III	3-0-0	3
<b>4.</b>	19A01704a 19A01704b 19A03704a 19A03704b 19A04704a  19A04704b 19A05704a 19A05704b 19A27704a 19A27704b  19A54704a  19A51704a	Open Elective-III Air pollution and control. Basics of civil Engineering Finite element methods Product Marketing Introduction to Microcontrollers & Applications Principles of Digital Signal Processing Fundamentals of Game Development Cyber Security Corporate Governance in Food Industries Process Technology for Convenience & RTE Foods Numerical Methods for Engineers (ECE, CSE, IT &CE ) Chemistry of Nanomaterials and Applications	OEC-III	3-0-0	3
<b>5.</b>	19A52701a 19A52701b 19A52701c 19A52701d 19A52701e	Humanities Elective-II Organizational Behavior Management Science Business Environment Strategic Management E-Business	HSMC	3-0-0	3
<b>6.</b>	19A02705	Power Systems & Simulation Lab	PCC	0-0-3	1.5
<b>7.</b>	19A02706	Measurements Lab	PCC	0-0-3	1.5
<b>8.</b>	19A02707	Industrial Training/Skill Development/Research Project*	PR	-----	2
<b>Total</b>					<b>20</b>

Semester – VIII (Theory - 2)					
S.No	Course No	Course Name	Category	L-T-P	Credits
1.	19A02801a	Professional Elective-IV Electrical Distribution System Automation	PE	3-0-0	3
	19A02801b	FPGA based controller design			
	19A02801c	Intelligent Control Techniques			
	19A04604b	Principles of Communication Systems			
	19A02801d	Energy Storage Systems			
2.	19A01802a	Open Elective-IV Disaster Management.	OE	3-0-0	3
	19A01802b	Global Warming and climate changes			
	19A03802a	Energy conservation and management			
	19A03802b	Non - destructive testing			
	19A04802a	Introduction to Image Processing			
	19A04802b	Principles of Cellular and Mobile Communications			
	19A04802c	Industrial Electronics			
	19A04802d	Electronic Instrumentation			
	19A05802a	Block Chain Technology and Applications			
	19A05802b	MEAN Stack Technology			
	19A27802a	Food Plants Utilities & Services			
	19A27802b	Nutraceuticals & Functional Foods			
	19A54802a	Mathematical Modeling & Simulation			
	19A51802a	Green Chemistry and Catalysis for Sustainable Environment			
3.	19A02803	Project	PR	-----	7
				<b>Total</b>	<b>13</b>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**ELECTRICAL & ELECTRONICS ENGINEERING**

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**Socially Relevant Projects**

1. Energy Auditing
2. Solar Water Pumping Systems
3. Automatic Traffic Light Control Systems
4. Building Electrical Safety Measures
5. Electrical Protection Systems in Agricultural Fields

**Honours Degree in Electrical Engineering**

S.No.	Course No.	Course Name	L	T	P	Credits
1.	19A02H01	Adaptive Control Systems	3	1	0	4
2.	19A02H02	AC Drives	3	1	0	4
3.	19A02H03	Hybrid and Electric Vehicles	3	1	0	4
4.	19A02H04	Power System Wide Area Monitoring and Control	3	1	0	4
5.	19A02H05	Restructured Power Systems	3	1	0	4
Total						20

**Minor Degree in Electrical Engineering**

S.No.	Course No.	Course Name	L	T	P	Credits
1.	19A02301T	Basic Electrical Circuits	2	1	0	3
2.	19A02501T	AC Machines	2	1	0	3
3.	19A02502	Control Systems	2	1	0	3
4.	19A02302	Power System Architecture	3	0	0	3
5.	19A02701	Measurements & Sensors	2	1	0	3
6.	19A02M01	Minor Discipline Project	-	-	-	5
Total						20

**(19A54101) ALGEBRA & CALCULUS**

(Common to all branches of Engineering)

**Course Objectives:**

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

**Bridge Course:** Limits, continuity, Types of matrices

**Unit 1:Matrices**

**10 hrs**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigenvalues and eigenvectors, diagonal form and different factorizations of a matrix; (L3)
- identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (L3)

**Unit 2: Mean Value Theorems**

**6 hrs**

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof);

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- analyze the behaviour of functions by using mean value theorems (L3)

**Unit 3:Multivariable calculus**

**8 hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

#### **Unit 4:Multiple Integrals**

**10hrs**

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates.

#### **Learning Outcomes:**

- At the end of this unit, the student will be able to
- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

#### **Unit 5:Special Functions**

**6 hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

#### **Text Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

#### **Reference Books:**

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9<sup>th</sup> edition, Pearson edn
5. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
6. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
7. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
8. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education
9. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.

10. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

**Course Outcomes:**

At the end of the course, the student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- Utilize mean value theorems to real life problems (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5)
- Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– I-I Sem** **L T P C**  
**3 0 0 3**  
**(19A56101T) APPLIED PHYSICS**  
**(ECE, CSE, EEE & IT Branches)**

**Course Objectives:**

- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications.
- To explain the significant concepts of dielectric and magnetic materials this leads to potential applications in the emerging micro devices.
- To impart knowledge in basic concepts of electromagnetic waves and its propagation in optical fibers along with its Engineering applications.
- To identify the importance of semiconductors in the functioning of electronic devices.
- To teach the concepts related to superconductivity which lead to their fascinating applications.
- To familiarize the applications of nanomaterials relevant to engineering branches.

**Unit-I : Wave Optics**

**8hrs**

Interference-Principle of Superposition-Interference of light-Conditions for sustained Interference -Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength- Engineering applications of Interference

Diffraction-Fraunhofer Diffraction-Single and Double slits - Diffraction Grating – Grating Spectrum -Determination of Wavelength - Engineering applications of diffraction

Polarization-Polarization by double refraction-Nicol's Prism--Half wave and Quarter wave plate- Engineering applications of Polarization.

**Unit Outcomes:**

**The students will be able to**

- **explain** the need of coherent sources and the conditions for sustained interference (L2)
- **identify** engineering applications of interference including homodyne and heterodyne detection (L3)
- **analyze** the differences between interference and diffraction with applications (L4)
- **illustrate** the concept of polarization of light and its applications (L2)
- **classify** ordinary polarized light and extraordinary polarized light (L2)

**Unit-II : Dielectric and Magnetic Materials**

**(8hrs)**

Introduction--Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic, (Quantitative), Orientation Polarizations (Qualitative) - Frequency dependence of polarization-Lorentz (internal) field-Claussius -Mosotti equation-Applications of Dielectrics: Ferroelectricity.

Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials-

Weiss theory of ferromagnetism (qualitative)-Hysteresis-soft and hard magnetic materials-Magnetic device applications (Magnetic bubble memory).

### **Unit Outcomes:**

#### **The students will be able to**

- **explain** the concept of dielectric constant and polarization in dielectric materials (L2)
- **summarize** various types of polarization of dielectrics (L2)
- **interpret** Lorentz field and Claussius- Mosotti relation in dielectrics (L2)
- **classify** the magnetic materials based on susceptibility and their temperature dependence (L2)
- **explain** the applications of dielectric and magnetic materials (L2)
- **Apply** the concept of magnetism to magnetic devices (L3)

### **Unit – III: Electromagnetic Waves and Fiber Optics**

**10hrs**

Divergence and Curl of Electric and Magnetic Fields- Gauss' theorem for divergence and Stokes' theorem for curl- Maxwell's Equations (Quantitative)- Electromagnetic wave propagation (Non-conducting medium) -Poynting's Theorem.

Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile –Propagation of electromagnetic wave through optical fiber – modes -importance of V-number- Attenuation, Block Diagram of Fiber optic Communication -Medical Applications-Fiber optic Sensors.

### **Unit Outcomes:**

#### **The students will be able to**

- **apply** the Gauss' theorem for divergence and Stokes' theorem for curl (L3)
- **evaluate** the Maxwell's equations, Maxwell's displacement current and correction in Ampere's law (L5)
- **asses** the electromagnetic wave propagation and its power in non-conducting medium (L5)
- **explain** the working principle of optical fibers (L2)
- **classify** optical fibers based on refractive index profile and mode of propagation (L2)
- **identify** the applications of optical fibers in medical, communication and other fields (L2)
- **Apply** the fiber optic concepts in various fields (L3).

### **Unit – IV: Semiconductors**

**8 hrs**

Origin of energy bands - Classification of solids based on energy bands – Intrinsic semiconductors - density of charge carriers-Fermi energy – Electrical conductivity - extrinsic semiconductors - P-type & N-type - Density of charge carriers - Dependence of Fermi energy on carrier concentration and temperature- Direct and Indirect band gap semiconductors-Hall effect- Hall coefficient - Applications of Hall effect - Drift and Diffusion currents - Continuity equation - Applications of Semiconductors.



### **Unit Outcomes:**

The students will be able to

- **classify** the energy bands of semiconductors (L2)
- **outline** the properties of n-type and p-type semiconductors and charge carriers (L2)
- **interpret** the direct and indirect band gap semiconductors (L2)
- **identify** the type of semiconductor using Hall effect (L2)
- **identify** applications of semiconductors in electronic devices (L2)

### **Unit – V: Superconductors and Nanomaterials**

**8 hrs**

Superconductors-Properties- Meissner's effect-BCS Theory-Josephson effect (AC &DC)- Types of Super conductors-Applications of superconductors.

Nano materials – Significance of nanoscale – Properties of nanomaterials: Physical, Mechanical, Magnetic, Optical – Synthesis of nanomaterials: Top-down-Ball Milling, Bottom-up -Chemical vapour deposition – characterization of nanomaterials: X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM) - Applications of Nano materials.

### **Unit Outcomes:**

The students will be able to

- **explain** how electrical resistivity of solids changes with temperature (L2)
- **classify** superconductors based on Meissner's effect (L2)
- **explain** Meissner's effect, BCS theory & Josephson effect in superconductors (L2)
- **identify** the nano size dependent properties of nanomaterials (L2)
- **illustrate** the methods for the synthesis and characterization of nanomaterials (L2)
- **Apply** the basic properties of nanomaterials in various Engineering branches (L3).

### **Text Books:**

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy” A Text book of Engineering Physics”- S. Chand Publications, 11<sup>th</sup> Edition 2019.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.

### **Reference Books:**

1. Shatendra Sharma, Jyotsna Sharma, “ Engineering Physics”, Pearson Education,2018
2. David J.Griffiths, “Introduction to Electrodynamics”- 4/e, Pearson Education,2014
3. T Pradeep “A Text book of Nano Science and Nano Technology”- Tata Mc GrawHill 2013

### **Course Outcomes:**

The students will be able to

- **identify** the wave properties of light and the interaction of energy with the matter (L3)
- **apply** electromagnetic wave propagation in different guided media (L2)
- **asses** the electromagnetic wave propagation and its power in different media (L5)
- **calculate** conductivity of semiconductors (L3)
- **interpret** the difference between normal conductor and superconductor (L2)
- **demonstrate** the application of nanomaterials (L2)

**(19A05101T) PROBLEM SOLVING AND PROGRAMMING**  
**(Common to All Branches of Engineering)**

**Course Objectives:**

1. Introduce the internal parts of a computer, and peripherals.
2. Introduce the Concept of Algorithm and use it to solve computational problems
3. Identify the computational and non-computational problems
4. Teach the syntax and semantics of a C Programming language
5. Demonstrate the use of Control structures of C Programming language
6. Illustrate the methodology for solving Computational problems

**Unit 1:**

**Computer Fundamentals: What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU.**

**Introduction to Programming, Algorithms and Flowcharts:** Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

**Unit Outcomes:**

Student should be able to

1. Identify the different peripherals, ports and connecting cables in a PC (L2)
2. Illustrate the working of a Computer (L3)
3. Select the components of a Computer in the market and assemble a computer (L4)
4. Solve complex problems using language independent notations (L3)

**Unit 2:**

**Introduction to computer problem solving:** Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, the analysis of algorithms.

**Fundamental algorithms:** Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.

**Learning Outcomes:** Student should be able to

1. Solve Computational problems (L3)
2. Apply Algorithmic approach to solving problems (L3)

3. Analyze the algorithms (L4)

### **Unit 3:**

**Types, Operators, and Expressions:** Variable names, data types and sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

**Input and output:** standard input and output, formatted output-Printf, formatted input-Scanf.

**Control Flow:** Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Do-while, break and continue, Goto and labels.

**Functions and Program Structure:** Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.

**Learning Outcomes:** Student should be able to

1. Recognize the programming elements of C Programming language (L1)
2. Select the control structure for solving the problem (L4)
3. Apply modular approach for solving the problem (L3)

### **Unit 4:**

**Factoring methods:** Finding the square root of a number, the smallest divisor of a number, the greatest common divisor of two integers, generating prime numbers.

**Pointers and arrays:** Pointers and addresses, pointers and function arguments, pointers and arrays, address arithmetic, character pointers and functions, pointer array; pointers to pointers, Multi-dimensional arrays, initialization of arrays, pointer vs. multi-dimensional arrays, command line arguments, pointers to functions, complicated declarations.

**Array Techniques:** Array order reversal, finding the maximum number in a set, removal of duplicates from an order array, finding the k<sup>th</sup> smallest element

**Learning Outcomes:** Student should be able to

1. Solve mathematical problems using C Programming language (L3)
2. Structure the individual data elements to simplify the solutions (L6)
3. Facilitate efficient memory utilization (L6)

### **Unit 5:**

**Sorting and Searching:** Sorting by selection, sorting by exchange, sorting by insertion, sorting by partitioning, binary search.

**Structures:** Basics of structures, structures and functions, arrays of structures, pointers to structures, self-referential structures, table lookup, typedef, unions, bit-fields.

**Some other Features:** Variable-length argument lists, formatted input-Scanf, file access, Error handling-stderr and exit, Line Input and Output, Miscellaneous Functions.

**Learning Outcomes:** Student should be able to

1. Select sorting algorithm based on the type of the data (L4)
2. Organize heterogeneous data (L6)
3. Design a sorting algorithm (L6)

**Text Books:**

1. Pradip Dey, and Manas Ghosh, “Programming in C”, 2018, Oxford University Press.
2. R.G. Dromey, “How to Solve it by Computer”. 2014, Pearson.
3. Brian W. Kernighan, and Dennis M. Ritchie, “The C Programming Language”, 2<sup>nd</sup> Edition, Pearson.

**Reference Books:**

1. RS Bichkar “Programming with C”, 2012, Universities Press.
2. Pelin Aksoy, and Laura Denardis, “Information Technology in Theory”, 2017, Cengage Learning.
3. Byron Gottfried and Jitender Kumar Chhabra, “Programming with C”, 4<sup>th</sup> Edition, 2019, McGraw Hill Education.

**Course Outcomes:**

1. Construct his own computer using parts (L6).
2. Recognize the importance of programming language independent constructs (L2)
3. Solve computational problems (L3)
4. Select the features of C language appropriate for solving a problem (L4)
5. Design computer programs for real world problems (L6)
6. Organize the data which is more appropriated for solving a problem (L6)

(19A52101T) COMMUNICATIVE ENGLISH I  
(Common to All Branches of Engineering)

### Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

### Course Objectives

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

### Unit 1

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing:** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

## Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

## Unit 2

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

## Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better reading comprehension
- write well structured paragraphs on specific topics
- identify basic errors of grammar/ usage and make necessary corrections in short texts

## Unit 3

**Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed. **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

## Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks and summarize the content with clarity and precision
- participate in informal discussions and report what is discussed
- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

## Unit4

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

### Learning Outcomes

At the end of the module, the learners will be able to

- infer and predict about content of spoken discourse
- understand verbal and non-verbal features of communication and hold formal/informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

## Unit 5

**Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences. **Grammar and Vocabulary:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

### Learning Outcomes

At the end of the module, the learners will be able to

- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts orally and in writing
- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors

### Text Book

- **English all round: Communication Skills for Undergraduate Learners Vol. I,** Orient BlackSwan Publishers, First Edition 2019.

## Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*. Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.

## Sample Web Resources

Grammar/Listening/Writing

[1-language.com](http://1-language.com)

<http://www.5minuteenglish.com/>

<https://www.englishpractice.com/>

Grammar/Vocabulary

[English Language Learning Online](http://www.bbc.co.uk/learningenglish/)

<http://www.bbc.co.uk/learningenglish/>

<http://www.better-english.com/>

<http://www.nonstopenglish.com/>

<https://www.vocabulary.com/>

[BBC Vocabulary Games](#)

[Free Rice Vocabulary Game](#)

Reading

<https://www.usingenglish.com/comprehension/>

<https://www.englishclub.com/reading/short-stories.htm>

<https://www.english-online.at/>

Listening

<https://learningenglish.voanews.com/z/3613>

<http://www.englishmedialab.com/listening.html>

Speaking

<https://www.talkenglish.com/>

[BBC Learning English – Pronunciation tips](#)

[Merriam-Webster – Perfect pronunciation Exercises](#)

All Skills

<https://www.englishclub.com/>

<http://www.world-english.org/>

<http://learnenglish.britishcouncil.org/>

Online Dictionaries

[Cambridge dictionary online](#)

[MacMillan dictionary](#)



**Course Outcomes:**

At the end of the course, the learners will be able to

- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

**Course Objectives :**

1. To know about different tools, abbreviations and symbols in Electrical Engineering
2. To learn about types of measuring instruments to measure electrical quantities
3. To gain knowledge on different types of earthing and earth resistance
4. To study different types of wiring

**List of Exercises / Experiments:**

1. Study of Introduction to Electrical tools, symbols and abbreviations
2. Study of types of sizes of wires and making “T” joint and straight joint for wires
3. Measurements of Electrical quantities (like Voltage, Current, Power, Power factor in RLC circuits)
4. Study of measurements of Energy (using Single phase and Three phase Energy meter) by connecting different loads
5. Study of earthing and measurement of earth resistance
6. Study and performance of residential wiring (using Energy meter, Fuses, Switches, Indicator, Lamps, etc.)
7. Study of Fluorescent lamp wiring
8. Study of various electrical gadgets (CFL and LED)
9. Study of PV Cell
10. Study of Induction motor and Transformer
11. Assembly of choke or small transformer
12. Study of trouble shooting of electrical equipments (fan, iron box, mixer-grinder, etc.)
13. Introduction to basics of Electronic components: Solder practice, Multi meter, Power supply
14. Measurement of wire guages using guage meter
15. Identification of color code, resistors, ICs, Transistors, capacitors, diodes, SCRs, IGBTs etc.

**References:**

1. Lab manual of Electrical Engineering by TTTI, Chennai.

**Course Outcomes:**

1. Able to demonstrate knowledge on different tools, abbreviations and symbols used in Electrical Engineering
2. Able to measure different electrical quantities using measuring instruments

3. Able to demonstrate how to trouble shoot the electrical equipments (like fan, grinder, motor, etc.)
4. Able to do wiring and earthing for residential houses

**(19A56101P) APPLIED PHYSICS LAB**  
**(ECE, CSE, CSSE, EEE, EIE & IT Branches)**

**Course Objectives:**

- Understands the concepts of interference and diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

**Note: In the following list, out of 15 experiments, any 12 experiments must be performed in a semester**

**List of Physics Experiments**

1. Determine the thickness of the wire using wedge shape method  
Experimental outcomes:  
operates optical instrument like travelling microscope. (L2)  
estimate the thickness of the wire using wedge shape method (L2)  
Identifies the formation of interference fringes due to reflected light from non uniform thin film. (L2)
2. Determination of the radius of curvature of the lens by Newton's ring method  
Experimental outcomes:  
operates optical instrument like travelling microscope. (L2)  
estimate the radius of curvature of the lens (L2)  
Identifies the formation of interference fringes due to reflected light from non uniform thin film. (L2)  
plots the square of the diameter of a ring with no. of rings (L3)
3. Determination of wavelength by plane diffraction grating method  
Experimental outcomes:  
operates optical instrument like spectrometer. (L2)  
estimate the wavelength of the given source (L2)  
Identifies the formation of grating spectrum due to diffraction. (L2)
4. Dispersive power of a diffraction grating  
Experimental outcomes:  
operates optical instrument like spectrometer. (L2)  
estimate the wavelength of the given source (L2)  
Identifies the formation of grating spectrum due to diffraction. (L2)
5. Resolving power of a grating  
Experimental outcomes:  
operates optical instrument like spectrometer. (L2)  
estimate the resolving power of the grating (L2)  
Illustrates the role of resolving power in various optical instruments. (L3)
6. Determination of dielectric constant by charging and discharging method.

- Experimental outcomes:  
operates various instruments and connect them as per the circuit. (L2)  
estimate the dielectric constant of the given substance. (L2)  
Identifies the significance of dielectric constant in various devices. (L2)
7. Magnetic field along the axis of a circular coil carrying current.  
Experimental outcomes:  
operates various instruments and connect them as per the circuit. (L2)  
estimate the magnetic field along the axis of a circular coil carrying current. (L2)  
plots the intensity of the magnetic field of circular coil carrying current with distance (L3)
8. To determine the self inductance of the coil (L) using Anderson's bridge.  
Experimental outcomes:  
operates various instruments and connect them as per the circuit. (L2)  
estimate the self inductance of the coil using Anderson's bridge. (L2)  
Identifies the significance of self inductance of the coil in electric devices. (L2)
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)  
Experimental outcomes:  
operates various instruments and connect them as per the circuit. (L2)  
estimate the hysteresis loss, coercivity and retentivity of the ferromagnetic material. (L2)  
classifies the soft and hard magnetic material based on B-H curve. (L2)  
plots the magnetic field H and flux density B (L3)
10. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle  
Experimental outcomes:  
operates various instruments and connect them as per the circuit. (L2)  
estimate the numerical aperture and acceptance angle of a given optical fiber. (L2)  
Identifies the significance of numerical aperture and acceptance angle of a optical fiber in various engineering applications. (L2)
11. Measurement of magnetic susceptibility by Gouy's method  
Experimental outcomes:  
operates various instruments and connect them as per the circuit. (L2)  
estimate the magnetic susceptibility of the given material. (L2)  
Identifies the significance of magnetic susceptibility in various engineering applications. (L2)
12. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.  
Experimental outcomes:  
operates various instruments and connect them as per the circuit. (L2)  
estimate the charge carrier concentration and mobility in a semiconductor. (L2)  
Illustrates the applications of hall effect. (L3)  
plots the voltage with current and voltage with magnetic field (L3)
13. To determine the resistivity of semiconductor by Four probe method  
Experimental outcomes:

- operates various instruments and connect them as per the circuit. (L2)  
 estimate the resistivity of a semiconductor. (L2)  
 Identifies the importance of Four probe method in finding the resistivity of semiconductor. (L3)
14. To determine the energy gap of a semiconductor  
 Experimental outcomes:  
 operates various instruments and connect them as per the circuit. (L2)  
 estimate the energy gap of a semiconductor. (L2)  
 Illustrates the engineering applications of energy gap . (L3)  
 plots  $1/T$  with  $\log R$  (L3)
15. Measurement of resistance with varying temperature.  
 Experimental outcomes:  
 operates various instruments and connect them as per the circuit. (L2)  
 estimate the resistance with varying temperature. (L2)  
 plots **resistance** R with temperature T (L3)

### Course Outcomes:

*The students will be able to*

- **operate** optical instruments like microscope and spectrometer (L2)
- **determine** thickness of a hair/paper with the concept of interference (L2)
- **estimate** the wavelength of different colors using diffraction grating and resolving power (L2)
- **plot** the intensity of the magnetic field of circular coil carrying current with distance (L3)
- **evaluate** the acceptance angle of an optical fiber and numerical aperture (L3)
- **determine** magnetic susceptibility of the material and its losses by B-H curve (L3)
- **determine** the resistivity of the given semiconductor using four probe method (L3)
- **identify** the type of semiconductor i.e., n-type or p-type using hall effect (L3)
- **calculate** the band gap of a given semiconductor (L3)

### References Books:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php> -Virtual Labs, Amrita University

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– I–I Sem** **L T P C**  
**0 0 3 1.5**  
**(19A05101P) PROBLEM SOLVING AND PROGRAMMING LAB**  
**(Common to All Branches of Engineering)**

**Laboratory Experiments #**

1. Assemble and disassemble parts of a Computer
2. Design a C program which reverses the number
3. Design a C program which finds the second maximum number among the given list of numbers.
4. Construct a program which finds the kth smallest number among the given list of numbers.
5. Design an algorithm and implement using C language the following exchanges  
$$a \leftarrow b \leftarrow c \leftarrow d$$
6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them.
7. Implement the C program which computes the sum of the first n terms of the series  
$$\text{Sum} = 1 - 3 + 5 - 7 + 9$$
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565.
9. Design an algorithm and implement using a C program which finds the sum of the infinite series  
$$1 - x^2/2! + x^4/4! - x^6/6! + \dots$$
10. Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1.
11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa.
12. Develop an algorithm which computes the all the factors between 1 to 100 for a given number and implement it using C.
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n.
14. Design a C program which reverses the elements of the array.
15. Given a list of n numbers, Design an algorithm which prints the number of stars equivalent to the value of the number. The stars for each number should be printed horizontally.
16. Implement the sorting algorithms a. Insertion sort b. Exchange sort c. Selection sort

d.. Partitioning sort.

17. Illustrate the use of auto, static, register and external variables.

18. Design algorithm and implement the operations creation, insertion, deletion, traversing on a singly linked list.

19. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers.

20. Design a C program which sorts the strings using array of pointers.

# The above list is not exhaustive. Instructors may add some experiments to the above list. Moreover, 50% of the experiments are to be changed every academic year. Instructors can choose the experiments, provided those experiments are not repetitions.

**Course outcomes:** Student should be able to

1. Construct a Computer given its parts (L6)
2. Select the right control structure for solving the problem (L6)
3. Analyze different sorting algorithms (L4)
4. Design solutions for computational problems (L6)
5. Develop C programs which utilize the memory efficiently using programming constructs like pointers.

**References:**

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", Tata McGraw-Hill, 2<sup>nd</sup> edition, 2002.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.



**(19A52101P) COMMUNICATIVE ENGLISH I LAB**  
**(Common to All Branches of Engineering)**

**Introduction**

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

**Course Objectives**

- To expose the students to variety of self instructional, learner friendly modes of language learning
- To help the students cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL, and GMAT etc.
- To enable them to learn better pronunciation through stress, intonation and rhythm
- To train them to use language effectively to face interviews, group discussions, public speaking
- To initiate them into greater use of the computer in resume preparation, report writing, format making etc

**Course Outcomes**

- CO1: To remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
- CO2: To apply communication skills through various language learning activities
- CO3: To analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- CO4: To evaluate and exhibit acceptable etiquette essential in social and professional settings
- CO5: To create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

**Unit 1**

1. Phonetics for listening comprehension of various accents
2. Reading comprehension
3. Describing objects/places/persons

### **Learning Outcomes**

At the end of the module, the learners will be able to

- understand different accents spoken by native speakers of English
- employ suitable strategies for skimming and scanning on monitor to get the general idea of a text and locate specific information
- learn different professional registers and specific vocabulary to describe different persons, places and objects

### **Unit 2**

1. JAM
2. Small talks on general topics
3. Debates

### **Learning Outcomes**

At the end of the module, the learners will be able to

- produce a structured talk extemporarily
- comprehend and produce short talks on general topics
- participate in debates and speak clearly on a specific topic using suitable discourse markers

### **Unit 3**

1. Situational dialogues – Greeting and Introduction
2. Summarizing and Note making
3. Vocabulary Building

### **Learning Outcomes**

At the end of the module, the learners will be able to

- Learn different ways of greeting and introducing oneself/others
- summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions
- replenish vocabulary with one word substitutes, homonyms, homophones, homographs to reduce errors in speech and writing

### **Unit4**

1. Asking for Information and Giving Directions
2. Information Transfer
3. Non-verbal Communication – Dumb Charade

### **Learning Outcomes**

At the end of the module, the learners will be able to

- Learn different ways of asking information and giving directions
- Able to transfer information effectively
- understand non-verbal features of communication

## Unit 5

1. Oral Presentations
2. Précis Writing and Paraphrasing
3. Reading Comprehension and spotting errors

### Learning Outcomes

At the end of the module, the learners will be able to

- make formal oral presentations using effective strategies
- learn different techniques of précis writing and paraphrasing strategies
- comprehend while reading different texts and edit short texts by correcting common errors

### Reference Books

- English in Action, 1st Edition, 2019, Maruthi Publications.
- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*. Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.

### Sample Web Resources

Grammar/Listening/Writing

[1-language.com](http://1-language.com)

<http://www.5minuteenglish.com/>

<https://www.englishpractice.com/>

Grammar/Vocabulary

[English Language Learning Online](http://www.bbc.co.uk/learningenglish/)

<http://www.bbc.co.uk/learningenglish/>

<http://www.better-english.com/>

<http://www.nonstopenglish.com/>

<https://www.vocabulary.com/>

[BBC Vocabulary Games](#)

[Free Rice Vocabulary Game](#)

Reading

<https://www.usingenglish.com/comprehension/>

<https://www.englishclub.com/reading/short-stories.htm>

<https://www.english-online.at/>

Listening

<https://learningenglish.voanews.com/z/3613>

<http://www.englishmedialab.com/listening.html>

## Speaking

<https://www.talkenglish.com/>

[BBC Learning English – Pronunciation tips](#)

[Merriam-Webster – Perfect pronunciation Exercises](#)

## All Skills

<https://www.englishclub.com/>

<http://www.world-english.org/>

<http://learnenglish.britishcouncil.org/>

## Online Dictionaries

[Cambridge dictionary online](#)

[MacMillan dictionary](#)

[Oxford learner's dictionaries](#)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)–I- II Sem** **L T P C**  
**3 0 0 3**  
**(19A01201T) BASIC CIVIL & MECHANICAL ENGINEERING**  
**(EEE)**

**Course Objectives:**

- Impart basic principles of stress, strain, shear force, bending moment and torsion.
- To teach principles of strain measurement using electrical strain gauges
- Describe technical details of power plants, gas turbines, hydro power plants and non-conventional energy sources.
- Teach different types of drives for power transmission
- Impart concepts of CAD, CAM & CIM

**PART - A**

**UNIT – I:**

Basic Definitions of Force – Stress – Strain – Elasticity. Shear force – Bending Moment – Torsion . Simple problems on Shear force Diagram and Bending moment Diagram for cantilever and simply supported beams.

**LO 1:** understand principles of Stress and Strain.

**LO 2:** able to draw SFD & BMD for simply supported beams and cantilever beams.

**UNIT – II:**

Measurement of Strain - Electrical Capacitance and Resistance Strain gauges – multi channel strain indicators. Rosette analysis – Rectangular and Triangular strain rosettes – Wheatstone bridge.

**LO 1:** understand basic principles of Strain Measurement.

**LO 2:** Apply the concepts of Strain Rosettes for strain measurement .

**UNIT – III:**

Characteristics of common building materials – Brick – Types – Testing; Timber – Classification – Seasoning – Defects in Timber ; Glass – Classification – uses; steel and its applications in construction industry.

**LO 1:** understand common building materials used in construction.

**LO 2:** Analyze characteristics of common building materials .

**Text Books:**

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi.
2. Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd.

**Reference Books:**

1. S.Trymbaka Murthy., “Computer Aided Engineering Drawing” , Universities Press
2. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies.
3. Venugopal K. and Prahuraja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam.

4. Er. R. Vaishnavi, Basic Civil and Mechanical Engineering, 2/e, S.Chand Publications.

### Course Outcomes:

At the end of the course, student is able to

- Draw SFD and BMD for cantilever and Simply supported beams. (L.1)
- Understand the working principles of electrical resistors and capacitors. (L.2)
- Apply concepts of Rosetta analysis for strain measurements. (L.3)

## PART – B

### Course Objectives

- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- To teach working principle of hydraulic machinery.
- To familiarize the developments in IC engines.
- To teach combustion process in SI and CI engines.
- Explain the principles of refrigeration and air conditioning.

### UNIT – 1

**Power Plant Engineering:** Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant – Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump –Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

### Learning Outcomes

At the end of this unit, the student will be able to

- Outline sources of energy, compare and selection of types of power plants (L2).
- Explain working principle and compare types of diesel power plant (L2).
- Explain construction and operation of different pumps (L2).
- Classify pumps based on principle of operation (L1).
- Classify turbines based on principle of operation (L1).

### UNIT – 2

**IC Engine:** Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

**Boilers:** Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers –

Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

**Learning outcomes:**

After completion of this unit, students will be able to

- Understand classification and working of IC engines (L1).
- Compare 2 stroke and 4 stroke, petrol and diesel engines (L3).
- Understand classification and construction of boilers (L1).
- Compare boiler mountings and accessories (L3).

**UNIT – 3**

**Refrigeration and Air Conditioning:** Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning – Psychrometry – Window Air Conditioning.

**Learning outcomes:**

After completion of this unit, students will be able to

1. Analyze the basics cycles of Refrigeration and Air Conditioning Systems (L4).
2. Outline the operation of refrigerators (L2).
3. Identify different refrigerants and applications (L1).

**Text Books:**

1. Basic Civil and Mechanical Engineering, by Prof.V.Vijayan, Prof.M.Prabhakaran and Er.R.Viashnavi, S.Chand Publication.
2. Elements of Mechanical Engineering Fourth Edition S Trymbaka Murthy, University Press.

**Course Outcomes:**

At the end of this course, the student will be able to

- Outline sources of energy, power plant economics, and environmental aspects (L2).
- Describe working components of a steam power plant (L2).
- Illustrate the working mechanism of Diesel and Gas turbine power plants (L2).
- Explain different types of pumps and their application (L2).
- Explain working of IC engines with combustion process (L2).
- Possess the knowledge of system components of refrigeration and air conditioning (L3)

**(19A54201) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**  
**(Civil, Mechanical, EEE, ECE and EIE)**

**Course Objectives:**

- 1) To enlighten the learners in the concept of differential equations and multivariable calculus.
- 2) To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

**UNIT 1: Linear differential equations of higher order**

**8hrs**

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- identify the essential characteristics of linear differential equations with constant coefficients (L3)
- solve the linear differential equations with constant coefficients by appropriate method (L3)

**UNIT 2: Equations reducible to Linear Differential Equations**

**8hrs**

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications to L-C-R Circuit problems and Mass spring system.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- classify and interpret the solutions of linear differential equations (L3)
- formulate and solve the higher order differential equation by analyzing physical situations (L3)

**UNIT 3: Partial Differential Equations**

**8 hrs**

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solutions to homogenous and non-homogenous higher order linear partial differential equations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs (L3)
- outline the basic properties of standard PDEs (L2)

**UNIT4: Vector differentiation**

**8hrs**



Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- apply del to Scalar and vector point functions (L3)
- illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

**UNIT 5: Vector integration**

**8hrs**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field (L4)
- evaluate the rates of fluid flow along and across curves (L4)
- apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

**Text Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

**Reference Books:**

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
6. Micheael Greenberg, Advanced Engineering Mathematics, 9<sup>th</sup> edition, Pearson edn
7. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
8. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
9. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
10. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
11. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
12. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

**Course Outcomes:**

At the end of the course, the student will be able to

- solve the differential equations related to various engineering fields (L6)
- Identify solution methods for partial differential equations that model physical processes (L3)
- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L6)

(19A51102T) CHEMISTRY  
(CSE, CSSE, ECE, EIE, EEE and IT)

**Course Objectives:**

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches

**Unit 1: Structure and Bonding Models:**

(10 hrs)

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of  $\Psi$  and  $\Psi^2$ , applications to hydrogen, particle in a box and their applications for conjugated molecules, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of  $O_2$  and  $CO$ , etc.  $\pi$ -molecular orbitals of butadiene and benzene, calculation of bond order, crystal field theory – salient features – splitting in octahedral and tetrahedral geometry, magnetic properties and colour, band theory of solids – band diagrams for conductors, semiconductors and insulators, role of doping on band structures.

**Learning Outcomes:**

*At the end of this unit, the students will be able to*

- **apply** Schrodinger wave equation to hydrogen and particle in a box (L3)
- **illustrate** the molecular orbital energy level diagram of different molecular species (L2)
- **explain** the band theory of solids for conductors, semiconductors and insulators (L2)
- **discuss** the magnetic behaviour and colour of complexes (L3)

**Unit 2: Electrochemistry and Applications:**

(10 hrs)

Electrodes – concepts, reference electrodes (Calomel electrode,  $Ag/AgCl$  electrode and glass electrode) electrochemical cell, Nernst equation, cell potential calculations, numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications, photogalvanic cells with specific examples. Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Secondary cells – lead acid, and lithium ion batteries- working of the batteries including cell reactions.

**Learning Outcomes:**

*At the end of this unit, the students will be able to*

- **apply** Nernst equation for calculating electrode and cell potentials (L3)

- **differentiate** between pH metry, potentiometric and conductometric titrations (L2)
- **explain** the theory of construction of battery and fuel cells (L2)
- **solve** problems based on cell potential (L3)

### Unit 3: Polymer Chemistry:

(10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – Bakelite, urea-formaldehyde, Nylon-66, carbon fibres, Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

#### Learning Outcomes:

*At the end of this unit, the students will be able to*

- **explain** the different types of polymers and their applications (L2)
- **explain** the preparation, properties and applications of Bakelite, Nylon-66, and carbon fibres (L2)
- **describe** the mechanism of conduction in conducting polymers (L2)
- **discuss** Buna-S and Buna-N elastomers and their applications (L2)

### Unit 4: Instrumental Methods and Applications

(10 hrs)

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle and applications of pH metry, potentiometry, conductometry, UV-Visible, IR and NMR Spectroscopies. Principles of Gas Chromatography (GC) and High Performance Liquid Chromatography (HPLC), separation of gaseous mixtures and liquid mixtures

#### Learning outcomes:

After completion of Module IV, students will be able to

- **explain** the different types of spectral series in electromagnetic spectrum (L2)
- **understand** the principles of different analytical instruments (L2)
- **explain** the different applications of analytical instruments (L2)

### Unit 5: Molecular Machines and Molecular Switches:

(10 hrs)

Concepts and terms of supra molecular chemistry, complementarity, Basic Lock and Key principle, examples of Supramolecules, Molecular recognition- cation binding, anion binding, simultaneous cation and anion binding, supramolecular reactivity and catalysis

Self assembly in biological systems, Synthetic systems- catenanes, rotaxanes, metal ion assisted assemblies, template synthesis of macrocyclic ligands

Applications of Supramolecular Devices- Ionic devices, Electronic devices, Switching devices

#### Learning Outcomes:

*At the end of this unit, the students will be able to*

- **explain** the band theory of solids for conductors, semiconductors and insulators (L2)
- **explains** supramolecular chemistry and self assembly (L2)
- **demonstrate** the application of Rotaxanes and Catenanes as artificial molecular machines (L2)

**Text Books:**

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

**Reference Books:**

1. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. J.M. Lehn, Supra Molecular Chemistry, VCH Publications

**Course Outcomes:**

At the end of the course, the students will be able to

- **compare** the materials of construction for battery and electrochemical sensors (L2)
- **explain** the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers. (L2)
- **explain** the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures (L2)
- **apply** the principle of supramolecular chemistry in application of molecular machines and switches (L3)

**(19A05201T) DATA STRUCTURES**  
**(Common to All Branches of Engineering)**

**Course Objectives:**

1. To teach the representation of solution to the problem using algorithm
2. To explain the approach to algorithm analysis
3. To introduce different data structures for solving the problems
4. To demonstrate modeling of the given problem as a graph
5. To elucidate the existing hashing techniques

**Unit – 1: Introduction**

Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, How fast can we sort, Merge sort, Heap sort

**Learning Outcomes :**

Student should be able to

1. Analyze the given algorithm to find the time and space complexities.(L4)
2. Select appropriate sorting algorithm (L4)
3. Design a sorting algorithm (L6)

**Unit – 2: Stack, Queue and Linked lists**

Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

**Learning outcomes:** Student should be able to

1. Evaluate expressions (L5)
2. Develop the applications using stacks and queues (L3)
3. Construct the linked lists for various applications (L6)

**Unit – 3 :Trees**

Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, Optimal Binary search Trees, AVL Trees. B-Trees: B-Trees, B + Trees.

**Learning outcomes**

1. Explain the concept of a tree (L2)
2. Compare different tree structures (L4)
3. Apply trees for indexing (L3)

## **Unit – 4 : Graphs and Hashing**

The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure

Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

### **Learning outcomes:**

Student should be able to

1. Recognize the importance of Graphs in solving real world problems (L2)
2. Apply various graph traversal methods to applications (L3)
3. Design a minimum cost solution for a problem using spanning trees (L6)
4. Select the appropriate hashing technique for a given application (L5)
5. Design a hashing technique (L6)

## **Unit – 5: Files and Advanced sorting**

File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization.

Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

### **Learning outcomes:** Student should be able to

1. Organize data in the form of Files (L6)
2. Apply sorting on large amount of data (L3)

### **Text Books:**

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson Freed “Fundamentals of Data Structures in C”, 2<sup>nd</sup> Edition, University Press, 2007.
2. Alan L. Tharp, “File Organization and Processing”, Wiley and Sons, 1988.

### **Reference Books:**

1. D. Samanta, “Classic Data Structures”, 2<sup>nd</sup> Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
2. Peter Bras, “Advanced Data Structures”, Cambridge University Press, 2016
3. Richard F. Gilberg, Behrouz A. Forouzan, “Data Structures A Pseudo code Approach with C”,  
Second Edition, Cengage Learning 2005.

### **Course Outcomes:**

Students should be able to

1. Select Appropriate Data Structure for solving a real world problem (L4)
2. Select appropriate file organization technique depending on the processing to be done (L4)
3. Construct Indexes for Databases (L6)
4. Analyse the Algorithms (L4)
5. Develop Algorithm for Sorting large files of data (L3)

**(19A03101) ENGINEERING WORKSHOP**

**(Common to all branches)**

**Course Objective:**

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

**Wood Working:**

Familiarity with different types of woods and tools used in wood working and make following joints

- a) Half – Lap joint
- b) Mortise and Tenon joint
- c) Corner Dovetail joint or Bridle joint

**Sheet Metal Working:**

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

- a) Tapered tray
- b) Conical funnel
- c) Elbow pipe
- d) Brazing

**Fitting:**

Familiarity with different types of tools used in fitting and do the following fitting exercises

- a) V-fit
- b) Dovetail fit
- c) Semi-circular fit
- d) Bicycle tire puncture and change of two wheeler tyre

**Electrical Wiring:**

Familiarities with different types of basic electrical circuits and make the following connections

- a) Parallel and series
- b) Two way switch
- c) Godown lighting
- d) Tube light
- e) Three phase motor
- f) Soldering of wires

**Course Outcomes:**

After completion of this lab the student will be able to

1. Apply wood working skills in real world applications. (13)
2. Build different parts with metal sheets in real world applications. (13)
3. Apply fitting operations in various applications. (13)
4. Apply different types of basic electric circuit connections. (13)
5. Demonstrate soldering and brazing. (12)



**(19A03102) ENGINEERING GRAPHICS LAB**  
**(Common to All Branches of Engineering)**

**Course Objectives:**

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling.
- Instruct graphical representation of machine components.

**Part A: Manual Drawing: (7 Classes)**

**Introduction to Engineering graphics:** Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions.

- a) Conic sections including the rectangular hyperbola- general method only,
- b) Cycloid, epicycloids and hypocycloid
- c) Involute

**(2L + 6P hrs)**

**Projection of points, lines and planes:** Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces. **(2L + 6P hrs)**

**Projections of solids:** Projections of regular solids inclined to one or both planes by rotational or auxiliary views method. **(1L + 3P hrs)**

**Sections of solids:** Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections. **(1L + 3P hrs)**

**Development of surfaces:** Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts. **(1L + 6P hrs)**

**Part B: Computer Aided Drafting: (6 Classes)**

**Introduction to AutoCAD:** Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.

**(1L + 3P hrs)**

Dimensioning principles and conventional representations.

**Orthographic Projections:** Systems of projections, conventions and application to orthographic projections. (3L + 9P hrs)

**Isometric Projections:** Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids. (2L + 6P hrs)

**Text Books:**

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000

**Reference Books:**

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

**Course Outcomes:**

After completing the course, the student will be able to

- draw various curves applied in engineering. (L2)
- show projections of solids and sections graphically. (L2)
- draw the development of surfaces of solids. (L3)
- use computers as a drafting tool. (L2)
- draw isometric and orthographic drawings using CAD packages. (L3)

**Note:**

1. Manual (part A) and Computer Aided Drafting (part B) classes can be held in alternative weeks for optimal utilization of computer facilities.
2. External examinations to be conducted both manual and computer mode with equal weight of marks.

**Additional Sources**

1. Youtube: <http://sewor.carleton.ca/gkardos/88403/drawings.html> conic sections-online, red woods.edu

**(19A01201P) BASIC CIVIL & MECHANICAL ENGINEERING LAB**

**(EEE)**

**Part A**

**Laboratory Experiments:**

1. Bending test on (Steel/Wood) Cantilever beam.
2. Bending test on (Steel/Wood) simply supported beam.
3. Use of electrical resistance strain gauges.
4. Compression test on Bricks
5. Water absorption test on Bricks
6. Torsion test.
7. Tests on closed coiled and open coiled helical springs

**Part B**

**Course Objectives:**

- Understand the functioning and performance of I.C. Engines
- To find heat losses in various engines

**List of Experiments:**

1. Load test on four stroke Diesel Engine with mechanical loading.
2. Load test on four stroke Diesel Engine with DC Generator loading.
3. Heat balance test on Four Stroke Diesel Engine.
4. Load test on two stroke petrol engine.
5. A) Study of Valve & Port diagram.  
B) Study of boilers.
6. Performance test on vapour compression refrigeration system.
7. Performance test on vapour absorption refrigeration system.

**Course Outcomes:**

Upon the successful completion of course, students will be able to

- Explain different working cycles of engine.
- Illustrate the working of refrigeration systems
- Evaluate heat balance sheet of IC engine.

(19A51102P) CHEMISTRY LAB  
(CSE, CSSE, ECE, EIE, EEE and IT)

**Course Objectives:**

- Verify the fundamental concepts with experiments

**List of Experiments:**

1. Measurement of 10Dq by spectrophotometric method
2. Models of potential energy surfaces
3. Conductometric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a polymer
8. Verify Lambert-Beer's law
9. Thin layer chromatography
10. Identification of simple organic compounds by IR and NMR
11. HPLC method in separation of gaseous and liquid mixtures
12. Estimation of Ferrous Iron by Dichrometry.

**Course Outcomes:**

At the end of the course, the students will be able to

- **determine** the cell constant and conductance of solutions (L3)
- **prepare** advanced polymer materials (L2)
- **measure** the strength of an acid present in secondary batteries (L3)
- **analyse** the IR and NMR of some organic compounds (L3)

**(19A05201P) DATA STRUCTURES LAB**  
**(Common to All Branches of Engineering)**

**Course Objectives:**

1. To introduce to the different data structures
2. To elucidate how the data structure selection influences the algorithm complexity
3. To explain the different operations that can be performed on different data structures
4. To introduce to the different search and sorting algorithms.

**Laboratory Experiments**

1. String operations using array of pointers
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms.
3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time.
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List
5. Stack implementation using arrays
6. Stack implementation using linked lists
7. Queue implementation using arrays. Implement different forms of queue. While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank.
8. Queue implementation using linked lists
9. Creation of binary search tree, performing operations insertion, deletion, and traversal.
10. Breadth first search
11. Depth first search
12. Travelling sales man problem
13. File operations
14. Indexing of a file
15. Reversing the links (not just displaying) of a linked list.
16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using 'Ladies first' principle. You may create new linked lists if necessary.
17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form.
18. A table can be defined as a collection of rows and columns. Each row and

column may have a label. Different values are stored in the cells of the table. The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table. User may like to remove row/column. Create table datatype and support different operations on it.

**Course Outcomes:**

At the end of the course students should be able to

1. Select the data structure appropriate for solving the problem (L5)
2. Implement searching and sorting algorithms (L3)
3. Design new data types (L6)
4. Illustrate the working of stack and queue (L4)
5. Organize the data in the form of files (L6)

**(19A54302) COMPLEX VARIABLES AND TRANSFORMS**

(Common to ECE & EEE)

**Course Objective:**

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.

**Unit-I:Complex Variable – Differentiation:**

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations ( $\sin z$ ,  $e^z$ ,  $\cos z$ ,  $z^2$ ) Mobius transformations (bilinear) and their properties.

**Unit Outcomes:**

Students will be able to

- Understand functions of Complex variable and its properties.
- Find derivatives of complex functions.
- Understand the analyticity of complex functions .
- Understand the conformal mappings of complex functions.

**Unit-II: Complex Variable – Integration:**

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with  $f(z)$  not having poles on real axis).

**Unit Outcomes:**

Students will be able to

- Understand the integration of complex functions.
- Apply Cauchy's integral theorem and Cauchy's integral formula.
- Understand singularities of complex functions.
- Evaluate improper integrals of complex functions using Residue theorem.

### **Unit-III: Laplace Transforms**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

#### **Unit Outcomes:**

Students will be able to

- Understand the concept of Laplace transforms and find the Laplace transforms of elementary functions.
- Find the Laplace transforms of general functions using its properties.
- Understand Laplace transforms of special functions(Unit step function, Unit Impulse & Periodic).
- Apply Laplace transforms to solve Differential Equations.

### **Unit-IV: Fourier series**

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.

#### **Unit Outcomes:**

Students will be able to

- Understand finding Fourier series expression of the given function.
- Determine Fourier coefficients (Euler's) and identify existence of Fourier series of the given function.
- Expand the given function in Fourier series given in Half range interval.
- Apply Fourier series to establish Identities among Euler coefficients.
- Find Fourier series of wave forms.

### **Unit-V: Fourier transforms & Z Transforms:**

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem .

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.



**Unit Outcomes:**

Students will be able to

- Find Fourier Sine and cosine integrals.
- Understand Fourier transforms.
- Apply properties of Fourier transforms.
- Understand Z transforms.
- Apply properties of Z transforms.
- Apply Z transforms to solve difference equations.

**Text Books:**

1. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India

**Reference Books:**

1. B.V.Ramana, Higher Engineering Mathematics, Mc Graw Hill publishers.
2. Alan Jeffrey, Advanced Engineering Mathematics, Elsevier.

**Course Outcomes:**

After the completion of course, students will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
- Understand the usage of Laplace Transforms, Fourier Transforms and Z transforms.
- Evaluate the Fourier series expansion of periodic functions.

**(19A02301T) BASIC ELECTRICAL CIRCUITS**

**Course Objectives:**

To make the student learn about

- Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters.
- The Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference
- Series and parallel resonances, bandwidth, current locus diagrams
- Network theorems and their applications
- Network Topology and concepts like Tree, Cut-set , Tie-set, Loop, Co-Tree.

**Unit- 1 Introduction to Electrical & Magnetic Circuits**

**Electrical Circuits:** Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. Examples

**Magnetic Circuits:** Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

**Unit Outcomes:**

- To know about Kirchhoff's Laws in solving series, parallel, non-series-parallel configurations in DC networks
- To know about voltage source to current source and vice-versa transformation in their representation
- To understand Faraday's laws
- To distinguish analogy between electric and magnetic circuits
- To understand analysis of series and parallel magnetic circuits

**Unit- II Single Phase A.C Circuits**

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Phasor diagrams - Concept of Power Factor-Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

**Unit Outcomes:**

- To understand fundamental definitions of 1- $\phi$  AC circuits
- To distinguish between scalar, vector and phasor quantities
- To understand voltage, current and power relationships in 1- $\phi$  AC circuits with basic elements R, L, and C.
- To understand the basic definitions of complex immittances and complex power
- To solve 1- $\phi$  AC circuits with series and parallel combinations of electrical circuit elements R, L and C.

**Unit- III Three Phase A.C. Circuits**

Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

**Unit Outcomes:**

- To know about advantages of 3- $\phi$  circuits over 1- $\phi$  circuits
- To distinguish between balanced and unbalanced circuits
- To know about phasor relationships of voltage, current, power in star and delta connected balanced and unbalanced loads
- To know about measurement of active, reactive powers in balanced circuits
- To understand about analysis of unbalanced circuits and power calculations

**Unit- IV Network Theorems**

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

**Unit Outcomes:**

- To know that electrical circuits are 'heart' of electrical engineering subjects and network theorems are main part of it.
- To distinguish between various theorems and inter-relationship between various theorems
- To know about applications of certain theorems to DC circuit analysis
- To know about applications of certain theorems to AC network analysis
- To know about applications of certain theorems to both DC and AC network analysis

## **Unit- V Network Topology**

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis.

### **Unit Outcomes:**

- To understand basic graph theory definitions which are required for solving electrical circuits
- To understand about loop current method
- To understand about nodal analysis methods
- To understand about principle of duality and dual networks
- To identify the solution methodology in solving electrical circuits based on the topology

### **Course Outcomes:**

After completing the course, the student should be able to do the following

- Given a network, find the equivalent impedance by using network reduction techniques and determine the current through any element and voltage across and power through any element.
- Given a circuit and the excitation, determine the real power, reactive power, power factor etc.,.
- Apply the network theorems suitably.
- Determine the Dual of the Network, develop the Cut Set and Tie-set Matrices for a given Circuit. Also understand various basic definitions and concepts.

### **Text Books:**

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5<sup>th</sup> Edition, 2013.
2. Circuit Theory (Analysis & Synthesis) A. Chakrabarti, Dhanpat Rai & Sons, 7<sup>th</sup> Revised Edition, 2018.

### **Reference Books:**

1. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7<sup>th</sup> Edition, 2006.
2. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
3. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2<sup>nd</sup> Edition, 2019.
4. Electric Circuits- Schaum's Series, Mc Graw Hill, 5<sup>th</sup> Edition, 2010.
5. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5<sup>th</sup> Edition, 2014.

(19A02302) POWER SYSTEM ARCHITECTURE

**Course Objectives:**

To make the student learn about:

- The block diagram and operation of Conventional Power generating systems and their components.
- The role of non conventional power generating systems and their operation and economic aspects.
- Calculation of different transmission line parameters and their use.
- Modelling of transmission line and evaluation of constants.

**UNIT-I CONVENTIONAL POWER GENERATING SYSTEMS**

**Thermal Power:** Block Diagram of Thermal Power Station (TPS), Brief Description of TPS Components

**Hydro Power:** Selection of Site, Classification, Layout, Description of Main Components.

**Nuclear Power:** Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors.

**Unit Outcomes:** *At the end of the unit, the student will be able to*

- Understand the concept of layout and design aspects of Thermal, Hydro and Nuclear Power Plants.
- Obtain the principle of operation of Thermal, Hydro and Nuclear Power Plants.

**UNIT -II NON CONVENTIONAL POWER GENERATING SYSTEMS**

**Solar Power Generation:** Role and Potential of Solar Energy Options, Principles of Solar Radiation, Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

**Wind Power Generation:** Role and potential of Wind Energy Options, Horizontal and Vertical Axis Wind Mills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.

**Biogas Power Generation:** Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.

**Geothermal and Ocean Power Generation:** Principle of Geothermal Energy Methods of Harnessing-Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants- Economic Aspects.

**Unit Outcomes:** At the end of the unit, the student will be able to

- Understand the concept of design of Solar, Wind, Bio-Gas, Geothermal and Ocean Power generation.
- Obtain the principle of operation of Solar, Wind, Bio-Gas, Geothermal and Ocean Power generation.

### **UNIT-III TRANSMISSION LINE PARAMETERS**

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

**Unit Outcomes:** *At the end of the unit, the student will be able to*

1. Obtain the transmission line parameters for different types of lines and also for symmetrical and asymmetrical single and three phase, single and double circuit lines.

### **UNIT – IV MODELING OF TRANSMISSION LINES**

Classification of Transmission Lines - Short, medium and long lines and their models - representations - Nominal-T, Nominal- $\pi$  and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent –  $\pi$ , Numerical Problems. – Surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Ferranti effect, Charging current, Need of Shunt Compensation.

**Unit Outcomes:** At the end of the unit, the student will be able to

- Obtain the classification of transmission lines and A,B,C,D constants for transmission lines, need of shunt compensation.

### **UNIT-VGENERAL ASPECTS OF DISTRIBUTION SYSTEMS**

Classification of Distribution Systems - Comparison of DC & AC and Under-Ground & Over - Head Distribution Systems. Voltage Drop and power loss in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor, LVDC Distribution Network. Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, feeder loading; basic design of secondary distribution. Voltage Drop and power loss in A.C. Distributors.

#### **SUBSTATIONS:**

**Location of Substations:** Rating of distribution substations, service area within primary feeders. Benefits derived through optimal location of substations.

**Classification of substations:** Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment.

**Bus bar arrangements in Sub-Stations:** Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar, Double breaker – One and half breaker system with relevant diagrams, lightning arrestors, Substation grounding.

**Unit Outcomes:** At the end of the unit, the student will be able to

- Compare DCvs AC and Under-Ground vs Over - Head Distribution Systems, types of Distribution Systems.
- Get the knowledge about Design of Distribution Feeders, Voltage Drop and power loss in A.C. Distributors.
- Learn Substation and types of Substations, Various arrangements in Substations.

**Course Outcomes:**

After completing the course, the student should be able to do the following:

- CO1 Remember and understand the concepts of conventional and nonconventional power generating systems.
- CO2 Apply the economic aspects to the power generating systems.
- CO3 Analyse the transmission lines and obtain the transmission line parameters and constants.
- CO4 Design and Develop the schemes to improve the generation and capability of transmission line to meet the day to day power requirements.

**TEXT BOOKS:**

1. M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, “Power System Engineering”, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. C.L Wadhwa, “Electric Power Generation Distribution and Utilization”, New Age International (P) Ltd., 2005.
3. G.D. Rai, “Non Conventional Energy Sources” Khanna Publishers, 2000.

**REFERENCE BOOKS:**

1. John Twidell and Tony Weir, “Renewable Energy Resources”, Second Edition, Taylor and Francis Group, 2006.
2. S. N. Singh, “Electrical Power Generation, Transmission and Distribution”, PHI, 2003.
3. V.K. Mehta and Rohit Mehta, “Principles of Power Systems”, S. Chand & Company, LTD., New Delhi 2004.
4. S. N. Bhadra, D. Kasta & S. Banerjee, “Wind Electrical Systems”. Oxford University Press, 2013.

(19A02303T) DC MACHINES & TRANSFORMERS

**UNIT-I**

**Magnetic Material Properties and Applications:**

Introduction, Magnetic materials and their properties, magnetically induced emf and force, AC operation of magnetic circuits, hysteresis and eddy current losses, permanent magnets, and applications of permanent magnet materials.

**Principles of electromechanical energy conversion:**

Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems, forces/torques in systems with permanent magnets, energy conversion via electric field, dynamical equations of electro mechanical systems

**Unit Outcomes:**

- Able to understand the electromechanical energy conversion system
- To understand about various magnetic materials, properties and Applications

**UNIT-II**

**DC Generators**

Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation, armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, emf induced in a coil undergoing commutation, methods of improving commutation, OCC and load characteristics of different types of generators.

Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections

**Unit Outcomes:**

- Able to understand the construction, operation and armature windings of a DC generator
- Able to analyze the characteristics of DC generators

**UNIT-III**

**DC Motors**

Force on conductor carrying current, back emf, Torque and power developed by armature, speed control of DC motors(Armature control and Flux control methods), Necessity of starters,



constructional details of 3-point and 4-point starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency

**Testing of DC machines:** Brake test, Swinburne's test, Hopkinson's test, Fields test, Retardation test.

**Unit Outcomes:**

- Able to analyze speed control of DC motors, testing methods and parallel operation of DC machines
- Analyze the characteristics of DC motors

**UNIT-IV**

**Single Phase Transformers**

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagrams(no load and on load), Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, losses and efficiency Testing - open circuit and short circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

**Unit Outcomes:**

- Able to understand the construction, operation and parallel operation of transformer
- To predetermine the efficiency and regulation of a transformer

**UNIT-V**

**Three Phase Transformers**

Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers- Cooling of transformers.

**Unit Outcomes:**

- Able to understand and analyze the phase conversions
- Analyze the tap changing of transformers

**Course Outcomes:**

At the end of this course, students will demonstrate the ability to

- Understand the concepts of magnetic circuits.
- Understand the operation of DC machines.
- Analyse the differences in operation of different DC machine configurations.
- Analyse single phase and three phase transformers circuits.

**Text Books:**

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

**References:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

**(19A04306T) SEMICONDUCTOR DEVICES AND CIRCUITS**

**Course Objectives:**

- To study the characteristics of various types of semiconductor devices.
- To apply the characteristics of semiconductor devices to develop engineering solutions.
- To analyze functioning of various types of electronic devices and circuits.

**Unit1**

p-n junction Diode: Qualitative theory of the p-n junction, p-n junction as a diode, current components in a p-n diode, Volt-Ampere characteristics, Temperature dependence of p-n diode characteristics, Diode resistance, Qualitative treatment of Transition and Diffusion capacitances.

Diode as Rectifier: Half wave and Full wave rectifier, Bridge rectifier, Filters – Inductor and Capacitor Filter. Ripple factor with and without filters.

**Unit Outcomes:**

- Explain the concept of p-n junction as diode (L2)
- Apply the concept of diode for developing rectifiers (L3)
- Analyse temperature dependence of diode characteristics (L4)

**Unit2**

Special Purpose Diodes: Zener versus Avalanche breakdown, Principle of operation, characteristics and applications of Zener diode, Tunnel diode, Photo diode, LED, PIN diode, Schottky barrier diode and Varactor diode.

Bi-Polar Junction Transistor: Junction transistor, Transistor current components, Transistor as an amplifier, Input and Output characteristics of BJT in Common Base, Common Emitter and Common Collector configurations. Transistor as a switch.

**Unit Outcomes:**

- Study the characteristics of various special purpose diodes and BJT (L2)
- Apply the concepts of special purpose diodes and BJT to solve engineering problems (L3)
- Compare the BJT characteristics in various configurations (L4)

### **Unit 3**

Transistor biasing and Stabilization: The Operating Point, DC & AC load lines, Bias Stability, Fixed Bias, Collector-to-Base Bias, Self-Bias, Bias Stabilization, Bias Compensation, Thermistor and Sensistor Compensation, Thermal Runaway, Thermal Stability.

Small Signal Low-frequency Transistor Models: Transistor Hybrid Model, Determination of the h parameters from the characteristics, Analysis of Transistor amplifier using h parameters, Comparison of Transistor amplifier configurations.

#### **Unit Outcomes:**

- Explain the concept of biasing and its temperature stability and compensation (L2)
- Apply transistor hybrid model to calculate h-parameters (L3)
- Analyse transistor amplifier using h-parameters (L4)

### **Unit 4**

Low-frequency Transistor Amplifier circuits: Simplified Common-emitter Hybrid Model, Simplified Calculations for the Common-Collector, Common-base and Common-emitter amplifier, Common emitter amplifier by passed and un-bypassed Emitter Resistance, Miller's Theorem, Dual of Miller's Theorem.

#### **Unit outcomes:**

- State Miller's and dual of Miller's theorems (L1)
- Apply the concept of BJT to develop amplifier circuits (L3)
- Analyse the simplified hybrid model of transistor in various configurations (L4)

### **Unit5**

Field-effect Transistors: The Junction Field-effect Transistor, The Pinch-off Voltage, The JFET Volt-Ampere Characteristics, MOSFET characteristics (Enhancement and depletion mode), The FET and MOSFET Small-signal Model, Biasing of FET and MOSFET.

The Common-source Amplifier, The Common-drain Amplifier, A Generalized FET Amplifier, The FET as a Voltage-variable Resistor. The Unijunction Transistor.

#### **Unit outcomes:**

- Study the characteristics of JFET, MOSFET and UJT (L2)
- Apply the characteristics of FETs and UJT to develop engineering solutions (L3)

#### **Course Outcomes:**

CO1. List various types of semiconductor devices (L1)

CO2. Study the characteristics of various types of semiconductor devices (L2)

CO3. Apply the characteristics of semiconductor devices to develop engineering solutions (L3)

CO4. Analyse functioning of various types of electronic devices and circuits (L4)

**Text Books:**

1. J. Millman, C. C. Halkias and Satyabrata Jit, "Electronic Devices and Circuits", 4<sup>th</sup> edition, Mc Graw Hill, 2015.
2. S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", 4<sup>th</sup> edition, McGraw-Hill, 2017.

**References:**

1. J. Milliman, C. C. Halkias and Chetan Parikh, "Integrated Electronics", 2<sup>nd</sup> edition, Mc Graw Hill, 2010.
2. David A. Bell, "Electronic Devices and Circuits", 5<sup>th</sup> edition, Oxford, 2008.

(19A04304) DIGITAL ELECTRONICS AND LOGIC DESIGN

(Common to EEE & ECE)

**Course Objectives:**

- To teach significance of number systems, conversions, binary codes and functionality of logic gates.
- To discuss different simplification methods for minimizing Boolean functions.
- To impart knowledge on operation, characteristics and various configurations of TTL and CMOS logic families.
- To outline procedures for the analysis and design of combinational and sequential logic circuits.
- To introduce programmable logic devices.

**Unit I**

**Number Systems and Codes:** Decimal, Binary, Octal, and Hexa-decimal number systems and their conversions, ASCII code, Excess -3 codes, Gray code.

Binary codes Classification, Error detection and correction – Parity generators and checkers – Fixed point and floating-point arithmetic.

**Boolean Algebra & Logic Gates:** Boolean operations, Boolean functions, Algebraic manipulations, Min-terms and Maxterms, Sum-of-products and Product-of-sum representations, Two-input logic gates, NAND /NOR implementations.

**Minimization of Boolean Functions:** Karnaughmap, Don't-care conditions, Prime implicants, Minimization of functions using Quine-McClusky method.

**Unit Outcomes:**

- Summarize advantages of using different number systems. (L2)
- Explain usefulness of different coding schemes and functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Compare K- Map and Q-M methods of minimizing logic functions. (L5)

**Unit II**

**Combinational Circuits:** Introduction, Analysis of combinational circuits, Design Procedure– Binary Adder-Subtractor, Decimal Adder, Multiplier, Comparator, Code Converters, Encoders, Decoders, Multiplexers, Demultiplexers, Illustrative examples.

**Sequential Circuits-1:** Introduction, Latches –RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops, Edge-triggered flip-flops, Flip-flop conversions.

### **Unit Outcomes:**

- Apply Boolean algebra for describing combinational digital circuits. (L2)
- Analyze standard combinational circuits such as adders, subtractors, multipliers, comparators etc. (L4)
- Design various Combinational logic circuits. (L4)
- Implement logic functions with decoders and multiplexers. (L5)

### **Unit III**

**Sequential Circuits-2:** Analysis and Design of Synchronous Sequential Circuits: Moore and Mealy machine models, State Equations, State Table, State diagram, State reduction & assignment, Synthesis using flip flops, Elements of Design style, Top-down design, Algorithmic state Machines (ASM), ASM chart notations.

**Registers and Counters:** Registers, shift registers, Ripple counters, Synchronous counters, Modulus-n Counter, Ring counter, Johnson counter, Up-Down counter.

### **Unit Outcomes:**

- Describe behaviour of Flip-Flops and Latches.(L2)
- Compare Moore and Mealy machine models.(L5)
- Design synchronous sequential circuits using flip flops and construct digital systems using components such as registers and counters (L4)
- Utilize concepts of state and state transition for analysis and design of sequential circuits (L3)

### **Unit IV**

**Memory and Programmable Logic:** RAM, Types of Memories, Memory decoding, ROM, Types of ROM, Programmable Logic Devices (PLDs): Basic concepts, PROM as PLD, Programmable Array Logic (PAL) and Programmable Logic Array (PLA), Design of combinational and sequential circuits using PLDs.

### **Unit Outcomes:**

- Define RAM, ROM, PROM, EPROM and PLDs. (L1)
- Describe functional differences between different types of RAM & ROM. (L2)
- Compare different types of Programmable Logic Devices. (L5)
- Design simple digital systems using PLDs. (L4)

### **Unit V**

**Digital Logic Families:** Unipolar and Bipolar Logic Families, Transistor-Transistor Logic (TTL): Operation of TTL, Current sink logic, TTL with active pull up, TTL with open collector output, Shockley TTL, TTL characteristics, I<sup>2</sup>L, ECL logic Families.

**CMOS:** CMOS Inverter, CMOS characteristics, CMOS configurations - Wired Logic, Open drain outputs, Interfacing: TTL to CMOS and CMOS to TTL, Tristate Logic, Characteristics of Digital ICs: Speed, power dissipation, figure of merit, fan-out, Current and voltage parameters, Noise immunity, operating temperature range, power supply requirements.

**Unit Outcomes:**

- Summarize significance of various TTL , I<sup>2</sup>L, ECL and CMOS subfamilies. (L2)
- Examine Interface aspects of TTL & CMOS logic families. (L5)
- Explain characteristics of digital ICs such as speed, power dissipation, figure of merit, fan-out, noise immunity etc. (L2)
- Compare bipolar and MOS logic families. (L5)

**Course Outcomes:**

After completion of the course, student will be able to

**CO1:** Understand various number systems, error detecting, correcting binary codes, logic families, combinational and sequential circuits. (L1)

**CO2:** Apply Boolean laws, k-map and Q-M methods to minimize switching functions. Also describe the various performance metrics for logic families. (L2)

**CO3:** Design combinational and sequential logic circuits. (L4)

**CO4:** Compare different types of Programmable logic devices and logic families. (L5)

**TEXTBOOKS:**

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 4<sup>th</sup> Edition Pearson Education, 2013.
2. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory", Third Edition, Tata McGraw Hill, 2010.
3. R. P. Jain, "Modern Digital Electronics", 4<sup>th</sup> edition, McGraw Hill Education , India Private Limited, 2012.

**REFERENCES:**

1. J.F Wakerly, "Digital Design: Principles and Practices", 4<sup>th</sup> Edition, Pearson India, 2008.
2. Charles H Roth (Jr) and Larry L. Kinney, "Fundamentals of Logic Design", 5th Edition Cengage Learning India Edition, , 2010.
3. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.



**(19A02303P) DC MACHINES & TRANSFORMERS LAB**

**Course Objectives:**

To conduct various experiments on

- DC motors and DC Generators
  - The speed control techniques of DC motors.
  - To conduct various experiments for testing on 1-phase transformers
1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
  2. Load test on DC shunt generator. Determination of characteristics.
  3. Brake test on DC shunt motor. Determination of performance curves.
  4. Swinburne's test on DC shunt motor, Predetermination of efficiency.
  5. Speed control of DC shunt motor (Armature control and Field control method).
  6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
  7. OC and SC test on single phase transformer
  8. Parallel operation of single phase transformers.
  9. Sumpner's test on single phase transformers.
  10. Load test on DC long shunt compound generator. Determination of characteristics.
  11. Load test on DC short shunt compound generator. Determination of characteristics.
  12. Separation of losses in DC shunt motor.

**Note:** Minimum ten experiments are required to be conducted as compulsory experiments:

**Course Outcomes:**

CO1 Able to conduct and analyze load test on DC shunt generators

CO2 Able to understand and analyze magnetization characteristics of DC shunt generator

CO3 Able to understand and analyze speed control techniques and efficiency of DC machines

CO4 Able to understand to predetermine efficiency and regulation of single phase Transformers

**Reference Book:**

1. D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017

**(19A04306P) SEMICONDUCTOR DEVICES AND CIRCUITS LAB**

**All the experiments shall be conducted and there is no choice.**

**List of Experiments:**

1. Draw and study the characteristics of Semi-conductor diode and calculate static and dynamic resistance
2. Draw and study the characteristics of Zener Diode and study its application as Regulator
3. Draw and study the input and output characteristics of Transistor in Common Emitter configuration
4. Draw and study the input and output characteristics of Transistor in Common Base configuration
5. Draw and study the drain and transfer characteristics of FET in Common Source Configuration
6. Draw and study the characteristics of UJT
7. Rectifiers
  - a. To simulate the rectifiers and trace their output waveforms with and without filters using PSPICE / Multisim
  - b. To design half wave, full wave & bridge rectifiers with and without filters, using discrete components and calculate ripple factor in each case.
8. Common Emitter Amplifier (Self bias Amplifier)
  - a. Design and simulate self- bias Common Emitter amplifier using PSPICE /Multisim and study the Gain and Bandwidth of the amplifier
  - b. Design self- bias Common Emitter amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response
9. Miller's and Dual of Miller's theorem
  - a. Design and simulate to Prove the Miller's and dual of Miller's theorem in CE amplifier
  - b. Design and construct the amplifier with discrete components to prove Miller's and dual of Miller's theorem
10. FET Amplifier
  - a. Design and simulate common source FET amplifier using PSPICE /Multisim and study the Gain and Bandwidth of amplifier
  - b. Design common source FET amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response

**(19A02301P) BASIC ELECTRICAL CIRCUITS LAB**

Hands-on experiments related to the course contents of **Electrical Circuit Analysis**

1. Verification of Thevenin's and Norton's Theorems
2. Verification of Superposition Theorem for average and rms values
3. Maximum Power Transfer Theorem for DC and AC circuits
4. Verification of Compensation Theorem for DC circuits
5. Verification of Reciprocity, Millmann's Theorems for DC circuits
6. Determination of Self, Mutual Inductances and Coefficient of Coupling
7. Measurement of Active Power for Star Connected Balanced Loads
8. Measurement of Reactive Power for Star Connected Balanced Loads
9. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads
10. Measurement of Active Power for Delta Connected Balanced Loads
11. Measurement of Reactive Power for Delta Connected Balanced Loads

**Course Outcomes:**

At the end of the course, students will be able to

CO1: Remember, understand and apply various theorems and verify practically.

CO2: Understand and analyze active, reactive power measurements in three phase balanced & un balanced circuits.

**(19A99302) BIOLOGY FOR ENGINEERS**

**Course Objectives:** To provide basic understanding about life and life Process. Animal and plant systems. To understand what biomolecules are, their structures and functions. Application of certain biomolecules in Industry.

- Brief introduction about human physiology and bioengineering.
- To understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
- How biology Principles can be applied in our daily life using different technologies.
- Brief introduction to the production of transgenic microbes, Plants and animals.

**Unit I: Introduction to Basic Biology**

Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification.

**Unit Outcomes:**

After completing this unit, the student will be able to

- Summarize the basis of life. (L1)
- Understand the difference between lower organisms (prokaryotes) from higher organisms (eukaryotes). (L2)
- Understand how organisms are classified. (L3)

**Unit II: Introduction to Biomolecules**

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

**Unit Outcomes:**

After completing this unit, the student will be able to

- Understand what are biomolecules? their role in living cells, their structure, function and how they are produced. (L1)
- Interpret the relationship between the structure and function of nucleic acids. (L2)
- Summarize the applications of enzymes in industry. (L3)
- Understand what is fermentation and its applications of fermentation in industry. (L4)

### **Unit III: Human Physiology**

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

#### **Unit Outcomes:**

After completing this unit, the student will be able to

- Understand what nutrients are (L1)
- Understand the mechanism and process of important human functions (L2 & L3)

### **Unit IV: Introduction to Molecular Biology and recombinant DNA Technology**

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. rDNA technology. Introduction to gene cloning.

#### **Unit Outcomes:**

After completing this unit, the student will be able to

- Understand and explain about gene structure and replication in prokaryotes and Eukaryotes (L1)
- How genetic material is replicated and also understands how RNA and proteins are synthesized. (L2)
- Understand about recombinant DNA technology and its application in different fields.(L3)
- Explain what is cloning. (L4)

### **Unit V: Application of Biology**

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basics of Production of Transgenic plants and animals.

#### **Unit Outcomes:**

After completing this unit, the student will be able to Understand.

- How biology is applied for production of useful products for mankind.(L1)
- What are biosensors, biochips etc. (L2)
- Understand transgenic plants and animals and their production (L3)

## **Course Outcomes:**

After studying the course, the student will be able to:

- Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.
- Explain about biomolecules, their structure and function and their role in the living organisms. How biomolecules are useful in Industry.
- Briefly about human physiology.
- Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.
- Know about application of biological Principles in different technologies for the production of medicines and Pharmaceutical molecules through transgenic microbes, plants and animals.

## **Text books:**

1. P.K.Gupta, Cell and Molecular Biology, 5<sup>th</sup> Edition, Rastogi Publications -
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

## **Reference Books:**

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2<sup>nd</sup> ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology -- 2014

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– II-II Sem** **L T P C**  
**2 1 0 3**  
**(19A54304) NUMERICAL METHODS AND PROBABILITY THEORY**

(Common to EEE and MECH)

**Course Objective:**

This course aims at providing the student with the knowledge on

- Various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
- The theory of Probability and random variables.

**Unit-I: Solution of Algebraic & Transcendental Equations:**

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method

System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

**Unit Outcomes:**

Students will be able to

- Calculate the roots of equation using Bisection method and Iterative method.
- Calculate the roots of equation using Regula falsi method and Newton Raphson method.
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Siedal method.

**Unit-II: Interpolation**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

**Unit Outcomes:**

Students will be able to

- Understand the concept of interpolation.
- Derive interpolating polynomial using Newton's forward and backward formulae.
- Derive interpolating polynomial using Lagrange's formulae.
- Derive interpolating polynomial using Gauss forward and backward formulae.

**Unit-III: Numerical Integration & Solution of Initial Value Problems to Ordinary Differential Equations**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule  
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

### **Unit Outcomes:**

Students will be able to

- Solve integral equations using Simpson's 1/3 and Simpson's 3/8 rule.
- Solve integral equations using Trapezoidal rule.
- Solve initial value problems to ordinary differential equations using Taylor's method.
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods.

### **Unit-IV: Probability theory:**

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

### **Unit Outcomes:**

Students will be able to

- Understand the concept of Probability.
- Solve problems on probability using addition law and multiplication law.
- Understand Random variables and probability mass and density functions.
- Understand statistical constants of random variables.

### **Unit-V: Random Variables & Distributions:**

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution

### **Unit Outcomes:**

Students will be able to

- Understand Probability distribution function.
- Solve problems on Binomial distribution.
- Solve problems on Poisson distribution.
- Solve problems on Normal distribution.

### **Course Outcomes:**

After the completion of course, students will be able to

- Apply numerical methods to solve algebraic and transcendental equations
- Derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically



- Apply Probability theory to find the chances of happening of events.
- Understand various probability distributions and calculate their statistical constants.

**Text Books:**

1. B.S.Grewal, “Higher Engineering Mathematics”, Khanna publishers.
2. Ronald E. Walpole, “Probability and Statistics for Engineers and Scientists”, PNIE.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India

**Reference Books:**

1. B.V.Ramana, “Higher Engineering Mathematics”, Mc Graw Hill publishers.
2. Alan Jeffrey, “Advanced Engineering Mathematics”, Elsevier Publishers

(19A02401T) ELECTRICAL CIRCUIT ANALYSIS

**Course Objectives:**

- To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
- To know the applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources.
- Study of Different types of filters, equalizers.

**Unit - I: Locus Diagrams & Resonance**

Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.

**Unit Outcomes:**

The student will be able to

- Learn about basic concepts of Locus diagrams with different parameter variations of Electrical circuit elements
- Learn about occurrence of resonance with the presence of electrical circuit elements under certain operating conditions

**Unit - II: Two Port Networks**

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

**Unit Outcomes:**

The student will be able to

- Understand and estimate the network parameters of T &  $\pi$  configurations of DC circuits or resistive elements
- Understand how Laplace transforms studied in mathematics courses, can be applied to identifying energy storage elements in electrical circuits

**Unit - III: Transient Analysis**

**D.C Transient Analysis:** Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method

Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation.

**A.C Transient Analysis:** Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.

#### **Unit Outcomes:**

The student will be able to

- Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in DC excitations
- Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in sinusoidal excitations

#### **Unit - IV: Fourier Transforms**

Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

#### **Unit Outcomes:**

The student will be able to

- Know how to apply Fourier transforms studied in Mathematics to Electrical circuits for non-sinusoidal periodic and non-periodic input waves
- Understand properties of Fourier series and Transforms

#### **Unit - V: Filters**

Filters – Low Pass – High Pass and Band Pass – RC, RL filters– derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers.

#### **Unit Outcomes:**

The student will be able to

- Understand about what is a Filter, Classification, where they can be used, etc.
- Understand about attenuators and equalizers used in electronic high frequency circuits

#### **Course Outcomes:**

- Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.

- Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources are known.
- Design of filters, equalizers and PSPICE programs for Circuit Analysis.

**Text Books:**

1. William Hayt, Jack E. Kemmerly and Jamie Phillips, “Engineering Circuit Analysis”, Mc Graw Hill, 9<sup>th</sup> Edition, 2019.
2. A. Chakrabarti, “Circuit Theory: Analysis & Synthesis”, Dhanpat Rai & Sons, 2008.

**Reference Books:**

1. M.E. Van Valkenberg, “Network Analysis”, 3rd Edition, Prentice Hall (India), 1980.
2. V. Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall International, 2009.
3. Charles K. Alexander and Matthew. N. O. Sadiku, “Fundamentals of Electric Circuits” Mc Graw Hill, 5<sup>th</sup> Edition, 2013.
4. Mahamood Nahvi and Joseph Edminister, “Electric Circuits” Schaum’s Series, 6<sup>th</sup> Edition, 2013.
5. John Bird, Routledge, “Electrical Circuit Theory and Technology”, Taylor & Francis, 5<sup>th</sup> Edition, 2014.

**Course Objectives:**

- To understand the basic principles of electrostatics
- To understand the basic principles of magneto statics for time invariant and time varying fields
- To understand the principles of dielectrics, conductors and magnetic potentials

**UNIT-I ELECTROSTATICS**

Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss Law-Application of Gauss Law-Maxwell's First Law – Numerical Problems.

Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

**Unit Outcomes:**

- Able to Determine electric field and potentials using Coulomb's law & Gauss law.
- Analyze Potential differences for different configurations.
- Able to Classify static electric magnetic fields in different engineering situations.
- Able to Determine the Concepts of Electric dipole, Electrostatic Energy and Energy density.

**UNIT- II CONDUCTORS AND DIELECTRICS**

Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

**Unit Outcomes:**

- Analyze the Concepts of Conduction and Convection currents.
- Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors.
- Able to Calculate Energy stored and energy density in a static electric fields.

### **UNIT-III MAGNETO STATICS**

Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular & Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems.

Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

#### **Unit Outcomes:**

- Analyze the Concepts of Magnetic field intensity using Biot-Savart Law & Ampere Law.
- Able to understand Maxwell's equations.
- Develop MFI due to an infinite sheet of current and a long filament carrying conductor in Different loops.

### **UNIT – IV MAGNETIC POTENTIAL**

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations.

Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.

#### **Unit Outcomes:**

- Understand scalar magnetic potential and vector magnetic potential and its applications.
- Able to calculate the magnetic forces and torque produced by currents in Magnetic Field.
- Ability to calculate self and mutual Inductances.
- Analyze the Concepts of Magnetic boundary conditions & Energy stored in the Magnetic field.

## **UNIT-V TIMEVARYING FIELDS**

Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current.

Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.

### **Unit Outcomes:**

- Acquires knowledge on time varying fields & Faraday's law for Electromagnetic induction
- Analyze the Concepts Maxwell's Equations in Different Forms.
- Understand the Concepts Calculation of Poynting vector & Theorem.
- Analyze the Concepts of Wave Theory

### **Course Outcomes:**

After completion of the course, the student will be able to:

- Understand the concept of electrostatics
- Understand the concepts of Conductors and Dielectrics
- Understand the fundamental laws related to Magneto Statics
- Understand the concepts of Magnetic Potential and Time varying Fields

### **TEXT BOOKS:**

1. Sadiku, Kulkarni, "Principles of Electromagnetics", 6<sup>th</sup> Edition, Oxford University Press, 2015
2. William.H.Hayt, "Engineering Electromagnetics", Mc Graw Hill, 2010.

### **REFERENCE BOOKS:**

1. J.D.Kraus, "Electromagnetics", 5<sup>th</sup> Edition, Mc Graw Hill Inc, 1999.
2. David K. Cheng, "Field & Electromagnetic Waves", 2<sup>nd</sup> Edition, 1989.
3. Joseph A. Edminister, "Electromagnetics", 2<sup>nd</sup> Edition, Schaum's Outline, Mc Graw Hill, 2017.
4. K.A. Gangadhar and P.M. Ramanathan, "Electromagnetic Field Theory", 8<sup>th</sup> Reprint, Khanna Publications, 2015.

**(19A02403) POWER ELECTRONICS**

**Course Objectives:**

The student will be able to:

1. Understand the differences between signal level and power level devices.
2. Analyze controlled rectifier circuits.
3. Analyze the operation of DC-DC choppers.
4. Analyze the operation of voltage source inverters.

**UNIT-I: Power Switching Devices**

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

**Unit Outcomes:**

At the end of the unit, students will be able to

- Understand the basic power semiconductor devices their construction, principle of working and their characteristics.
- Understand in detail about SCR i.e., its characteristics, series and parallel connection of SCR's, specification, its ratings and various commutation methods.
- Apply the above concepts to solve numerical problems.

**UNIT-II: Thyristor Rectifiers**

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor-Numerical problems.

**Unit Outcomes:**

At the end of the unit, students will be able to

- Understand the concepts of phase control technique, midpoint and bridge connections of half and full controlled converters with various loads for both 1 $\emptyset$  and 3 $\emptyset$  phase converters, effect of source inductance and dual converters.
- Analyze and evaluate voltages and currents, active and reactive power inputs to converter with and without freewheeling diode for 1 $\emptyset$  and 3 $\emptyset$  converters.
- Apply the above concepts to solve numerical problems.



### **UNIT-III: DC-DC buck converter**

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

#### **DC-DC boost converter:**

Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

#### **Unit Outcomes:**

At the end of the unit, students will be able to

- Understand the concepts of various control strategies, types of choppers and analyze their principle operation, waveforms of voltages and currents at different loads.
- Apply the above concepts to solve numerical problems.

### **UNIT-IV:**

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

#### **Unit Outcomes:**

At the end of the unit, students will be able to

- Understand the construction, working of single phase voltage inverters with their waveforms in various operating modes when different loads are applied and the different modulating techniques available.
- Understand the construction, working of three phase voltage inverters with their waveforms in various operating modes when different loads are applied, harmonic components and the different modulating techniques available.
- Apply the above concepts to solve numerical problems.

### **UNIT-V: AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS:**

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

**Unit Outcomes:**

At the end of the unit, students will be able to

- Understand the concept of AC voltage controllers
- Understand the concept of Cyclo Converters

**Course Outcomes:**

At the end of this course students will be able to:

- Understand the operation, characteristics and usage of basic Power Semiconductor Devices.
- Understand different types of Rectifier circuits with different operating conditions.
- Understand DC-DC converters operation and analysis of their characteristics.
- Understand the construction and operation of voltage source inverters, Voltage Controllers and Cyclo Converters.
- Apply all the above concepts to solve various numerical problem solving

**TEXT BOOKS:**

1. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", 2<sup>nd</sup> edition, Prentice Hall of India, 1998
2. P.S.Bimbhra, "Power Electronics", 4<sup>th</sup> Edition, Khanna Publishers, 2010.
3. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw Hill Publishing Company, 1998.

**REFERENCE BOOKS:**

1. Ned Moha, "Power Electronics", Wiley, 2011.
2. Robert W. Erickson and Dragan Maksimovic, "Fundamentals of Power Electronics" 2<sup>nd</sup> Edition, Kluwer Academic Publishers, 2004.
3. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, 1996.
4. V.R.Murthy, "Power Electronics", 1<sup>st</sup> Edition, Oxford University Press, 2005.
5. P.C.Sen, "Power Electronics", Tata Mc Graw-Hill Education, 1987.

(19A04405) ANALOG ELECTRONIC CIRCUITS

**Course Objectives:**

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits to solve engineering problems
- Analyse various electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

**Unit 1**

**Multistage Amplifiers:** Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.

**Unit outcomes:**

- Name different coupling schemes in amplifiers (L1)
- Explain the principles of Darlington amplifier (L2)
- Apply multistage amplifiers to solve engineering problems (L3)
- Analyse multistage amplifiers (L4)
- Justify choice of transistor configuration in a cascade amplifier (L5)

**Unit 2**

**Feedback Amplifiers:** Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage – shunt.

**Oscillators**

Sinusoidal Oscillators, Conditions for oscillations, Phase - shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

**Unit Outcomes:**

- Classify feedback amplifiers and oscillators (L1)
- Explain the concept of feedback and conditions for oscillations (L2)
- Apply the feedback amplifiers and oscillators to solve engineering problems (L3)
- Analyse feedback amplifiers and oscillator (L4)

### Unit 3

**Large Signal Amplifiers(Power Amplifiers):** Introduction, Classification, Class A large signal amplifiers, Second - Harmonic Distortion, Higher - Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.

#### Unit Outcomes:

- Classify the large signal amplifiers (L1)
- Explain the operation of different types of large signal amplifiers (L2)
- Apply large signal amplifiers in a given engineering situation (L3)
- Analyse harmonic distortion in large signal amplifiers (L4)

### Unit 4: Linear Integrated Circuits:

**Operational Amplifier:** Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal op-amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations. The Practical op-amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain – bandwidth product, frequency limitations and compensations, transient response.

#### Unit Outcomes:

- Understand different Offsets present in Op amp & nullification circuits. (L1)
- Examine performance of Op-Amp in open loop and closed configurations. (L2)
- Analyse emitter-coupled differential amplifier. (L3)
- Compare ideal and practical Op-Amps. (L5)

### Unit 5: Applications of Linear Integrated Circuits:

Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, Oscillators: RC phase shift oscillator, Wien bridge oscillator, Square wave generator.

**Special Purpose Integrated Circuits:** Functional block diagram, working, design and applications of Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO 566, PLL 565, Fixed and variable Voltage regulators.

**Unit Outcomes:**

- Understand various applications of Linear ICs (L1)
- Explain operation of Op. Amp. in various applications, Timer, Fixed voltage regulators(L2)
- Apply linear ICs in a given engineering situation (L3)

**Course outcomes:**

On successful completion of the course, the student shall be able to

CO1. List various types of feedback amplifiers, oscillators and large signal amplifiers (L1)

CO2. Explain the operation of various electronic circuits and linear ICs (L2)

CO3. Apply various types of electronic circuits to solve engineering problems (L3)

CO4. Analyse various electronic circuits and regulated power supplies for proper understanding (L4)

CO5. Justify choice of transistor configuration in a cascade amplifier (L5)

CO6. Design electronic circuits for a given specification (L6)

**Text Books:**

1. Millman, Halkias and Jit, “Electronic Devices and Circuits”, 4<sup>th</sup> Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, “Electronic Devices and Circuits”, 4<sup>th</sup> Edition, Mc Graw Hill Education (India) Private Ltd., 2017.
3. Ramakanth A. Gayakwad, “Op-Amps & Linear ICs”, 4<sup>th</sup> Edition, Pearson, 2017.

**Reference Books:**

1. Millman and Taub, Pulse, Digital and Switching Waveforms, 3<sup>rd</sup> Edition, Tata McGraw-Hill Education, 2011.
2. J. Milliman, C. C. Halkias and Chetan Parikh, “Integrated Electronics”, 2<sup>nd</sup> Edition, Mc Graw Hill, 2010.
3. David A. Bell, “Electronic Devices and Circuits”, 5<sup>th</sup> edition, Oxford Press, 2008.
4. D. Roy Choudhury, “Linear Integrated Circuits”, 2<sup>nd</sup> Edition, New Age International (p) Ltd, 2003.

(19A05304T) PYTHON PROGRAMMING

**Course Objectives:**

1. To learn the fundamentals of Python
2. To elucidate problem-solving using a Python programming language
3. To introduce a function-oriented programming paradigm through python
4. To get training in the development of solutions using modular concepts
5. To introduce the programming constructs of python

**Unit – I**

**Introduction:** What is a program, Running python, Arithmetic operators, Value and Types.

**Variables, Assignments and Statements:** Assignment statements, Script mode, Order of operations, string operations, comments.

**Functions:** Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

**Unit Outcomes:**

Student should be able to

- List the basic constructs of Python.
- Solve the problems by applying modularity principle.

**Unit – II**

**Case study:** The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring.

**Conditionals and Recursion:** floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input.

**Fruitful Functions:** Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of Faith, Checking types,

**Unit Outcomes:**

Student should be able to

- Apply the conditional execution of the program.
- Apply the principle of recursion to solve the problems.

### Unit – III

**Iteration:** Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms.

**Strings:** A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison.

**Case Study:** Reading word lists, Search, Looping with indices.

**Lists:** List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

#### Unit Outcomes:

Student should be able to

- Use the data structure list.
- Design programs for manipulating strings.

### Unit – IV

**Dictionaries:** A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables.

**Tuples:** Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences.

**Files:** Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.

**Classes and Objects:** Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.

Classes and Functions:

#### Unit Outcomes:

Student should be able to

- Apply object orientation concepts.
- Use data structure dictionaries.
- Organize data in the form of files.

### Unit – V

**Classes and Functions:** Time, Pure functions, Modifiers, Prototyping versus Planning

**Classes and Methods:** Object oriented features, Printing objects, The init method, The \_\_str\_\_ method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation

**Inheritance:** Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Class diagrams, Data encapsulation.

**The Goodies:** Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, defaultdict, Named tuples, Gathering keyword Args,

**Unit Outcomes:**

Student should be able to

- Plan programs using object orientation approach.
- Illustrate the principle of inheritance.

**Course Outcomes:**

Student should be able to

1. Apply the features of Python language in various real applications.
2. Select appropriate data structure of Python for solving a problem.
3. Design object oriented programs using Python for solving real-world problems.
4. Apply modularity to programs.

**Text books:**

1. Allen B. Downey, “Think Python”, 2<sup>nd</sup> edition, SPD/O’Reilly, 2016.

**Reference Books:**

1. Martin C.Brown, “The Complete Reference: Python”, McGraw-Hill, 2018.
2. Kenneth A. Lambert, B.L. Juneja, “Fundamentals of Python”, CENGAGE, 2015.
3. R. Nageswara Rao, “Core Python Programming”, 2<sup>nd</sup> edition, Dreamtech Press, 2019



**(19A52301)UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**  
(Common to all)

**Introduction:**

This course discusses the role of human values in one's family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course names as "H-102 Universal Human Values 2 : "Understanding Harmony" is designed which may be covered in their III or IV Semester.

In the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

**Course Objective:**

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

**COURSE TOPICS:**

The course has 28 lectures and 14 practice sessions in 5 modules:

**Unit 1:**

**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

## **Unit 2:**

### **Understanding Harmony in the Human Being - Harmony in Myself!**

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

## **Unit 3:**

### **Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples

from students' lives

#### **Unit 4:**

#### **Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

#### **Unit 5:**

#### **Implications of the above Holistic Understanding of Harmony on Professional Ethics**

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

## **Text Book**

1. R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, “Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics”, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

## **Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.
2. A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi “The Story of My Experiments with Truth”
5. E. F. Schumacher. “Small is Beautiful”
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa “Economy of Permanence”
8. Pandit Sunderlal “Bharat Mein Angreji Raj”
9. Dharampal, “Rediscovering India”
10. Mohandas K. Gandhi, “Hind Swaraj or Indian Home Rule”
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

## **MODE OF CONDUCT (L-T-P-C 2-1-0-2)**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor’s role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one’s own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up “ordinary” situations rather than “extra-ordinary” situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to

development of commitment, namely behaving and working based on basic human values.

**OUTCOME OF THE COURSE:**

By the end of the course,

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**Course Objectives:**

1. Understand and experimentally verify various resonance phenomenon
2. Understand and analyze various current locus diagrams.
3. Apply and experimentally analyze two port network parameters
4. Simulation of various circuits using PSPICE software.

**Experiments:**

1. Locus Diagram of RL Series Circuits:
  - a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'
2. Locus Diagram of RC Series Circuits:
  - a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'
3. Series Resonance
4. Parallel Resonance
5. Determination of Z Parameters
6. Determination of Y Parameters
7. Transmission Parameters
8. Hybrid Parameters
9. Determination of Coefficient of coupling

**PSPICE Simulation Experiments:**

1. Simulation of DC Circuits
2. Simulation of AC Circuits
3. DC Transient Response
4. Mesh Analysis
5. Nodal Analysis

**References:**

1. David A. Bell, Fundamentals of Electric Circuits: Lab Manual OUP Canada, 7<sup>th</sup> Edition, 2009.
2. Muhammad H. Rashid, Introduction to PSPICE using OrCAD for Circuits and Electronics, Pearson Education, 3<sup>rd</sup> Edition, 2003.

(19A04406) ELECTRONIC CIRCUITS LAB

**Course Objectives:**

- To learn basic techniques for the design of analog circuits, digital circuits and fundamental concepts used in the design of systems.
- To design and analyze multistage amplifiers, feedback amplifiers and OP AMP based circuits.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.

**PART A**

**List of Experiments:**

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/Wien bridge oscillator and square wave generator for the given specifications. Determine the frequency of oscillation.
5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without cross-over distortion. Determine maximum output power and efficiency.
6. Design inverting and noninverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.
7. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.
8. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.
9. Design an astable multi-vibrator circuit for the given specifications using 555 timer. Observe ON & OFF states of transistor in an astable multi-vibrator. Plot output waveforms.

**Note:** Design & simulate any 6 experiments with Multisim / PSPICE or equivalent software and verify the results in hardware lab with discrete components.

## **PART B**

### **List of Experiments:**

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Realization of Boolean Expressions using Gates
3. Design a 3 – bit Adder / Subtractor
4. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
5. Design and construct basic flip-flops R-S,J-K,J-K Master slave flip-flops using gates and verify their truth tables
6. Design and implementation of Mod-N synchronous counter using J-K flip-flops.
7. Design and implementation of i) Ring counter and ii) Johnson counter using 43 bit shiftregister
8. Design and realization of 8x1 MUX using 2x1 MUX

**Note:** Student has to perform minimum of 4 experiments using digital ICs

### **Course Outcomes:**

At the end of this course, students will demonstrate the ability to

- Analyze various amplifier circuits.
- Design multistage amplifiers.
- Design OPAMP based analog circuits.
- Understand working of logic gates.
- Design and implement Combinational and Sequential logic circuits.



(19A99301) ENVIRONMENTAL SCIENCE

**Course Objectives:**

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

**UNIT – I**

**Multidisciplinary Nature Of Environmental Studies:** – Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

**Unit Outcomes**

- To know the importance of public awareness
- To know about the various resources

**UNIT – II**

**Ecosystems:** Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Biodiversity And Its Conservation :** Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity:

consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **Course Outcomes:**

- To know about various eco systems and their characteristics
- To know about the biodiversity and its conservation

### **UNIT – III**

**Environmental Pollution:** Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

**Solid Waste Management :** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

### **Course Outcomes:**

- To know about the various sources of pollution.
- To know about the various sources of solid waste and preventive measures.
- To know about the different types of disasters and their managerial measures.

### **UNIT – IV**

**Social Issues And The Environment:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution)

Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

### **Course Outcomes:**

- To know about the social issues related to environment and their protection acts.
- To know about the various sources of conservation of natural resources.
- To know about the wild life protection and forest conservation acts.

### **UNIT – V**

**Human Population And The Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**Field Work:** Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

### **Unit Outcomes:**

- To know about the population explosion and family welfare programmes.
- To identify the natural assets and related case studies.

### **Course Outcomes:**

At the end of the course, the student will be able to

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes.

**TEXT BOOKS:**

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

**REFERENCES:**

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

**(19A02501T)AC MACHINES**

**Course Objectives:**

The students will be able to:

- Understand the fundamentals of AC machines, know equivalent circuit performance characteristics.
- Understand the methods of starting of Induction motors.
- Understand the methods of starting of Synchronous motors.
- Understand the parallel operation of Alternators.

**UNIT-I**

**Fundamentals of AC machine windings**

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factors.

**Learning Outcomes:**

By the end of the unit, student will be able to:

- Understand the fundamentals of various parts used, different types of windings, distribution factor, air gap mmf distribution, constant and pulsating magnetic fields, addition of pulsating magnetic fields and revolving magnetic field.
- Analyze Magnetic and pulsating fields produced by spatially displaced windings and when the windings are spatially shifted by an angle.
- Apply above concepts to solve numerical problems.

**UNIT-II**

**Induction Machines**

Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram-performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging.

### **LearningOutcomes:**

By the end of the unit, student will be able to:

- Understand the construction, types, equivalent circuit, torque slip characteristics and various losses present in an induction machine.
- Analyze the phasor diagram, efficiency, starting and maximum torque, effect of parameter variation on torque speed characteristics
- Apply above concepts to solve numerical problems.

### **UNIT-III**

#### **Single-phase induction motors**

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase motors, reluctance single phase motors, stepper motors, BLDC motors.

### **Learning Outcomes:**

By the end of the unit, student will be able to:

- Understand induction generator operation, self-excitation, doubly fed induction machines, various methods of starting, braking and speed control of induction motors.
- Understand the constructional features, principle involved, equivalent circuit of single-phase induction motor and various starting methods and its applications.
- Apply above concepts to solve numerical problems.

### **UNIT-IV**

#### **Synchronous generators**

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation-EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

### **LearningOutcomes:**

By the end of the unit, student will be able to:

- Understand the constructional features, emf generated, equivalent circuit, armature reaction, voltage regulation, characteristics, two reaction theory of synchronous machine.
- Analyze the phasor diagrams, parallel operation of alternators, synchronization and load division of synchronous generators.
- Apply above concepts to solve numerical problems.

## **UNIT-V**

### **Synchronous motors**

Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, Predetermination of V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.

### **Learning Outcomes:**

By the end of the unit, student will be able to:

- Understand the principle of operation, methods of starting, concept of hunting, synchronous condenser and power factor correction of synchronous motors.
- Analyze the phasor diagram, determination of V and inverted V curves and power circles of synchronous motor.
- Apply above concepts to solve numerical problems.

### **Course Outcomes:**

At the end of this course, students will be able to:

- Understand the basics of ac machine windings, construction, principle of working, equivalent circuit of induction and synchronous machines.
- Analyze the phasor diagrams of induction and synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators.
- Apply the concepts to determine V and inverted V curves and power circles of synchronous motor.
- Analyze the various methods of starting in both induction and synchronous machines.

### **Text Books:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

### **References:**

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

**(19A02502) CONTROL SYSTEMS**

**Course Objectives:**

To make the students learn about:

- Merits and demerits of open loop and closed loop systems; the effect of feedback
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function
- Transient and steady state response, time domain specifications and the concept of Root loci
- Frequency domain specifications, Bode diagrams and Nyquist plots
- State space modelling of Control system

**UNIT – I**

**CONTROL SYSTEMS CONCEPTS**

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchronos.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Write the differential equations for mechanical and electrical systems
- Obtain the transfer function from block diagrams, servo motors and signal flow graphs

**UNIT-II**

**TIME RESPONSE ANALYSIS**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

**Learning Outcomes:**

At the end of the unit, the student will be able to



- Analyze the time domain specifications
- Calculate the steady state errors
- Understand about Proportional, Integral and Derivative controllers along with combinations

### **UNIT– III**

#### **STABILITY ANALYSIS IN TIME DOMAIN**

The concept of stability – Routh’s stability criterion – Stability and conditional stability – limitations of Routh’s stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to  $G(s)H(s)$  on the root loci.

#### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Analyze the concept of stability in time domain
- Apply the concept of Routh’s stability and Root locus in time domain

### **UNIT– IV**

#### **FREQUENCY RESPONSE ANALYSIS**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

#### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Evaluate the frequency domain specifications from Bode, Polar and Nyquist plots
- Design Compensators for various systems
- Deducing transfer functions from Bode Plots
- Understand difference between Phase and Gain margins

### **UNIT– V**

#### **STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

## **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the concept of state space, controllability and observability
- Obtain the transfer function from state space and vice versa
- Understand the state transition method of solving time invariant state equations

## **Course Outcomes:**

After completing the course, the student should be able to:

- Understand the concepts of control systems classification, feedback effect, mathematical modelling, time response and frequency response characteristics, state space analysis
- Apply the concepts of Block diagram reduction, Signal flow graph method and state space formulation for obtaining mathematical and Root locus, Bode, Nyquist, Polar plots for stability calculations, controllability and observability and demonstrate the use of these techniques.
- Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.
- Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them in solving various engineering applications.

## **TEXT BOOKS:**

1. Katsuhiko Ogata, "Modern Control Engineering", 5<sup>th</sup> edition, Prentice Hall of India Pvt. Ltd., 2010.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering" 5<sup>th</sup> edition, New Age International (P) Limited Publishers, 2007.

## **REFERENCE BOOKS:**

1. M.Gopal, "Control Systems Principles & Design" 4<sup>th</sup> Edition, Mc Graw Hill Education, 2012.
2. B. C. Kuo and Farid Golnaraghi, "Automatic Control Systems" 8<sup>th</sup> edition, John Wiley and Sons, 2003.
3. Joseph J Distefano III, "Feedback and Control Systems", Allen R Stubberud & Ivan J Williams, 2<sup>nd</sup> Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Graham C. Goodwin, "Control System Design" Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Gene F. Franklin, "Feedback Control of Dynamic Systems", J.D. Powell and Abbas Emami-Naeini, 6<sup>th</sup> Edition, Pearson, 2010.

(19A52601T) ENGLISH LANGUAGE SKILLS

**Introduction**

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language skills in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. They should be able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

**Course Objectives**

- Facilitate active listening to enable inferential learning through expert lectures and talks
- Impart critical reading strategies for comprehension of complex texts
- Provide training and opportunities to develop fluency in English through participation in formal group discussions and presentations using audio-visual aids
- Demonstrate good writing skills for effective paraphrasing, argumentative essays and formal correspondence
- Encourage use of a wide range of grammatical structures and vocabulary in speech and writing

**UNIT -I**

**Text:**

1. **Lines Composed a Few Miles above Tintern Abbey - William Wordsworth**
2. **The Lotos-Eaters - Alfred Tennyson**

**Listening:** Listening to famous speeches for structure and style

**Speaking:** Oral presentations on general topics of interest.

**Reading:** Reading for meaning and pleasure – reading between the lines.

**Writing:** Appreciating and analyzing a poem –Paraphrasing, note-taking.

**Grammar and Vocabulary: Tenses (Advanced Level)** Correcting errors in punctuation - Word roots and affixes.

**Learning Outcomes**

At the end of the module, the learners will be able to

- Understand the purpose of rhythm and rhyme and the use of figures of speech in making the presentation lively and attractive
- Apply the knowledge of structure and style in a presentation, identify the audience and make note of key points
- Make formal structured presentations on general topics using grammatical understanding
- Prioritize information from reading texts after selecting relevant and useful points
- Paraphrase short academic texts using suitable strategies and conventions

## UNIT -II

**Text: The Model Millionaire – Oscar Wilde**

**Listening:** Following the development of theme; answering questions on key concepts after listening to stories online.

**Speaking:** Narrating personal experiences and opinions.

**Reading:** Reading for summarizing and paraphrasing; recognizing the difference between facts and opinions.

**Writing:** Summarizing, précis writing, letter and note-making

**Grammar and Vocabulary:** Subject-verb agreement, noun-pronoun agreement, collocations.

### Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend academic lectures, take notes and answer questions
- Make formal structured presentations on academic topics
- Distinguish facts from opinions while reading
- Summarize and make a précis of reports
- Use correct English avoiding common errors in formal speech and writing

## UNIT – III

**Text: Speech at IIM Calcutta – AzimPremji**

**Listening:** Identifying views and opinions expressed by different speakers while listening to speeches.

**Speaking:** Small talks on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position.

**Reading:** Identifying claims, evidences, views, opinions and stance/position.

**Writing:** Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences.

**Grammar and Vocabulary:** The use of Active and passive Voice, vocabulary for academic texts

## Learning Outcomes

At the end of the module, the learners will be able to

- Critically follow and participate in a discussion
- participate in group discussions using appropriate conventions and language strategies
- comprehend complex texts and identify the author's purpose
- produce logically coherent argumentative essays
- use appropriate vocabulary to express ideas and opinions

## UNIT – IV

### **Text: A Biography of Steve Jobs**

**Listening:** Listening to identify important moments - Understanding inferences; processing of information using specific context clues from the audio.

**Speaking:** Group discussion; reaching consensus in group work (academic context).

**Reading:** Reading for inferential comprehension.

**Writing:** Applying for internship/ job - Writing one's CV/Resume and cover letter.

**Grammar and Vocabulary: Phrasal verbs, phrasal prepositions and technical vocabulary.**

## Learning Outcomes

At the end of the module, the learners will be able to

- Draw inferences and conclusions using prior knowledge and verbal cues
- Express thoughts and ideas with acceptable accuracy and fluency
- Develop advanced reading skills for deeper understanding of texts
- Prepare a cv and write a cover letter to seek internship/ job
- Understand the use of technical vocabulary in academic writing

## Unit –V

### **Text: How I Became a Public Speaker - George Bernard Shaw**

**Listening:** Understanding inferences - processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge.

**Speaking:** Formal team presentations on academic/ general topics.

**Reading:** Intensive and extensive reading.

**Writing:** Structure and contents of a Report – Abstract – Project report features.

**Grammar and Vocabulary:** Correcting common errors, improving vocabulary and avoiding clichés and jargons.

## Learning Outcomes

At the end of the module, the learners will be able to

- Develop advanced listening skills for in-depth understanding of academic texts

- Collaborate with a partner to make effective presentations
- Understand and apply the structure of project reports
- Demonstrate ability to use grammatically correct structures and a wide range of vocabulary

### **Course Outcomes**

At the end of the course, the learners will be able to

- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

### **Text Book**

- “Forging Ahead”: A Course Book for B.Tech Students. Orient BlackSwan, 2020.

### **Reference Books**

- 1) Bailey, Stephen. “Academic writing: A handbook for international students”. Routledge, 2014.
- 2) Chase, Becky Tarver. Pathways: Listening, “Speaking and Critical Thinking”. Heinley ELT; 2nd Edition, 2018.
- 3) Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- 4) Hewings, Martin. “Cambridge Academic English” (B2). CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)

**(19A02504) ELECTRICAL MACHINE DESIGN**

**Course Objectives:**

The student will be able to:

- Know about various principles of design factors, ratings based on heating and cooling of electrical machines
- Know about designing of DC machines along with windings
- Understand about overall designing of 1- $\phi$  transformer
- Be able to know about designing of Induction machine along with winding configurations
- Able to know about designing of Synchronous machines

**UNIT-I:**

**DESIGN FACTORS, HEATING AND COOLING**

Introduction, Design factors, Limitations in Design. Theory of solid body heating, Heating time constant and estimation, Selection of machine power rating, types of duties and ratings (Description only), Selection of motor capacity for continuous, short-time and Intermittent periodic duty ratings, Concept of the methods used for determination of machine rating for variable loads.

**Learning Outcomes**

At the end of the module, the learners will be able to

- To know about fundamental aspects of design parameters and limitations in designing
- To know about heating and cooling phenomenon in selection of machine rating and types of ratings
- To know the design aspects of continuous and short time ratings of machines
- To know the design aspects of machine for variable loads

**UNIT-II:**

**DESIGN OF DC MACHINES**

Output equation and main dimensions, choice of flux density, choice of ampere-conductors, Selection of number of poles, Length of air gap, Design of field winding, Simplex Lap and Wave windings-Numerical examples.

**Learning Outcomes**

At the end of the module, the learners will be able to

- To know about designing aspects of DC machines with respect to performance equations and characteristics

- To understand necessity of air gap and its length requirement between armature and field
- To know about classification of field windings and design of them
- To understand about complete design aspects of DC machines
- To be able to design DC machine based on the specified ratings

### **UNIT-III:**

#### **DESIGN OF SINGLE PHASE TRANSFORMERS**

Output of transformer, Design of core, Selection of type of winding, Design of insulation, Overall design, No-load current estimation, Design of tank with tubes-Numerical examples.

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- To know about the design aspects of 1- $\phi$  transformer based on performance equations
- To understand about the design aspects based on core, type of winding
- To know about design of tanks in 1- $\phi$  transformers
- To know about design aspects of insulations in transformers
- To understand complete design aspects of 1- $\phi$  transformers and to be able to design for specified rating

### **UNIT-IV:**

#### **DESIGN OF INDUCTION MACHINES**

Three phase Induction machine output equation and main dimensions, Selection of stator and rotor slots, Length of air gap, and Reduction of harmonic torques, Hemitropic, whole coil and Mush windings-Numerical examples.

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- To know about the design aspects of three phase induction machines based on performance equations
- To know about selection of stator and rotor slots, air gap
- To know about necessity mitigating harmonic torque
- To know about various winding designs of induction machines and to distinguish between squirrel cage & slip ring machines
- To understand complete aspects of 3- $\phi$  induction machine and to be able to design for a specified rating

### **UNIT-V:**

#### **DESIGN OF SYNCHRONOUS MACHINES**

Output equation, Main dimensions for cylindrical and salient pole machines, Choice of specific magnetic and electric loadings, Effect of SCR on machine performance, Length of air gap, Selection of stator slots, and mitigation of harmonics-Numerical examples.



## Learning Outcomes

At the end of the module, the learners will be able to

- To know about the design aspects of synchronous machines based on performance equations
- To distinguish between cylindrical and salient pole machines
- To design synchronous machine based on shunt circuit ratio calculations
- To know about the specific electric and magnetic loads and their choice
- To understand complete design aspects of 3- $\phi$  synchronous machine and to be able to design for a specified rating

## Course Outcomes:

The student will be able to:

- Understand various design factors, types of windings, choice of machine, selection and ratings
- Able to design DC machine based on specified rating
- Able to design 1- $\phi$  transformer based on specified rating
- Able to design 3- $\phi$  Induction machine based on specified rating
- Able to design 3- $\phi$  Synchronous machine based on specified rating

## Text books:

1. A.K. Sawhney and Chakrabarti, "A course on Electrical Machine Design", 6<sup>th</sup> edition, Dhanpat Rai & Co Pvt. Ltd., 2014.
2. K. G. Upadhyay, "Design of Electrical Machines", 1<sup>st</sup> Edition, New Age International Pvt. Ltd., 2018.

## Reference books:

1. M G Say, "The performance and Design of Alternating Current Machines", 3<sup>rd</sup> edition, CBS Publishers & Distributors, New Delhi, 2002.
2. A. E. Clayton and N N Hancock, "Performance and Design of Direct Current Machines", 3<sup>rd</sup> edition, CBS Publication, 2004.
3. V. N. Mittle and Aravind Mittal, "Design of Electrical Machines", Standard Publishers Distributions, 2009.
4. R. K. Agarwal, "Principles of Electrical Machine Design", S.K. Kataria & Sons, 2010.

**(19A02503a) HVDC AND FACTS**  
**PROFESSIONAL ELECTIVE-I**

**Course Objectives:**

To get the student exposed to:

- High voltage DC transmission systems
- Flexible AC transmission systems
- Various configurations of the above, Principle of operation, Characteristics of various FACTS devices

**UNIT-I:**

**INTRODUCTION**

Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS.

**Learning Outcomes**

At the end of the module, the learners will be able to

- Know about difference between HVDC and FACTS
- Know about limitations of conventional transmission systems
- Know about recent developments in Power Electronic switching devices

**UNIT – II:**

**HIGH VOLTAGE DC TRANSMISSION – I**

Types of HVDC links - Monopolar, Homopolar, Bipolar and Back-to-Back, Advantages and disadvantages of HVDC Transmission, Analysis of Greatz circuit, Analysis of bridge circuit without overlap, Analysis of bridge with overlap less than  $60^\circ$ , Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link.

**Learning Outcomes**

At the end of the module, the learners will be able to

- To learn about various HVDC link configurations
- To develop equivalent circuit of HVDC link

## **UNIT – III:**

### **HIGH VOLTAGE DC TRANSMISSION – II**

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- To learn about various DC link control techniques
- To learn about starting, stopping and reversal of power flow in DC links

## **UNIT-IV:**

### **FLEXIBLE AC TRANSMISSION SYSTEMS-I**

Types of FACTS Controllers, brief description about various types of FACTS controllers, Operation of 6-pulse converter, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation, principle of operation of various types of Controllable shunt Var Generation, Principle of switching converter type shunt compensator, principles of operation of various types of Controllable Series Var Generation, Principle of Switching Converter type series compensator.

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- To understand principle of working and differences between various pulse configurations of various converters
- To understand the necessity of compensators
- To analyze the configurations of shunt, VAR, series configurations, etc.

## **UNIT-V:**

### **FLEXIBLE AC TRANSMISSION SYSTEMS-II**

Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, UPFC and IPFC control structures (only block diagram description), objectives and approaches of voltage and phase angle regulators

## **Learning Outcomes**

At the end of the module, the learners will be able to

- To know more about advanced Power flow controllers
- To analyze the transmission control strategies
- To know about voltage and phase regulators

## **Course Outcomes:**

The student will be able to understand:

- The necessity of HVDC systems as emerging transmission networks
- Power Electronic devices to understand the necessity of reactive power compensation devices
- To obtain equivalent circuits of various HVDC system configurations

## **Text Books:**

1. Narain G. Hingorani and Laszlo Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. E.W. Kimbark, "Direct current transmission, Vol. I", Wiley Interscience, New York, 1971.

## **Reference Books:**

1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, New Delhi, 2007.
2. Anrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, "FACTS: Modelling and Simulation in Power Networks", John Wiley & Sons, West Sussex, 2004.
3. R Mohan Mathur and Rajiv K Varma, Thyristor-"Based FACTS Controllers for Electrical Transmission Systems", IEEE Press, Wiley-Interscience, New Jersey, 2002.

**(19A02503b) DC Drives**  
**(PROFESSIONAL ELECTIVE-I)**

**Course Objectives:**

- To understand the basic concepts of DC Motor fundamentals and mechanical systems.
- To understand the concept of converter control
- To design various chopper control techniques.
- To understand the concept of closed loop control of DC Drives
- To design digital control of DC Drives.

**UNIT-I:**

**DC MOTORS FUNDAMENTALS AND MECHANICAL SYSTEMS:** Introduction to high speed drives and modern drives. Characteristics of mechanical system – dynamic equations, components of torque, types of load;

**Learning Outcomes**

At the end of the module, the learners will be able to

- To understand the basic concepts of high speed drives
- To understand the basic concepts of modern drives
- To understand the basic concepts of mechanical systems
- To understand the basic concepts of types of loads and characteristics

**UNIT-II:**

**CONVERTER CONTROL:** Principle of phase control – Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters – waveforms performance parameters, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.

**Learning Outcomes**

At the end of the module, the learners will be able to

- Understand the concept of phase control of separately excited DC motor.
- Understand the concept of braking mechanisms of DC motor.
- Understand the performance characteristics of 1-phase and 3-phase converters
- To distinguish between various modes of operation

**UNIT-III:**

**CHOPPER CONTROL:** Introduction to time ratio control and frequency modulation; Class A,B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control – Chopper based implementation of braking schemes; Multi-phase chopper; Related problems.

### **Learning Outcomes**

At the end of the module, the learners will be able to

- Understand the concept of Chopper Control
- Design of Chopper.

### **UNIT-IV:**

**CLOSED LOOP CONTROL:** Modelling of drive elements – Equivalent circuit, transfer function of self, separately excited DC motors; Linear Transfer function model of power converters; Sensing and feedback elements - Closed loop speed control – current and speed loops, P, PI and PID controllers – response comparison. Simulation of converter and chopper fed DC drive.

### **Learning Outcomes**

At the end of the module, the learners will be able to

- Understand Equivalent circuit, transfer function of self, separately excited DC motor.
- Designing of current and speed loops, P, PI and PID controllers.

### **UNIT-V:**

**DIGITAL CONTROL OF D.C DRIVE:** Phase Locked Loop and micro-computer control of DC drives – Program flow chart for constant horse power and load disturbed operations; Speed detection and gate firing.

### **Learning Outcomes**

At the end of the module, the learners will be able to

- Understand the concept of PLL and micro controlled DC drives.
- Design of Speed detection and gate firing.

### **Course Outcomes:**

- Understand the basics of high speed DC Motor Drives.
- Understand the various characteristics of mechanical systems
- To analyze different modes of operation of converters and control strategies
- To understand basics of Chopper control and analysis
- To know about closed loop and digital control strategies of DC drives

## **TEXT BOOKS**

1. Gopal K Dubey, “Power Semiconductor controlled Drives”, Prentice Hall Inc., New Jersey, 1989.
2. R. Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.

## **REFERENCES**

1. Gopal K. Dubey, “Fundamentals of Electrical Drives”, Narosal Publishing House, New Delhi, 2001.
2. Bimal K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education Pvt. Ltd., New Delhi, 2003.
3. Vedam Subramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw-Hill publishing company Ltd., New Delhi, 2002.
4. P.C Sen, “Thyristor DC Drives”, John Wiley and sons, New York, 1981
5. By M. D. Singh and K.B. Khanchandani, “Power Electronics” 2<sup>nd</sup> Edition, Tata McGraw Hill, 2008.

**(19A02503c) PROGRAMMABLE LOGIC CONTROLLERS**  
**PROFESSIONAL ELECTIVE-I**

**Course Objectives:**

The student will be able to:

- Understand the basic functions and types of PLCs
- Get exposure of Easy Veep software, its applications
- Classification of PLCs and applications
- Programming using PLCs
- Troubleshooting aspects using PLCs

**UNIT-I**

Introduction:

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

**Learning Outcomes**

At the end of the module, the learners will be able to

- To understand about basic functions of PLCs
- To know about classification of PLCs
- To distinguish between PLCs and Mechanical relays
- To know about Processor and I/O cards

**UNIT-II**

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

**Learning Outcomes**

At the end of the module, the learners will be able to

- To know about Easy Veep software
- To know about Logic diagrams
- To understand about Search engine



- To know about interfacing of PC and PLCs

### **UNIT-III**

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.

Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- To know about basic features of PLCs
- To know about various instructions of PLC
- To know about various PLC versions
- To understand about Cascade control and subroutines

### **UNIT-IV**

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- To know about various Programming instructions
- To understand Math instructions in PLCs
- To know about Logical instructions
- To understand about Communications with PLC using set up and monitoring

### **UNIT-V**

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO<sub>2</sub>), plastic wrapping machines etc.

## **Learning Outcomes**

At the end of the module, the learners will be able to

- To know about analog and digital parameters in certain PLCs
- To apply PLCs for control system stability aspects
- To know about troubleshooting techniques
- To identify few applications of PLCs in Science and Technology fields

## **Course Outcomes:**

At the end of the course, the student will be able to:

- Understand different types of PLCs
- Understand the usage of Easy Veep software
- Understand the hardware details of Allen Bradley PLC
- Programming of PLCs
- Know about few applications of PLCs in different fields of Science and Technology

## **Text Books:**

1. Hugh Jack, “Automating manufacturing systems” with PLCs 2010.
2. PLC Hand Book (Automationdirect Siemens)

## **References:**

1. R. Bliesener, “Programmable Logic Controllers”, F Ebel, Festo. Didactic publishers, 2002.
2. W. Bolton, “Programmable Logic Controllers”, 4<sup>th</sup> Edition, Newnes, 2006.
3. by Jay F. Hooper, “Introduction to PLCs”, 2<sup>nd</sup> Edition, Carolina Academic Press, 2006.

**(19A04508) ANALOG AND DIGITAL IC APPLICATIONS**

**Course Objectives:**

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of PLL.
  
- To introduce the concepts of waveform generation and introduce some special function ICs.
- Exposure to digital IC's

**UNIT – I ICs and OP- AMPS**

**INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER:** Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

**UNIT – II Applications of OP- AMP**

**LINEAR APPLICATIONS OF OP-AMP:** Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

**NON-LINEAR APPLICATIONS OF OP-AMP:** Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators, Oscillators

**UNIT - III Active Filters and other ICs**

**ACTIVE FILTERS:** Introduction, Butterworth filters – 1<sup>st</sup> order, 2<sup>nd</sup> order low pass and high pass filters, band pass, band reject and all pass filters.

**TIMER AND PHASE LOCKED LOOPS:** Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL.

**UNIT – IV Voltage Regulators and Converters**

**VOLTAGE REGULATOR:** Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

**D to A AND A to D CONVERTERS:** Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

## **UNIT - V     Digital ICs**

**CMOS LOGIC:** CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.

**COMBINATIONAL CIRCUITS USING TTL 74XX ICS:** Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7-segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

**SEQUENTIAL CIRCUITS USING TTL 74XX ICS:** Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).

### **Course Outcomes (CO):**

CO1: List out the characteristics of Linear and Digital ICs.

CO2: Discuss the various applications of linear & Digital ICs.

CO3: Solve the application based problems related to linear and digital ICs.

CO4: Analyze various applications based circuits of linear and digital ICs.

CO5: Design the circuits using either linear ICs or Digital ICs from the given specifications.

### **Textbooks:**

1. D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuit", 4th edition (2012), New Age International Pvt.Ltd., New Delhi, India
2. Ramakant A. Gayakwad, "OP-AMP and Linear Integrated Circuits", 4th edition (2012), Prentice Hall / Pearson Education, New Delhi.
3. Floyd, Jain, "Digital Fundamentals", 8th edition (2009), Pearson Education, New Delhi.

### **References:**

1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.

**(19A02503d) WIND ENERGY SYSTEMS**

**(PROFESSIONAL ELECTIVE-I)**

**Course Objectives:**

- To know about basics of alternate source as wind energy and its types
- To know about operations of FSIG
- To know about configuration of DFIG and its performance
- To know about configuration of FRC and its performance
- To know about integration of various other sources with wind farms

**UNIT-I:**

**Fundamentals of Wind Energy Systems**

Wind farms, Wind energy generating system, wind power, efficiency of wind energy, conversion, types, WEC devices, characteristics - Power Vs Speed and Torque Vs Speed, Control strategies – pitch angle control, stall control and yaw control

**Learning Outcomes:-**

After completion of this unit student will

- To understand about fundamental concepts of wind farms
- To know about various types of WES
- To know about calculation of wind power and efficiency
- To know about various characteristics of WES
- To understand about various basic control strategies of WES

**UNIT-II:**

**Fixed Speed Induction Generator based Wind Turbines**

Configuration, Two speed operation, variable slip operation, Modelling of FSIG, Dynamic performance, Small disturbances, Performance during network faults

**Learning Outcomes:-**

After completion of this unit student will

- To understand about FSIG as WTG and its configuration
- To know about basic operations of FSIG
- To understand about modelling of FSIG
- To know about performance of FSIG for small perturbations

- To understand about performance of FSIG for faults

### **UNIT-III:**

#### **DFIG based Wind Turbines**

Configuration, Steady state characteristics, control strategies – control for optimum wind power extraction, current mode control, Rotor flux magnitude and angle control, dynamic performance, small disturbances, performance during network faults – Numerical problems

#### **Learning Outcomes:-**

After completion of this unit student will

- To understand about DFIG as WTG
- To know about various characteristics of DFIG
- To know about various control strategies of DFIG
- To know about performance of DFIG for small disturbances
- To understand about performance of DFIG during faults

### **UNIT-IV:**

#### **Variable Speed and FRC Wind Generators**

Classification of schemes – operating area, Induction Generators – Cage rotor Induction Generator, Doubly fed Induction Generator, Wound-field Synchronous Generator, Permanent Magnet Generator.

FRC based Synchronous Generator - Direct driven FRC Synchronous Generator, Permanent Magnet Synchronous Generator, dynamic performance. FRC Induction Generator – Steady state performance, control, performance characteristics - Numerical problems

#### **Learning Outcomes:-**

After completion of this unit student will

- To understand about variable speed IGs as WTG
- To know about classification of DFIG for variable speed operation
- To understand about FRC based SG as WTG
- To know about permanent magnet SG
- To know about performance characteristics of various DFIGs

### **UNIT- V:**

#### **Integration of Wind Farms**

Offshore wind farms, Onshore grid connection, Technical analysis, Hybrid Energy Systems – Wind-Diesel hybrid system with no storage and with battery backup, Wind-Photovoltaic systems – Numerical problems

## **Learning Outcomes:-**

After completion of this unit student will

- To understand about the necessity of integration of wind farms with other sources
- To distinguish between offshore and onshore wind farms
- To know about integration of WES with diesel
- To integrate the system with and without storage backup
- To understand about integration of grid with PV systems

## **Course Outcomes:**

1. To be able to distinguish between FSIG, VSIG, FRC as WES
2. To be able to understand which IG is to be selected based on the requirement
3. To be able to understand differences between various control strategies of different IGs
4. To be able to understand differences between various performance characteristics of different IGs
5. To know about integration of WES with other sources such as diesel, PV and their selection

## **TEXT BOOKS:**

1. S.N. Bhadra, D, Kastha and S. Banerjee, “Wind Electrical Systems”, 12<sup>th</sup> Impression, OXFORD University Press, 2013.
2. Olimpo Anaya-Lara, Nick Jenkins, Janaka Ekanayake, “Wind Energy Generation: Modelling and Control Phill Cartwright and Mike Hughes”, WILEY, 2009.

## **REFERENCES:**

1. Mukund R. Patel, “Wind and Solar Power Systems: Design, Analysis and Operation” 2<sup>nd</sup> Edition, Taylor & Francis, 2006.
2. N.K. Bansal, “Renewable Energy Sources & Conversion Technology Manfred Kleemann and Michael Meliss”, Tata Mc Graw Hill, 1990.

**(19A01506a) EXPERIMENTAL STRESS ANALYSIS**

**OPEN ELECTIVE-I**

**Course Objective:**

To bring awareness on experimental method of finding the response of the structure to different types of load.

- Demonstrates principles of experimental approach.
- Teaches regarding the working principles of various strain gauges.
- Throws knowledge on strain rosettes and principles of non destructive testing of concrete.
- Gives an insight into the principles of photo elasticity.

**UNIT-I**

**PRINCIPLES OF EXPERIMENTAL APPROACH:** - Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Demonstrate the merits and principles of experimental approach
- Give an insight into the uses and advantages of experimental stress analysis

**UNIT-II**

**STRAIN MEASUREMENT USING STRAIN GAUGES:** - Definition of strain and its relation of experimental Determinations Properties of Strain Gauge Systems-Types of Strain Gauges – Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Introduce various strain gauge systems and their properties
- Give information regarding the gauge factor and materials of adhesion bases

**UNIT-III**

**STRAIN ROSSETTES AND NON – DESTRUCTIVE TESTING OF CONCRETE:-** Introduction – the three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge. Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

**Learning outcomes:**



At the end of the unit, students will be able to:

- Introduces various strain rosettes and corrections for strain gauges
- Gives an insight into the destructive and non destructive testing of concrete

#### **UNIT-IV**

**THEORY OF PHOTOELASTICITY:** - Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster’s Stress Optic law.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Introduces stress optic laws.
- Gives the arrangements and working principles of polariscope.

#### **UNIT-V**

**TWO DIMENSIONAL PHOTOELASTICITY:** - Introduction – Iso-chromatic Fringe patterns- Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials.

#### **Learning outcomes:**

At the end of the unit, students will be able to:

- Introduces the understanding of different fringe patterns.
- Introduces model analysis and properties of photo elastic materials.

#### **Course Outcomes:**

After completion of the course

- The student will be able to understand different methods of experimental stress analysis
- The student will be able to understand the use of strain gauges for measurement of strain
- The student will be exposed to different Non destructive methods of concrete
- The student will be able to understand the theory of photo elasticity and its applications in analysis of structures

#### **TEXT BOOKS:-**

1. J.W.Dally and W.F.Riley, “Experimental stress analysis College House Enterprises”
2. Dr.Sadhu Singh, “Experimental stress analysis”, khanna Publishers

#### **REFERENCE BOOKS:**

1. U.C.Jindal, “Experimental Stress analysis”, Pearson Publications.
2. L.S.Srinath, “Experimental Stress Analysis”, MC.Graw Hill Company Publishers.

**(19A01506b) BUILDING TECHNOLOGY**  
**OPEN ELECTIVE-I**

**Course Objectives:**

- To impart to know different types of buildings, principles and planning of the buildings.
- To identify the termite control measure in buildings, and importance of grouping circulation, lighting and ventilation aspects in buildings.
- To know the different modes of vertical transportation in buildings.
- To know the utilization of prefabricated structural elements in buildings.
- To know the importance of acoustics in planning and designing of buildings.

**UNIT-I**

Overview of the course, basic definitions, buildings-types-components- economy and design-principles of planning of buildings and their importance. Definitions and importance of grouping and circulation-lighting and ventilation-consideration of the above aspects during planning of building.

**Learning outcomes:**

At the end of the unit, students will be able to:

- To be able to plan the building with economy and according to functional requirement.

**UNIT-II**

Termite proofing: Inspection-control measures and precautions- lighting protection of buildings-general principles of design of openings-various types of fire protection measures to be considered while panning a building.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Able to know the termite proofing technique to the building and protection form lightening effects.
- To be able to know the fire protection measure that are to be adopted while planning a building.

**UNIT-III**

Vertical transportation in a building: Types of vertical transportation-stairs-different forms of stairs- planning of stairs- other modes of vertical transportation – lifts-ramps-escalators.

**Learning outcomes:**

At the end of the unit, students will be able to:

- To be able to know the different modes of vertical transportation and their suitability

## **UNIT-IV**

Prefabrication systems in residential buildings- walls-openings-cupboards-shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, principles, seismic forces and their effect on buildings.

### **Learning outcomes:**

At the end of the unit, students will be able to:

- Identify the adoption of prefabricated elements in the building.
- Know the effect of seismic forces on buildings

## **UNIT-V**

Acoustics – effect of noise – properties of noise and its measurements, principles of acoustics of building. Sound insulation- importance and measures.

### **Learning outcomes:**

At the end of the unit, students will be able to:

- To know the effect of noise, its measurement and its insulation in planning the buildings

### **Course Outcomes:**

After completion of the course the student will be able to

- Understand the principles in planning and design the buildings.
- Know the different methods of termite proofing in buildings.
- Know the different methods of vertical transportation in buildings.
- Know the implementation of prefabricated units in buildings and effect of earthquake on buildings.
- Know the importance of acoustics in planning and designing of buildings.

### **TEXT BOOKS :**

1. Varghese, “Building construction”, PHI Learning Private Limited.
2. Punmia.B.C, “Building construction”, Jain.A.K and Jain.A.K Laxmi Publications.
3. S.P.Arora and S.P.Brndra “Building construction”, Dhanpat Rai and Sons Publications, New Delhi
4. “Building construction-Technical teachers training institute”, Madras, Tata McGraw Hill.

### **REFERENCE BOOKS:**

1. National Building Code of India, Bureau of Indian Standards

(19A03506a) INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES

OPEN ELECTIVE-I

**Course Objectives:**

- Provide good foundation on hybrid and electrical vehicles.
- To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles.
- Familiarize energy storage systems for electrical and hybrid transportation.
- To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

**UNIT I: Electric Vehicle Propulsion and Energy Sources**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

**Learning Outcomes:**

After successful completion of this unit, the students will be able to

- Summarize the concepts of electrical vehicle propulsion and energy sources. (12)
- Identify the types of power sources for electrical vehicles.(13)
- Demonstrate the design considerations for propulsion system. (12)
- Solve the problems on tractive power and energy required. (13)

**UNIT II: Electric Vehicle Power Plant And Drives**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives- PWM, current control method. Switch reluctance machine drives - voltage control, current control.

**Learning Outcomes:**

After successful completion of this unit, the students will be able to

- Choose a suitable drive scheme for developing an electric vehicles depending on resources.(11)
- List the various power electronic converters. (11)
- Describe the working principle dc/dc converters and buck boost convertor. (12)

- Explain about ac drives. (12)

### **UNIT III: Hybrid And Electric Drive Trains**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

#### **Learning Outcomes:**

After successful completion of this unit, the students will be able to

- Identify the social importance of hybrid vehicles. (13)
- Discuss impact of modern drive trains in energy supplies. (16)
- Compare hybrid and electric drive trains.(12)
- Analyze the power flow control and energy efficiency. (16)

### **UNIT IV: Electric and Hybrid Vehicles - Case Studies**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

#### **Learning Outcomes:**

After successful completion of this unit, the students will be able to

- List the various electric and hybrid vehicles in the present market. (11)
- Discuss lightly hybridized vehicle and low voltage systems.(16)
- Explain about hybrid electric heavy duty vehicles and fuel cell heavy duty vehicles. (12)

### **UNIT V: Electric And Hybrid Vehicle Design :**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

## Learning Outcomes:

After successful completion of this unit, the students will be able to

- Illustrate matching the electric machine and the internal combustion engine. (12)
- Select the energy storage technology. (13)
- Select the size of propulsion motor. (13)
- Design and develop basic schemes of electric and hybrid electric vehicles. (13)

## Course outcomes:

After learning the course the students will be able to:

- Explain the working of hybrid and electric vehicles. (12)
- Choose a suitable drive scheme for developing an hybrid and electric vehicles depending on resources. (13)
- Develop the electric propulsion unit and its control for application of electric vehicles.(13)
- Choose proper energy storage systems for vehicle applications. (13)
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.(13)

## Text Books :

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, 2<sup>nd</sup> edition, CRC Press, 2003.
2. [Amir Khajepour](#), [M. Saber Fallah](#), [Avesta Goodarzi](#), “Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach”, illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.

## References:

1. James Larminie, John Lowry, “Electric Vehicle Technology”, Explained, Wiley, 2003.
2. John G. Hayes, [G. Abas Goodarzi](#), “Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles”, 1<sup>st</sup> edition, Wiley-Blackwell, 2018.

(19A03506b) **RAPID PROTOTYPING**  
**OPEN ELECTIVE-I**

**Course Objectives:**

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.
- Train Various Pre – Processing, Processing and Post Processing errors in RP Processes.

**UNIT – I**

**10 Hours**

**Introduction:** Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

**RP Software:** Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain prototyping process. (12)
- Classify different rapid prototyping processes. (12)
- Summarize rp software's and represent a 3d model in stl format, other rp data formats. (12)

**UNIT – II**

**8 Hours**

**Solid and Liquid Based RP Systems:** Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications.

**Fusion Deposition Modeling (FDM):** Principle, Process, Materials, Advantages, Limitations, Applications. **Laminated Object Manufacturing (LOM):** Principle, Process, Materials, Advantages, Limitations, Applications.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the principles, advantages, limitations and applications of Solid and Liquid based AM systems. (L2)
- Identify the materials for Solid and Liquid based AM systems. (L2)

### UNIT – III

8 Hours

**Powder Based RP Systems:** Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.  
**Other RP Systems:** Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Explain the principles, advantages, limitations and applications of powder based AM systems. (L2)
- Understand the principles, advantages, limitations and applications of other Additive Manufacturing Systems such as 3D Printing, Ballistic Particle Manufacturing and Shape Deposition Modeling. (L2)

### UNIT – IV

8 Hours

**Rapid Tooling:** Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

**Reverse Engineering (RE):** Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Classify Rapid Tooling methods. (L2)
- Explain the concepts of reverse engineering and scanning tools. (L2)

### UNIT – V

8 Hours

**Errors in RP Processes:** Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc.

**RP Applications:** Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

#### Learning Outcomes:



At the end of the unit, the student will be able to

- Identify various Pre – Processing, Processing and Post – Processing errors in RP processes. (L2)
- Apply of RP in engineering design analysis and medical applications. (L3)

### **Course Outcomes:**

At the end of the course, the student will be able to

- Use techniques for processing of CAD models for rapid prototyping. (L3)
- Understand and apply fundamentals of rapid prototyping techniques. ((L3)
- Use appropriate tooling for rapid prototyping process. (L3)
- Use rapid prototyping techniques for reverse engineering. (L3)
- Identify Various Pre – Processing, Processing and Post Processing errors in RP processes. (L3)

### **Text Books:**

1. Chua C.K., Leong K.F. and Lim C.S., “Rapid Prototyping: Principles and Applications”, 2<sup>nd</sup> edition, World Scientific Publishers, 2003.
2. Ian Gibson, David W. Rosen, Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, 1<sup>st</sup> Edition, Springer, 2010.
3. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley & Sons, 2006.

### **Reference Books:**

1. Liou W. Liou, Frank W., Liou, “Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development”, CRC Press, 2007.
2. Pham D.T. and Dimov S.S., “Rapid Manufacturing; The Technologies and Application of RPT and Rapid tooling”, Springer, London 2001.
3. Gebhardt A., “Rapid prototyping”, Hanser Gardener Publications, 2003.
4. Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC Press, 2005.

**(19A04506a) ANALOG ELECTRONICS**  
**OPEN ELECTIVE-I**

**Course Objectives:**

- To understand the characteristics of various types of electronic devices and circuits (L1).
- To apply various principles of electronic devices and circuits to solve complex Engineering problems (L2).
- To analyze the functions of various types of electronic devices and circuits (L3).
- To evaluate the functions of various types of electronic devices and circuits in real time applications (L3).
- To design various types of electronic circuits for use in real time applications (L4).

**UNIT-I:**

**Diodes and Applications**

Properties of intrinsic and extrinsic semiconductor materials. Characteristics of PN junction diode and Zener diode. Applications of PN diode as a switch, rectifier and Zener diode as regulator. Special purpose diodes: Schottky diode, Tunnel diode, Varactor diode, photodiode and LED.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the characteristics of various types of diodes (L1).
- Apply the principles of diodes to solve complex Engineering problems (L2).
- Analyze the functions of diodes in forward and reverse bias conditions (L3).
- Evaluate the functions of diodes in real time applications (L3).
- Design rectifiers and switches using diodes (L4).

**UNIT-II:**

**BJT and its Applications**

Construction, Operation, and Characteristics in CE, CB and CC configurations. Fixed-Bias and Voltage Divider-Bias. Applications as switch and amplifier.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the characteristics and biasing of BJT (L1).
- Apply the principles of BJT to solve complex Engineering problems (L2).
- Analyse the functions of BJT in various configurations (L3).
- Evaluate the functions of BJT in real time applications (L3).
- Design amplifiers and switches using BJT (L4).

### **UNIT-III:**

#### **FETs and Applications**

**JFETs:**Construction, Operation, and Characteristics in CS configurations. Fixed-Bias and Voltage Divider -Bias. Applications as switch and amplifier.

**MOSFETs:**Construction, Operation, and Characteristics of Enhancement and Depletion modes in CS configurations. Biasing in Enhancement and Depletion modes. Applications as switch.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the characteristics and biasing of FETs (L1).
- Apply the principles of FETs to solve complex Engineering problems (L2).
- Analyze the functions of FETs in CS configuration (L3).
- Evaluate the functions of FETs in real time applications (L3).
- Design amplifiers and switches using FETs (L4).

### **UNIT-IV:**

#### **Feedback Amplifiers and Oscillators**

**Feedback Amplifiers:** Concept of feedback, General characteristics of negative feedback amplifiers, Voltage-series, Current-series, Voltage-shunt, and Current-shunt feedback amplifiers.

**Oscillators:**Conditions for oscillations, Hartley and Colpitts oscillators, RC phase-shift and Wien-bridge oscillators.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of negative & positive feedback and characteristics feedback amplifiers (L1).
- Apply the principles of feedback amplifiers and oscillators to solve complex Engineering problems (L2).
- Analyze the functions of feedback amplifiers and oscillators (L3).
- Evaluate the functions of feedback amplifiers and oscillators in real time applications (L3).
- Design feedback amplifiers and oscillators for specific applications (L4).

## **UNIT-V:**

### **Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits**

**Wave-Shaping & Multivibrator Circuits:** Introduction, Waveform Shaping Circuits –RC and RL Circuits. Clippers, Comparator and Clampers. Bistable, Schmitt Trigger, Monostable and Astable Multivibrators.

**Linear Integrated Circuits:** Operational Amplifier: Introduction, Block diagram, Basic applications – Inverting, Non-inverting, Summing amplifier, Subtractor, Voltage Follower. IC 555 Timer and IC 7805 Regulator.

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the operation of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits (L1).
- Apply the principles of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits to complex Engineering solve problems (L2).
- Analyse the functions of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits (L3).
- Evaluate the functions of Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits in real time applications (L3).
- Design Wave-Shaping & Multivibrator Circuits and Linear Integrated Circuits for specific applications (L4).

Note: In all the units, only qualitative treatment is required.

### **Course Outcomes:**

At the end of the course, the student should be able to

- Understand the characteristics of various types of electronic devices and circuits
- Apply various principles of electronic devices and circuits to solve complex Engineering problems
- Analyse the functions of various types of electronic devices and circuits, Evaluate the functions of various types of electronic devices and circuits in real time applications
- Design various types of electronic circuits for use in real time applications.

**TEXT BOOKS:**

1. S. Salivahanan and N. Suresh Kumar, “Electronic Devices and Circuits”, 4<sup>th</sup> Edition, McGraw Hill Education (India) Pvt Ltd., 2017.

**REFERENCES:**

1. J. Milliman, Christos C Halkias, and Satyabrata Jit, “Electronics Devices and Circuits”, 4<sup>th</sup> Edition, McGraw Hill Education (India) Pvt Ltd., 2015.
  2. David A. Bell “Electronics Devices and Circuits”, 5<sup>th</sup> Edition, Oxford University Press, 2008.
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**Blooms’ learning levels:**

L1: Remembering and Understanding

L2: Applying

L3: Analyzing/Derive

L4: Evaluating/Design

L5: Creating

(19A04506b) DIGITAL ELECTRONICS

OPEN ELECTIVE-I

**Course Objectives:**

- To introduce different methods for simplifying Boolean expressions
- To analyze logic processes and implement logical operations using combinational logic circuits
- To understand characteristics of memory and their classification.
- To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines
- To understand concept of Programmable Devices

**UNIT- I**

Minimization Techniques and Logic Gates Minimization Techniques: Boolean postulates and laws – De-Morgan’s Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don’t care conditions – Quine - McCluskey method of minimization. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND– NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates.

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Learn Boolean algebra and logical operations in Boolean algebra. (L1)
- Apply different logic gates to functions and simplify them. (L2)
- Analyze the redundant terms and minimize the expression using Kmaps and tabulation methods (L3)

**UNIT- II**

Combinational Circuits -Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Apply the logic gates and design of combinational circuits(L2)
- Design of different combinational logic circuits(L4)

### **UNIT -III**

Sequential Circuits-Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps-Circuit implementation - Modulo-n counter, Registers – shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Understand the clock dependent circuits (L1)
- Identify the differences between clocked and clock less circuits, apply clock dependent circuits(L2)
- Design clock dependent circuits(L4)

### **UNIT -IV**

Memory Devices Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

#### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Understand the principle of operation of basic memory devices, and programmable logic devices. (L1)
- Implement combinational logic circuits using memory and programmable logic devices (L2)

### **UNIT -V**

Synchronous and Asynchronous Sequential Circuits Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits.

## **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Understand how synchronous and asynchronous sequential circuit works (L1)
- Understand the FSM and its design principles. (L1)
- Analyze the procedure to reduce the internal states in sequential circuits (L3)
- Illustrate minimization of complete and incomplete state machines and to write a minimal cover table(L2)

## **Course Outcomes:**

- Explain switching algebra theorems and apply them for logic functions, discuss about digital logic gates and their properties, Identify the importance of SOP and POS canonical forms in the minimization of digital circuits.
- Evaluate functions using various types of minimizing algorithms like Boolean algebra, Karnaugh map or tabulation method.
- Analyze the design procedures of Combinational & sequential logic circuits.
- Design of different combinational logic circuits, and compare different semiconductor memories.

## **Text Books:**

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Zvi Kohavi, "Switching and Finite Automata Theory", 3<sup>rd</sup> Edition, South Asian Edition, 2010,

## **References:**

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
5. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
6. Donald D.Givone, "Digital Principles and Design", TMH, 2003.



**(19A05506a) FREE AND OPEN SOURCES SYSTEMS**

**(Open Elective –I)**  
**(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Understand the context and operation of free and open source software (FOSS) communities and associated software projects.
- Motivate the students to contribute in FOSS projects
- Familiarize with programming languages like Python, Perl, Ruby
- Elucidate the important FOSS tools and techniques

**UNIT I PHILOSOPHY**

Notion of Community--Guidelines for effectively working with FOSS community--, Benefits of Community based Software Development --Requirements for being open, free software, open source software –Four degrees of freedom - FOSS Licensing Models - FOSS Licenses – GPL- AGPL-LGPL - FDL - Implications – FOSS examples.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Analyze the benefits of Community based Software Development. (L4)
- Explain the degrees of Freedom. (L2)

**UNIT II LINUX**

Linux Installation and Hardware Configuration – Boot Process-The Linux Loader (LILO) - The Grand Unified Bootloader (GRUB) - Dual-Booting Linux and other Operating System - Boot-Time Kernel Options- X Windows System Configuration-System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Demonstrate Linux Installation and hardware configuration. (L2)
- Compare Linux and Windows System Configurations. (L4)

**UNIT III PROGRAMMING LANGUAGES**

Programming using languages like Python, Perl, Ruby

**Learning outcomes:**

At the end of the unit, students will be able to:

- Explain the syntax of programming Languages Python, Perl and Ruby. (L2)
- Develop applications in the Open source programming Languages. (L6)

#### **UNIT IV PROGRAMMING TOOLS AND TECHNIQUES**

Usage of design Tools like Argo UML or equivalent, Version Control Systems like Git or equivalent, – Bug Tracking Systems- Package Management Systems

##### **Learning outcomes:**

At the end of the unit, students will be able to:

- List various programming tools and explain their uses (L1)
- Make use of the various tools while building applications (L3)

#### **UNIT V FOSS CASE STUDIES**

Open Source Software Development - Case Study – Libre office -Samba

##### **Learning outcomes:**

At the end of the unit, students will be able to:

- Elaborate the open Source Software Development(L6)
- Compare Libre office with its proprietary equivalent (L5)

##### **Course Outcomes:**

Upon completion of the course, the students should be able to:

- Demonstrate Installation and running of open-source operating systems.(L2)
- Justify the importance of Free and Open Source Software projects. (L5)
- Build and adapt one or more Free and Open Source Software packages. (L6)
- Utilize a version control system. (L3)
- Develop software to and interact with Free and Open Source Software development projects.(L3)

##### **TEXT BOOK:**

Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, OReilly Media, 2009.

##### **REFERENCES:**

1. Philosophy of GNU URL: <http://www.gnu.org/philosophy/>.
2. Linux Administration URL: <http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/>.
3. The Python Tutorial available at <http://docs.python.org/2/tutorial/>.
4. Perl Programming book at <http://www.perl.org/books/beginning-perl/>.
5. Ruby programming book at <http://ruby-doc.com/docs/ProgrammingRuby/>.

6. Version control system URL: <http://git-scm.com/>.
7. Samba: URL : <http://www.samba.org/>.
8. Libre office: <http://www.libreoffice.org/>.

**(19A05506b) COMPUTER GRAPHICS and MULTIMEDIA ANIMATION**  
**(Open Elective –I)**  
**(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Introduce the use of the components of a graphics system and become familiar with the building approach of graphics system components and related algorithms.
- Understand the basic principles of 3- 3-dimensional computer graphics.
- Provide insites on how to scan, convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
- Provide an understanding of mapping from world coordinates to device coordinates, clipping, and projections.
- Discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

**UNIT I OVERVIEW OF COMPUTER GRAPHICS SYSTEM**

OverView of Computer Graphics System – Video display devices – Raster Scan and random scan system – Input devices – Hard copy devices.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Explain the overview of computer graphics with visualization. (L2)
- Classify the Input devices. (L2)
- Distinguish raster scan and random scan systems. (L4)

**UNIT II OUTPUT PRIMITIVES AND ATTRIBUTES**

Drawing line, circle and ellipse generating algorithms – Scan line algorithm – Character Generation – attributes of lines, curves and characters – Antialiasing.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Analyse output primitives and attributes. (L4)
- Design algorithms based on output. (L6)

**UNIT III TWO DIMENSIONAL GRAPHICS TRANSFORMATIONS AND VIEWING:**

Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines and clipping of polygons.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Create two-dimensional graphics. (L6)
- Examine the clipping of polygon. (L4)
- Compare different forms of variations. (L2)

**UNIT IV THREE DIMENSIONAL GRAPHICS AND VIEWING**

Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces, Splines, Bezier curves and surfaces – Geometric and Modelling transformations – Viewing - Parallel and perspective projections.

**Learning outcomes:**

At the end of the unit, students will be able to:

- Create three-dimensional graphics. (L6)
- Explain the Quadric surfaces and polygon table. (L2)
- Define modelling transformations. (L1)

**UNIT V REMOVAL OF HIDDEN SURFACES**

Visible Surface Detection Methods – Computer Animation.

**Learning outcomes:**

At the end of the unit, students will be able to:

- List the different types of detection methods. (L1)
- Compare various computer animations. (L2)

**Course outcomes:**

Upon completion of the course, the students should be able to:

- Explain the basic concepts used in computer graphics. (L2)
- Inspect various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping. (L4)
- Assess the importance of viewing and projections. (L5)
- Define the fundamentals of animation, virtual reality and its related technologies. (L3)
- Analyze the typical graphics pipeline (L4)

**TEXTBOOK**

1. Hearn, D. and Pauline Baker, M., Computer Graphics (C-Version), 2nd Edition, Pearson Education, 2002.

## **REFERENCES**

1. Neuman, W.M., and Sproull, R.F., Principles of Interactive Computer Graphics, Mc Graw Hill Book Co., 1979.
2. Roger, D.F., Procedural elements for Computer Graphics, Mc Graw Hill Book Co., 1985.
3. Asthana, R.G.S and Sinha, N.K., Computer Graphics, New Age Int. Pub. (P) Ltd., 1996.
4. Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Computer Graphics, Pearson Education, 2001.

**(19A27506a) BREWING TECHNOLOGY**  
**OPEN ELECTIVE - I**

**PREAMBLE**

This course covers the origin of brewing and ingredients used, methods and equipment used and innovations in this field.

**Course Objectives**

- To understand the Beer manufacturing, ingredients and their roles.
- To understand overall view of a brewing industry

**UNIT – I**

Introduction of brewing, history of brewing; Raw materials: barley, hops, water, yeast; Adjuncts for beer production: Maize, rice, millet, wheat, sugar etc. Malt production, role of enzymes for malting; Barley storage, steeping, germination, kilning, cooling, storage;

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Introduction of brewing, history of brewing
- Raw materials like barley, hops, water, yeast
- Adjuncts for beer production: Maize, rice, millet, wheat, sugar etc
- Malt production, role of enzymes for malting
- Barley storage, steeping, germination, kilning, cooling, storage

**UNIT – II**

Malt from other cereals, caramel malt, roasted malt, smoked malt, malt extract; Malt quality evaluation, Wort production, malt milling, Mashing, Mashing vessels; Wort boiling, clarification, cooling and aeration Enzyme properties, starch degradation, b-glucan degradation; Conversion of fatty matter, Biological acidification

**Learning Outcomes:**

At the end of the unit, the student should be able to:

- Malt from other cereals, caramel malt, roasted malt, smoked malt, malt extract

- Malt quality evaluation, Wort production, malt milling, Mashing, Mashing vessels
- Wort boiling, clarification, cooling and aeration Enzyme properties, starch degradation, b-glucon degradation
- Conversion of fatty matter, Biological acidification

### **UNIT – III**

Beer production methods, fermentation technology, changes during fermentation; Filtration procedure and equipment, beer stabilization conditions and durations, beer carbonation process; Packaging equipment and packaging materials, storage conditions and distribution process

#### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Beer production methods, fermentation technology, changes during fermentation
- Filtration procedure and equipment, beer stabilization conditions and durations, beer carbonation process
- Packaging equipment and packaging materials, storage conditions and distribution process

### **UNIT – IV**

Brewing Equipment. Grain mill, kettles, siphons, carboys, fermentation equipment, wort chillers, pumps beer bottles, cans, labels, bottle caps, sanitation equipments Preventive Production of beer against technology, ling phenomenon of beer, possible measures against staling reactions, oxidation

#### **Learning Outcomes:**

At the end of the unit, the student should be able to:

- Brewing Equipments like Grain mill, kettles, siphons, carboys, fermentation equipment, wort chillers
- pumps beer bottles, cans, labels, bottle caps, sanitation equipments
- Preventive Production of beer against technology, ling phenomenon of beer, possible measures against staling reactions, oxidation

### **UNIT – V**

Recent advances: Immobilized Cell Technology in Beer Production, immobilized yeast cell technology Energy management in the brewery and maltings; waste water treatment Automation and plant planning

#### **Learning Outcomes:**



At the end of the unit, the student should be able to:

- Immobilized Cell Technology in Beer Production, immobilized yeast cell technology
- Energy management in the brewery and maltings
- waste water treatment Automation and plant planning

### **Course Outcomes:**

By the end of this course, students will attain the:

- Knowledge of beer making, chemistry of ingredients used for brewing,
- Knowledge on brewing industry, Unit operations and equipments involved.

### **TEXT BOOKS**

1. Brewing: "Science and Practice, Brookes and Roger Stevens", Dennis E. Briggs, Chris A. Boulton, Peter A. 2004, Woodhead publishing limited.
2. Die Deutsche "Bibliothek Technology: "Brewing and Malting", Wolfgang Kunze. 2010, Bibliographic information published

### **REFERENCES**

1. "Handbook of Brewing": Process, Technology, Markets, Hans Michael Eblinger. 2009, Wiley-VCH Verlag GmbH & Co.
2. Brewing: "New Technologies", Charles W. Bamforth. 2006, Woodhead Pub.

**(19A27506b) COMPUTER APPLICATIONS IN FOOD INDUSTRY  
(OPEN ELECTIVE – I)**

**PREAMBLE**

This course covers all facets of computerization and various software's used and their usage.

**Course Objectives**

- Able to know about “The necessity of Software & their applications in Food Industries”
- Able to Implement the Programs in ‘C’ to perform various operations that are related to Food Industries.

**UNIT – I**

Computerization, Importance of Computerization in food industry and IT applications in food industries. Computer operating environments and information system for various types of food industries. Introduction to Bar charts and Pie charts & the procedure to develop bar charts and pie charts on given Data.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Computerization, Importance of Computerization in food industry and IT applications in food industries.
- Computer operating environments and information system for various types of food industries.
- Introduction to Barcharts and Piecharts & the procedure to develop barcharts and piecharts on given Data.

**UNIT – II**

Introduction to Software & Programming Languages, Properties, Differences of an Algorithm and Flowcharts, Advantages and disadvantages of Flowcharts & Algorithms. Introduction, Fundamentals & advantages of ‘C’. Steps in learning ‘C’ (Character set, Identifiers, Keywords) Steps in learning ‘C’ (Data types, Constants, Variables, Escape sequences).

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Introduction to Software & Programming Languages, Properties, Differences of an Algorithm and Flowcharts
- Advantages and disadvantages of Flowcharts & Algorithms. Introduction, Fundamentals & advantages of 'C'.
- Steps in learning 'C' (Character set, Identifiers, Keywords)
- Steps in learning 'C' (Data types, Constants, Variables, Escape sequences).

### **UNIT – III**

Steps in learning 'C' (Operators, Statements) Steps in learning 'C' (Header Files, Input & Output functions: Formatted I/O functions, Unformatted I/O functions). Basic Structure of a simple 'C' program. Decision Making/Control Statements. Branching, Concept of Looping & Looping statements.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Steps in learning 'C' (Operators, Statements)
- Steps in learning 'C' (Header Files, Input & Output functions: Formatted I/O functions, Unformatted I/O functions).
- Basic Structure of a simple 'C' program. Decision Making/Control Statements.
- Branching, Concept of Looping & Looping statements.

### **UNIT – IV**

Concept of Functions (Defining a function & Function Prototypes, Types of functions: Library functions & User defined functions. Concept of various types of User Defined Functions (i.e., About 4 types). Concept of Arrays & Types of Arrays (Single, Double and Multi-Dimensional Arrays). Concept of a String Library Functions.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Concept of Functions (Defining a function & Function Prototypes, Types of functions: Library functions & User defined functions.
- Concept of various types of User Defined Functions (i.e., About 4 types).
- Concept of Arrays & Types of Arrays (Single, Double and Multi-Dimensional Arrays).
- Concept of a String Library Functions.

### **UNIT – V**

Concept of Pointers, Structures & Unions. Introduction to Data Structures, Types of Data Structures (Primary & Secondary Data Structures) Concept of Linked Lists, Types of Linked Lists & Basic operations on linked Lists. Concept of Stacks & Operations on Stacks (PUSH

&POP Operations) Concept of Queues and types of Queues Operations on a Queue (ENQUEUE & DEQUEUE Operations)

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Concept of Pointers, Structures & Unions. Introduction to Data Structures, Types of Data Structures (Primary & Secondary Data Structures)
- Concept of Linked Lists, Types of Linked Lists & Basic operations on linked Lists.
- Concept of Stacks & Operations on Stacks (PUSH & POP Operations)
- Concept of Queues and types of Queues Operations on a Queue (ENQUEUE & Dequeue Operations)

### **Course Outcomes**

By the end of the course, the students will be able to

- know about the various steps which are related to computer and Software and their application in Food Industries
- know about the various steps which are necessary to implement the programs in 'C'

### **TEXT BOOKS**

1. Yeswanth Kanethkar, Let us 'C'
2. Balaguruswamy E., "Computer Programming in 'C'"
3. Mark Allen Wise , "Data Structures"

### **REFERENCES**

1. M. S Excel 2000, Microsoft Corporation
2. M. S. Office – Microsoft Corporation
3. Verton M.V. "Computer concepts for Agri Business", AVI Pub. Corp., West Port, USA.

(19A54506a) OPTIMIZATION TECHNIQUES  
(OPEN ELECTIVE-I)

**Course Objectives:**

The student will be able to learn:

- The basic concepts of Optimization
- The emphasis of this course is on different classical Optimization techniques linear programming and simplex algorithms.
- About optimality of balanced transportation Problems
- About Constrained and unconstrained nonlinear programming.
- About principle of optimality and dynamic programming

**UNIT – I Introduction and Classical Optimization Techniques:**

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions – Numerical examples.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know how to formulate statement of optimization problem with or without constraints
- To know about classification of single and multivariable optimization problems
- To know about necessary and sufficient conditions in defining the optimization problems
- To understand how to formulate Kuhn-Tucker conditions and to solve numerical problems

**UNIT – II Linear Programming**

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm – Numerical examples.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know about formulation of LPP
- To know about formulations of GPP
- To understand various theorems in solving simultaneous equations
- To understand about necessity of Simplex method and to solve numerical problems

### **UNIT – III Nonlinear Programming – One Dimensional Minimization methods**

Introduction, Unimodal function, Elimination methods- Unrestricted Search, Exhaustive Search, Dichotomous Search, Fibonacci Method, Golden Section Method and their comparison; Interpolation methods - Quadratic Interpolation Method, Cubic Interpolation Method and Direct Root Methods – Numerical examples.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know about NLP in one dimensional optimization problems
- To understand about various search methods
- To learn about various interpolation methods
- To distinguish and compare the various elimination methods with numerical examples

### **UNIT – IV Unconstrained & Constrained Nonlinear Programming**

**Unconstrained Optimization Techniques:** Introduction- Classification of Unconstrained Minimization Methods, General Approach, Rate of Convergence, Scaling of Design Variables; Direct Search methods- Random Search Methods, Grid Search Method, Pattern Directions, Powell's Method and Simplex Method

**Constrained Optimization Techniques:** Introduction, Characteristics of a Constrained Problem, Direct Search Methods - Random Search Methods, Basic Approach in the Methods of Feasible Directions, Rosen's Gradient Projection Method, Generalized Reduced Gradient Method and Sequential Quadratic Programming.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To distinguish between unconstrained and constrained optimization problems
- To learn about direct search methods in unconstrained NLP problems and comparison
- To understand about direct search methods in constrained NLP problems and comparison
- To do exercises for solving numerical examples of various methods

### **UNIT – V Dynamic Programming**

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution – Numerical examples.

## **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- To know what is DP problem?
- To know about computational procedure in solving DPP
- To know Calculus and Tabular methods of solving with numerical examples of various methods

## **Course Outcomes:**

The student gets thorough knowledge on:

- Basic methods, principles in optimization
- Formulation of optimization models, solution methods in optimization
- Finding initial basic feasible solutions.
- Methods of linear and non-linear (constrained and unconstrained) programming.
- Applications to engineering problems.

## **TEXT BOOKS:**

1. S. S. Rao, "Engineering optimization": Theory and practice 3rd edition, New Age International (P) Limited, 1998.
2. H.S. Kasana & K.D. Kumar, "Introductory Operations Research Springer (India)", 2004.

## **REFERENCES:**

1. R Fletcher, "Practical Methods of Optimization" , 2<sup>nd</sup> Edition, Wiley Publishers, 2000.
2. Jorge Nocedal and Wright S, "Numerical Optimization Springer", 1<sup>st</sup> Edition, 1999.
3. by K.V. Mital and C. Mohan, "Optimization Methods in Operations Research and systems Analysis" 3<sup>rd</sup> Edition, New Age International (P) Limited, 1996.
4. by S.D. Sharma, "Operations Research", Kedar Nath, 2012.
5. by H.A. Taha, "Operations Research", 9<sup>th</sup> Edition, An Introduction Pearson, 2010.
6. G. Hadley, "Linear Programming", Narosa, 2002.

**(19A52506a) TECHNICAL COMMUNICATION AND PRESENTATION SKILLS**  
**(OPEN ELECTIVE)**

**Course Objectives:**

- To develop awareness in students of the relevance and importance of technical communication and presentation skills.
- To prepare the students for placements
- To sensitize the students to the appropriate use of non-verbal communication
- To train students to use language appropriately for presentations and interviews
- To enhance the documentation skills of the students with emphasis on formal and informal writing

**SYLLABUS**

**UNIT -1:**

**Basics of Technical Communication** – Introduction – Objectives & Characteristics of Technical Communication – Importance and need for Technical communication - LSRW Skills – Barriers to effective communication

**Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of LSRW skills
- Identify and overcome the barriers to effective communication
- Realize the need and importance of technical communication

**UNIT -II**

**Informal and Formal Conversation** - Verbal and Non-verbal communication –Kinesics, Proxemics, Chronemics, Haptics, Paralanguage

**Learning Outcomes:**

At the end of the module, the learners will be able to

- State the difference between formal and informal conversation.
- Apply the knowledge of the difference between the verbal and non-verbal communication
- Evaluate the different aspects of non-verbal communication.



### **UNIT -III**

**Written communication** – Differences between spoken and written communication – Features of effective writing –Advantages and disadvantages of spoken and written communication- Art of condensation- summarizing and paraphrasing

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Know the difference between written and spoken communication
- Apply the awareness of features of effective writing.
- Implement the understanding of summarizing and paraphrasing.

### **UNIT -IV**

**Presentation Skills** – Nature and importance of oral presentation – Defining the purpose – Analyzing the audience - Planning and preparing the presentation, organizing and rehearsing the presentation –Individual and group presentations - Handling stage fright

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- State the importance of presentation skills in corporate climate.
- Analyze the demography of the audience.
- Plan, prepare and present individual and group presentations.

### **UNIT -V**

**Interview Skills** – The Interview process –Characteristics of the job interview – Pre-interview preparation techniques – Projecting the positive image – Answering Strategies

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Identify the characteristics of the job interview.
- Understand the process of Interviews.
- Develop a positive image using strategies in answering FAQs in interviews

#### **Course Outcomes**

- Understand the importance of effective technical communication
- Apply the knowledge of basic skills to become good orators
- Analyze non-verbal language suitable to different situations in professional life
- Evaluate different kinds of methods used for effective presentations

- Create trust among people and develop employability skills

**TEXT BOOKS:**

1. Ashrif Rizvi, “Effective Technical Communication”, TataMcGrahill, 2011
2. Meenakshi Raman &Sangeeta Sharma, “Technical Communication”, 3<sup>rd</sup> Edition, O U Press 2015

**REFERENCES:**

1. Pushpalatha & Sanjay Kumar, “Communication Skills”, Oxford Univsesity Press
2. Barron’s/Books on TOEFL/GRE/GMAT/CAT/IELTS DELTA/Cambridge University Press.2012.
3. Butterfield Jeff, “Soft Skills for Everyone”, Cengage Publications, 2011.
4. Universities Press (India) Pvt Ltd., “Management Shapers Series”,Himayatnagar, Hyderabad 2008.
5. John Hughes & Andrew Mallett, “Successful Presentations”Oxford.
6. Edgar Thorpe and Showick Thorpe, “Winning at Interviews”Pearson
7. Munish Bhargava, “Winning Resumes and Successful Interviews”, McGraw Hill

**(19A51506a) CHEMISTRY OF ENERGY MATERIALS**

**Course Objectives:**

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
- Necessity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

**UNIT-1: Electrochemical Systems:** Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batteries.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Solve the problems based on electrode potential (L3)
- Describe the Galvanic Cell (L2)
- Differentiate between Lead acid and Lithium ion batteries (L2)
- Illustrate the electrical double layer (L2)

**UNIT-2: Fuel Cells:** Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell,.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Describe the working Principle of Fuel cell (L2)
- Explain the efficiency of the fuel cell (L2)
- Discuss about the Basic design of fuel cells (L3)

- Classify the fuel cell (L2)

**UNIT-3: Hydrogen Storage:** Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogel storage by high pressure methods. Liquifaction method.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Differentiate Chemical and Physical methods of hydrogen storage (L2)
- Discuss the metal organic frame work (L3)
- Illustrate the carbon and metal oxide porous structures (L2)
- Describe the liquification methods (L2)

**UNIT-4:Solar Energy:** Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Apply the photo voltaic technology (L3)
- Demonstrate about solar energy and prospects (L2)
- Illustrate the Solar cells (L2)
- Discuss about concentrated solar power (L3)

**UNIT-5:** Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Differentiate between Photo and Photo electrochemical Conversions (L2)
- Illustrate the photochemical cells (L2)
- Identify the applications of photochemical reactions (L3)
- Interpret advantages of photoelectron catalytic conversion (L2)

**Course Outcome:**

- Ability to perform simultaneous material and energy balances.
- Student learn about various electrochemical and energy systems
- Knowledge of solid, liquid and gaseous fuels
- To know the energy demand of world, nation and available resources to fulfill the demand
- To know about the conventional energy resources and their effective utilization
- To acquire the knowledge of modern energy conversion technologies
- To be able to understand and perform the various characterization techniques of fuels
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively

**References :**

1. Physical chemistry **by** Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins
4. Fuel Cell Hand Book 7<sup>th</sup> Edition, by US Department of Energy (EG&G technical services and corporation)
5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff

**(19A02501P)AC MACHINES LAB**

**Course outcomes:**

By the end of the course, the student will be able to:

- Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods.
- Predetermine the regulation of Alternator by Zero Power Factor method  
 $X_d$  and  $X_q$  determination of salient pole synchronous machine.
- Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

**From the following list all the ten experiments are required to be conducted as compulsory experiments:**

1. No-load & Blocked-rotor tests on Squirrel cage Induction motor.
2. Load test on three phase slip ring Induction motor.
3. Speed control of three phase induction motor
4. Rotor resistance starter for slip ring induction motor
5. Load test on single phase induction motor.
6. Determination of Equivalent circuit of a single phase induction motor.
7. Predetermination of Regulation of a three phase alternator by synchronous impedance & m.m.f methods.
8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.
9. Determination of  $X_d$  and  $X_q$  of a salient pole synchronous machine.
10. V and inverted V curves of a 3-phase synchronous motor.

**Reference Book:**

1. D. P.Kothari and B. S. Umre, “Laboratory Manual for Electrical Machines”I.K International Publishing House Pvt. Ltd, 2017.
2. D.R. Kohli and S.K. Jain, “A Laboratory Course in Electrical Machines” NEM Chand & Bros.

19A52601P ENGLISH LANGUAGE SKILLS LAB

**Course Objectives**

- students will be exposed to a variety of self instructional, learner friendly modes of language learning
- students will cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL, and GMAT etc.
- students will learn better pronunciation through stress, intonation and rhythm
- students will be trained to use language effectively to face interviews, group discussions, public speaking
- students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

**UNIT-I**

1. Phonetics for listening comprehension of various accents - 2
2. Formal Presentations using PPT slides without Graphic Elements
3. Paraphrasing

**Learning Outcomes**

At the end of the module, the learners will be able to

- Understand different accents spoken by native speakers of English
- Make formal structured presentations on general topics using PPT slides without graphical elements
- Paraphrase short academic texts using suitable strategies and conventions

**UNIT-II**

1. Debate – 2 (Following Argument)
2. Listening to short speeches/ short stories for note-making and summarizing
3. E-mail Writing

**Learning Outcomes**

At the end of the module, the learners will be able to

- Participate in formal discussions and speak clearly on a specific topic using suitable discourse markers
- Make formal structured presentations on academic topics using ppt slides with relevant graphical elements
- Write formal emails in the standard format

### **UNIT-III**

1. Listening for Discussions
2. Group Discussions
3. Writing Persuasive/argumentative essays on general topics

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- Follow a discussion to identify the salient points
- Participate in group discussions using appropriate conventions and language strategies
- Produce logically coherent persuasive/argumentative essays

### **UNIT-IV**

1. Reviewing film/ book
2. Group Discussions – reaching consensus in Group Work
3. Resume Writing – Cover Letter – Applying for Internship

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- Judge a film or book
- Express thoughts and ideas with acceptable accuracy and fluency with a view to reach consensus in group discussions
- Prepare a CV and write a cover letter to seek internship/ job

### **UNIT-V**

1. Writing Project Reports
2. Editing Short Texts
3. Answering FAQs in Interviews

#### **Learning Outcomes**

At the end of the module, the learners will be able to

- Collaborate with a partner to make effective presentations
- Understand the structure and produce an effective project report.
- Edit short texts according to different needs of the work place.

#### **Course Outcomes**

- Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
- Apply communication skills through various language learning activities



- Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

### **SUGGESTED SOFTWARE:**

1. Walden Infotech English Language Communication Skills.
2. iTell- Orell Digital Language Lab
3. Digital Teacher
4. LES(Learn English Select) by British council
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
6. DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.
7. Lingua TOEFL CBT Insider, by Dreamtech
8. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
9. Cambridge Advanced Learners' English Dictionary with CD.

### **REFERENCE BOOKS:**

The software consisting of the prescribed topics elaborated above should be procured and used.

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communication" O U Press 2009.
2. Barron's Books on TOEFL/GRE/GMAT/CAT/IELTS /DELTA/Cambridge University Press.2012.
3. Butterfield Jeff, "Soft Skills for Everyone", Cengage Publications, 2011.
4. "Practice Psychometric Tests": How to familiarize yourself with genuine recruitment tests, 2012.
5. David A McMurrey & Joanne Buckely "Handbook for Technical Writing" CENGAGE Learning 2008.
6. "A Textbook of English Phonetics for Indian Students", 2<sup>nd</sup> Edition, T.Balasubramanyam. (Macmillan), 2012.
7. "A Handbook for English Laboratories", E. Suresh Kumar, P. Sreehari, Foundation Books, 2011

Note: Links provided by APSHE on LSRW, grammar and vocabulary

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)–III-I Sem** **L T P C**  
**0 0 2 1**  
**(19A02506) POWER ELECTRONICS AND SIMULATION LAB**

**Course Objectives:**

By the end of the course the student will be able to:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.
- Create and analyze various power electronic converters using PSPICE software.

**Any Eight of the Experiments in Power Electronics Lab**

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads
9. Single Phase Half controlled converter with R load
10. Three Phase half controlled bridge converter with R-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads

**Any two simulation experiments with PSPICE/PSIM**

14. PSPICE simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
15. PSPICE simulation of resonant pulse commutation circuit and Buck converters and chopper.
16. PSPICE simulation of single phase Inverter with PWM control.

**REFERENCE BOOKS:**

1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007.
2. M.H.Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications.

3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA.
5. MATLAB and its Tool Books user's manual and – Mathworks, USA.

**Socially Relevant Projects**

1. Energy Auditing
2. Solar Water Pumping Systems
3. Automatic Traffic Light Control Systems
4. Building Electrical Safety Measures
5. Electrical Protection Systems in Agricultural Fields

**Course Objectives :**

The objective of this course is

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues in research

**Syllabus**

**UNIT I**

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of research and its process
- Explain various types of research
- Know the steps involved in research design
- Understand the different research approaches

**UNIT II**

Sampling Design – steps in Sampling Design – Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of sampling and sampling design

- Explain various techniques in measurement and scaling
- Learn various methods of data collection
- Design survey questionnaires for different kinds of research
- Analyze the questionnaires

### **UNIT III**

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

#### **Learning Outcomes:-**

After completion of this unit student will

- Know the association of two variables
- Understand the importance of correlation and regression
- Compare and contrast correlation and regression
- Learn various types of correlation
- Apply the knowledge of C&R Analysis to get the results

### **UNIT IV**

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

#### **Learning Outcomes:-**

After completion of this unit student will

- Know the statistical inference
- Understand the hypothesis testing procedure
- Compare and contrast Parametric and Non-parametric Tests
- Understand the use of chi-square test in investigating the distribution of categorical variables
- Analyze the significance of variance and covariance

### **UNIT V**

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

#### **Learning Outcomes:-**

After completion of this unit student will

- Learn about report writing

- Understand how to write research paper
- Explain various techniques of interpretation
- Understand the importance of professional ethics in research
- Design a scientific paper to present in the conferences/seminars

### **Course Outcomes:**

At the end of the course, students will be able to

- Understand basic concepts and its methodologies
- Demonstrate the knowledge of research processes
- Read, comprehend and explain research articles in their academic discipline
- Analyze various types of testing tools used in research
- Design a research paper without any ethical issues

### **Text books:**

1. C.R.Kothari, “Research Methodology:Methods and Techniques”,2<sup>nd</sup> edition, New Age International Publishers.
2. A Step by Step Guide for Beginners, “Research Methodology”: Ranjit Kumar, Sage Publications

### **REFERENCES:**

1. P.Narayana Reddy and G.V.R.K.Acharyulu, “Research Methodology and Statistical Tools”, 1<sup>st</sup> Edition, Excel Books,New Delhi.
2. Donald R. “Business Research Methods”, Cooper & Pamela S Schindler, 9<sup>th</sup> edition.
3. S C Gupta, “Fundamentals of Statistics”, 7<sup>th</sup> edition Himalaya Publications

**(19A04301) SIGNALS AND SYSTEMS**

**Course Objectives:**

- To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domains.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To analyze characteristics of linear systems in time and frequency domains.
- To understand Laplace and z-transforms as mathematical tool to analyze continuous and discrete-time signals and systems.

**UNIT- I**

**Signals & Systems:** Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Concepts of Convolution and Correlation of signals, Analogy between vectors and signals-Orthogonality, mean square error, Fourier series: Trigonometric & Exponential, Properties of Fourier series, concept of discrete spectrum, Illustrative Problems.

**Learning Outcomes:-**

After completion of this unit student will

- Understand different types of signals and systems. (L1)
- State principles of vector spaces and concept of Orthogonality. (L2)
- Describe continuous time signal and discrete time signal. (L2)
- Analyze the periodic signals by applying Fourier series. (L3)

**UNIT- II**

**Continuous Time Fourier Transform:** Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Statement and proof of sampling theorem of low pass signals, Illustrative Problems.

**Learning Outcomes:-**

After completion of this unit student will

- Identify system properties based on impulse response and Fourier analysis. (L1)
- Analyze the spectral characteristics of signals. (L3)
- Illustrate signal sampling and its reconstruction. (L2)
- Apply Fourier transform to solve problems. (L2)

**UNIT- III**



**DISCRETE TIME FOURIER TRANSFORM:** Definition, Computation and properties of Discrete Time Fourier transform for different types of signals and systems, Illustrative Problems.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the properties of the discrete-time Fourier transform. (L1)
- Analyse the spectral characteristics of signals using Fourier transform. (L3)
- Evaluate the Fourier transform of Discrete-time signals. (L2)

**UNIT- IV**

**Signal Transmission Through Linear Systems:** Linear system, impulse response, Response of a linear system for different input signals, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between bandwidth and rise time, Energy and Power spectral densities, Illustrative Problems.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the impulse response, transfer characteristics of LTI system and various filters. (L1)
- Analyse filter characteristics and physical realisation of LTI system. (L3)
- Apply the relation between bandwidth and rise time & energy and power spectral densities in various applications. (L2)

**UNIT- V**

**Laplace Transform:** Definition, ROC, Properties, Inverse Laplace transforms, the S-plane and BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions.

**Z-TRANSFORM:** Definition, ROC, Properties, Poles and Zeros in Z-plane, The inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the limitations of Fourier transform and need for Laplace transform and develop. (L1)
- Apply transform techniques to analyse discrete-time signals and systems. (L2)

- Evaluate response of linear systems to known inputs by using Laplace transforms. (L2)
- Analyze the continuous-time and discrete-time signals and systems using Laplace and Z- transforms.(L3)

### **Course Outcomes:**

After completion of the course, student will be able to

- Understand the mathematical description and representation of continuous-time and discrete-time signals and systems. Also understand the concepts of various transform techniques. (L1)
- Apply sampling theorem to convert continuous-time signals to discrete-time signals and reconstruct back, different transform techniques to solve signals and system related problems. (L2)
- Analyze the frequency spectra of various continuous-time and discrete-time signals using different transform methods. (L3)
- Classify the systems based on their properties and determine the response of them. (L4)

### **Text Books:**

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, “Signals and Systems”, PHI, 2<sup>nd</sup> Edition, 2009.
2. Simon Haykin and Van Veen, “Signals & Systems”, Wiley, 2<sup>nd</sup> Edition, 2005.

### **References:**

1. BP Lathi, “Principles of Linear Systems and Signals”, Oxford University Press, 2<sup>nd</sup> Edition, 2015.
2. Matthew N.O. Sadiku and Warsame H. Ali, “Signals and Systems A primer with MATLAB”, CRC Press, 2016.
3. Hwei Hsu, “Schaum's Outline of Signals and Systems”, Fourth Edition, TMH, 2019.

**Course Objectives:**

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understand the Interfacing of 8086 with various advanced communication devices
- Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
- To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
- To understand Xilinx programming and understanding of Spartan FPGA board

**UNIT-I:**

**INTRODUCTION TO MICROPROCESSORS**

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams - CISC and ARM Processors.

**Learning Outcomes:-**

After completion of this unit student will

- To know about 8086 as one of digital compute platforms
- To know about Architecture and functions of 8086
- To understand about instruction set
- To know about pin and timing diagrams
- To know about processors CISC and ARM

**UNIT II:**

**ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE**

Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

## **Learning Outcomes:-**

After completion of this unit student will

- To understand the programming features of assembly language as one of digital compute platforms
- To know about evaluation of expressions, strings
- To understand about interfacing with A/D-D/A converters
- To understand about interrupt structures and various service routines in 8086
- To know about data transfer scheme

## **UNIT III:**

### **8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS**

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

## **Learning Outcomes:-**

After completion of this unit student will

- To understand about 8051 Microcontroller as one of the digital compute platforms
- To know about instruction sets of 8051
- To know about data transfer manipulations
- To understand and write programming using 8051
- To know about a few applications of 8051 like servo motor, stepper motor

## **UNIT IV:**

### **Introduction to the TMS320LF2407 DSP Controller**

Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

## **Learning Outcomes:-**

After completion of this unit student will

- To know about features of DSP controller C2xx as one of the DCPs
- To know about various instruction sets, control registers of C2xx DSP core
- To know about mapping of external devices to the DSP core

- To know about assembly programming using the instruction sets of TMS320LF2407 DSP controller

## **UNIT V:**

### **FPGA**

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.

### **Learning Outcomes:-**

After completion of this unit student will

- To know about FPGA as one of the digital compute platforms
- To know about various types of FPGA
- To know about programmable inter connect points
- To understand about Xilinx-HDL programming
- To know about applications of FPGA with a case study

### **Course Outcomes:**

1. Understand the basic architecture & pin diagram of 8086 microprocessor.
2. Assembly language programming to perform a given task, Interrupt service routines for all interrupt types
3. Microprocessor and Microcontroller designing for various applications.
4. Write Assembly Language Programs for the Digital Signal Processors and use Interrupts for real-time control applications
5. Write Xilinx programming and understanding of Spartan FPGA board

### **TEXT BOOKS**

1. Ramesh S. Gaonkar, “Microprocessor Architecture Programming and Applications with 8085”, Penram Intl. Publishing, 6<sup>th</sup> Edition, 2013
2. Ray A. K., Bhurchandi K. M., “Advanced Microprocessor and Peripherals”, Tata McGraw-Hill Publications, 3<sup>rd</sup> Edition, 2013.

## REFERENCE BOOKS

1. Douglas V Hall, "Microprocessor and Interfacing", 2<sup>nd</sup> Edition, Tata McGraw hill, 1992
2. Nilesh B Bahadure, "Microprocessor", PHI, 2010.
3. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and Applications Pearson International publishing (India).
4. Hamid A. Tolyat, "DSP Based Electro Mechanical Motion Control", CRC press, 2004.
5. Application Notes from the webpage of Texas Instruments.
6. XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998
7. XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999
8. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

**(19A02602) POWER SYSTEM ANALYSIS**

**Course Objectives:**

To make the students learn about:

- The use of per unit values and graph theory concepts, solving a problem using computer.
- Formation of  $Y_{bus}$  and  $Z_{bus}$  of a Power System network, power flow studies by various methods.
- Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
- Analysis of power system for steady state and transient stability and also methods to improve stability.

**UNIT -I**

**p. u. system and  $Y_{bus}$  formation**

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix,  $Y_{Bus}$  formation by Direct and Singular Transformation Methods, Numerical Problems.

**Learning Outcomes:-**

At the end of the unit, the student will be able to

- Understand the concepts of Per-Unit equivalent system
- To know about basic graph theory concepts as applied to power systems
- To compute the Bus Incidence matrix
- To formulate  $Y_{Bus}$  matrix using different methods.

**UNIT -II**

**Formation of  $Z_{bus}$**

Formation of  $Z_{Bus}$ : Partial network, Algorithm for the Modification of  $Z_{Bus}$  Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of  $Z_{Bus}$  for the changes in network ( Problems )

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Analyze the concept of formation of  $Z_{Bus}$
- To develop algorithm for modification of  $Z_{Bus}$ .
- Determine the  $Z_{Bus}$  matrix
- To compute modified  $Z_{Bus}$  for the changes in network.

### UNIT –III

#### Power flow Analysis

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Understand about Load flow Solution for Simple Power Systems.
- To determine the Load flow Solution using Gauss Seidel iterative method
- To determine the Load flow Solution using NR method in polar form
- To determine solution of DLF and FDLF
- To know about comparison of various Load flow solutions

### UNIT – IV

#### Short Circuit Analysis

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory:, Positive, Negative and Zero sequence components: Positive, Negative and Zero sequence Networks. Unsymmetrical Fault Analysis: LG, LL, LLG and LLLG faults with and without fault impedance, Numerical Problems.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Analyze the Calculations of MVA Calculations, Fault levels
- To understand about Sequence Components.
- Calculate the fault current using sequence impedances for unsymmetrical faults
- To determine the fault current for symmetrical faults

### UNIT –V

#### Stability Analysis



Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Learn the stability and types of stability
- Analyze the stability using equal area criterion
- To understand methods to improve stability
- Understand and evaluation of fault clearing angle and time

### **Course Outcomes:**

After completing the course, the student should be able to do the following:

- Remember and understand the concepts of per unit values, Y Bus and Z bus formation, load flow studies, symmetrical and unsymmetrical fault calculations.
- Apply the concepts of good algorithm for the given power system network and obtain the converged load flow solution and experiment some of these methods using modern tools and examine the results.
- Analyse the symmetrical faults and unsymmetrical faults and done the fault calculations, analyse the stability of the system and improve the stability. Demonstrate the use of these techniques through good communication skills.
- Develop accurate algorithms for different networks and determine load flow studies and zero, positive and negative sequence impedances to find fault calculations.
- Design and select efficient Circuit Breakers to improve system stability. Implement them in resolving various day-to-day issues in a Power System.

### **TEXT BOOKS:**

1. G.W.Stagg and A.H.El “Computer Methods in Power System Analysis”, Abiad, McGraw-Hill, 2006.
2. I.J.Nagrath & D.P.Kothari, “Modern Power system Analysis”, 4<sup>th</sup> Edition, Tata McGraw-Hill Publishing Company, 2011.

### **REFERENCE BOOKS:**

1. Grainger and Stevenson, “Power System Analysis”, McGraw Hill, 1994.
2. Hadi Saadat, “Power System Analysis”, McGraw Hill, 1998.
3. B.R.Gupta, “Power System Analysis and Design”, S. Chand & Company, 2005.

**(19A02603a) POWER QUALITY**

**PROFESSIONAL ELECTIVE -II**

**Unit 1 :**

Power quality: An Introduction, Power quality standards and monitoring, Passive Shunt and Series Compensation.

**Unit 2 :**

Active Shunt Compensation: DSTATCOM, Active Series Compensation: DVR.

**Unit 3 :**

Unified Power Quality Compensators, Loads That Cause Power Quality Problems.

**Unit 4 :**

Passive Power Filters, Shunt Active Power Filters, Series Active Power Filters, Hybrid Active Power Filters

**Unit 5:**

AC-DC Converters That Cause Power Quality Problems; Improved Power, Quality Converters: AC-DC Converters; Improved Power Quality Converters; Power quality improvement in electrical system applications

**Books and references:**

1. Bhim Singh, Ambrish Chandra and Kamal Al-Haddad, Power Quality: Problems and Mitigation Techniques, John Wiley & Sons Ltd., U.K, 2015
2. J. Schaefer, "Rectifier Circuits, Theory and Design," John Wiley & Sons, New York, 1965.
3. T.J.E. Miller, Reactive Power Control in Electric Systems, John Wiley Sons, Toronto, 1982.
4. R.M. Mathur, Static Compensators for Reactive Power Control, Contexts Publications, Winnipeg, Canada, 1984.
5. G. Seguier, "Power Electronic Converters-AC/DC Conversion," McGraw-Hill, 1986.
6. IEEE Guide for Specification of High Voltage Direct Current Systems Part I-Steady State Performance, IEEE Std. 1030, 1987
7. ABB Power Systems, "Harmonic Currents, Static VAR Systems," Information NR500-015E, Sept. 1988.

8. Mitsubishi Electric Corporation, "Active Filters: Technical Document, 2100/1100 Series," 1989.
9. D.c. Griffith, "Uninterruptible Power Supplies," Marcel Dekker Inc, New York, 1989.
10. J.W. Clark, "AC Power Conditioners-Design applications," Academic Press, USA 1990.
11. A.H. Kikuchi, "Active Power Filter," Toshiba GTR Module (IGBT) Application Notes, 1992.
12. IEEE Guide for Harmonic Control and reactive compensation of Static Power Converters, IEEE Std. 519-1992
13. W.E. Kazibwe and M.H. Sendaula, "Electrical Power Quality Control Techniques," Van Nostrand Reinhold Company, 1993.
14. G. T. Heydt, Electric Power Quality, second edition, Stars in a Circle, West Lafayette, 1994.
15. IEEE Recommended Practice for Monitoring Electric Power Quality, IEEE Std. 1159-1995
16. D.A. Paice, Power Electronic Converter Harmonics-Multipulse Methods for Clean Power, IEEE Press, New York, 1996.
17. J. Arrillaga, B.C. Smith, N.R. Wattson and A.R. Wood, "Power System Analysis," John Wiley and Sons, Inc., New York, 1997
18. M. H. J. Bollen, Understanding Power Quality Problems: Voltage Sags and Interruptions, IEEE Press Series on Power Engineering, New York, 2000.
19. J. Arrilaga, N R Wattson and S. Chen, Power System Quality Assessment, John Wiley & Sons, 2000.
20. B. W. Kennedy, Power Quality Primer, McGraw Hill Professional, 2000.
21. C. Sankaran, Power Quality, CRC Press, New York, 2001.
22. J. Schlabbach, D. Blume and T. Stephanblome, Voltage Quality in Electrical Power Systems, IEE Press Series on Power Engineering and Energy, 2001.
23. Ghosh Arindam, Ledwich Gerard, Power Quality Enhancement Using Custom Power Devices, Kluwer academic Publishers, London, 2002.
24. J.C. Das, Power System Analysis-Short Circuit Load Flow and Harmonics, Marcel Dekker Inc. New York, 2002.
25. E. Acha, V.G. Agelidis, O. Anaya Lara, T.E.J. Miller, Power Electronics Control In Electrical System, Newnes, Woburn,2002.
26. Jan de Kock, Kobus Strauss and Steve Mackay, Practical Power Distribution for Industry, Newnes, Burlington, 2004.

27. Ali Emadi, Abdolhosein Nasiri and Stoyan B. Bekiarov, Uninterruptible Power Supplies And Active Filters, CRC Press, New York,2005.
28. R. C. Dugan, M. F. McGranaghan and H. W. Beaty, Electric Power Systems Quality, 2nd Edition, McGraw Hill, New York, 2006.
29. M. H. J. Bollen and Irene Gu, Signal Processing of Power Quality Disturbances, Wiley-IEEE Press, 2006.
30. T. A. Short, Distribution Reliability And Power Quality, CRC Press, New York, 2006. 31. Francisco C. De La Rosa, Harmonics And Power Systems, CRC Press, New York, 2006.
32. Hirofumi Akagi, Edson Hirokazu Watanabe and Mauricio Aredes, Instantaneous Power Theory and Applications to Power Conditioning, Willey Interscience, New Jersey,2007.
33. Predrag Pejovi C, Three-Phase Diode Rectifiers with Low Harmonics Current Injection Methods, Springer Verlag, London, 2007.
34. A. M. Munoz, Power Quality: Mitigation Technologies in a Distributed Environment, Springer-Verlag, London, 2007.
35. Ewald F. Fuchs and Mohammad A. S. Mausoum, Power Quality in Power Systems and Electrical Machines, Elsevier Academic Press, London, 2008.
36. K.R. Padiyar, FACTS Controllers in Power Transmission and Distribution, Ist edition, New Age International 2008.
37. Angelo Baghini, Handbook on Power Quality, John Wiley & Sons, New Jersey, 2008.
38. R.Sastry Vedam and Mulukutla S. Sarma, Power Quality VAR Compensation In Power Systems, CRC Press, New York, 2009.
39. J. B. Dixit and Amit Yadav, Electrical Power Quality, University Science Press, New Delhi, 2010.
40. S. Chattopadhyay, M. Mitra and S.Sengupta, Electric Power Quality, Springer Verlag, London, 2011.
41. G. Benysek and M. Pasko (Editors), Power Theories for Improved Power Quality, Springer-Verlag London 2012.
42. Mohd. Hasan A, Wind Energy Systems: Solutions for Power Quality and Stabilization, CRC Press, New York, 2012
43. Fang Lin Luo and Hong Ye, Renewable Energy Systems: Advanced Conversion Technologies and Applications, CRC Press, 2012.
44. Fang Lin Luo and Hong Ye, Advanced DC/AC Inverters: Applications in Renewable Energy, CRC Press, 2013.
45. Q.-C. Zhong and T. Hornik, Control of power inverters in renewable energy and smart grid integration, John Wiley & Sons Ltd., U.K, 2013.

**(19A02603b) FUNDAMENTALS OF SEMICONDUCTOR DEVICES**  
**(PROFESSIONAL ELECTIVE-II)**

**Unit 1:** Importance of semiconductor devices and their diverse applications. Introduction to semiconductors, concept of energy bands and how bands form. Effective mass of electrons, E-k diagram. Concept of holes. Concept of Fermi level, Fermi-Dirac distribution. Doping (extrinsic & intrinsic semiconductor), density of states. Equilibrium electron-hole concentration, temperature-dependence. Carrier scattering and mobility, velocity saturation, Drift-diffusion transport, Excess carrier decay & recombination, charge injection, continuity equation, quasi-Fermi level.

**Unit 2:** p-n junction: static behaviour (depletion width, field profile), p-n junction under forward & reverse bias, current equations, generation-recombination current and reference to typical devices. Zener and avalanche breakdown, Capacitance-voltage profiling, metal/semiconductor junction – Ohmic and Schottky contacts, reference to device applications.

**Unit 3:** MOS capacitor, charge/field/energy bands, accumulation, inversion, C-V (high and low frequencies), deep depletion, Real MOS cap: Flat-band & threshold voltage, Si/SiO<sub>2</sub> system. MOSFET: structure and operating principle, derivation of I-V, gradual channel approximation, substrate bias effects, sub-threshold current and gate oxide breakdown. Control of threshold voltage, short channel effects. Moore's Law and CMOS scaling

**Unit 4:** Introduction to compound semiconductors & alloys, commonly used compound semiconductors, heterostructure band diagrams and basics of MODFET & HEMT, introduction to quantum well, applications of heterostructure device technologies. BJT: working principle, DC parameters and current components, base transport factor, Early Effect, charge control equation & current gain, need for HBT. Applications of BJTs/HBTs in real-life. (Basics of) - transistors for high-speed logic, transistors for high frequency (RF), transistors for high power switching, transistors for memories, transistors for low noise, transistors for the future.

**Unit 5:** Solar cells: principle, efficiency, Fill factor, Shockley-Quiesser limit, silicon solar cells, multi-junction solar cell, Photodetectors: operation, figures of merit (responsivity, QE, bandwidth, noise, Detectivity), examples from IR to UV detectors. LEDs: working principle, radiative/non-radiative recombination, various types of efficiencies (EQE, WPE, IQE), light extraction and escape cone. Blue LED and the Nobel Prize, visible LEDs and chromaticity.

**Books and references:**

1. Solid State Electronic Devices, by Ben Streetman and Sanjay Banerjee, Prentice Hall.
2. Introduction to Semiconductor Materials and Devices, by M. S. Tyagi, Wiley Publications.

**(10A02603c) NONLINEAR SYSTEM ANALYSIS**  
**(PROFESSIONAL ELECTIVE -II)**

**Unit 1 :** Why nonlinear systems? - Non-linear Models of Physical Systems, Mathematical Preliminaries: Finite dimensional normed spaces, Euclidean space and its topology, Infinite dimensional Banach spaces - Contraction mapping theorem

**Unit 2 :** Existence and Uniqueness results for solutions to non linear ODEs, ODEs as vector fields - One dimensional systems - Phase portrait of second order linear systems - Equilibrium points, linearization and their classification

**Unit 3 :** Examples: Simple pendulum, Bead on a hoop, Lotka-Volterra models for predation and competition, biological transcriptional system, van der Pol oscillator and conservative systems, non linear circuits - Limit cycles, Bifurcations of two dimensional flows: Saddle-node, pitchfork, transcritical and Hopf - their normal forms

**Unit 4 :** Notions of stability - Lyapunov and LaSalle's theorems, Finding Lyapunov functions: Linear systems, variable gradient method - Center Manifold Theorem

**Unit 5 :** Physical Non-linearities - Interconnections and feedback - Aizermann's conjecture – Passivity, PR systems - Dissipation equality - Passive filters, KYP Lemma - Popov and circle criterion

**Books and references:**

1. Nonlinear Systems - Hassan Khalil
2. Nonlinear dynamics and chaos: with applications to physics, biology, chemistry, and engineering - Steven Strogatz
3. Nonlinear systems: analysis, stability, and control - S.S.Sastry
4. Nonlinear Systems Analysis - Vidyasagar

**(19A04703c)INTRODUCTION TO EMBEDDED SYSTEM DESIGN**

(Professional Elective III)

**Unit 1:**Introduction to Embedded Systems and Computer Systems Terminology. Modular approach to Embedded System Design using Six-Box model: Input devices, output devices, embedded computer, communication block, host and storage elements and power supply. Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers. Elements of Microcontroller Ecosystem and their significance. Design of Power Supply for Embedded Systems. Linear Regulator Topologies. Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems.

**Unit 2:**Introduction to MSP430 Microcontroller. MSP430 CPU Architecture. Programming Methods for MSP430. Introduction to Lunchbox Platform. Fundamentals of Physical Interfacing: Connecting Input Devices:Switches, Keyboard and Output devices: LEDs, Seven Segment Displays(SSD). Assignment: MCQ/MSQ. Advanced Physical Interfacing: Driving load - high side, low side and H-bridge. Multiplexing displays including Charlieplexing. Shaft encoder.

**Unit 3:**Programming the MSP430. Basics of version control system - Git. Installing and using Code Composer Studio(CCS). Introduction to Embedded C. Interfacing LEDs and Switches with MSP430 using Digital Input and Output. MSP430 Clock and Reset System. MSP430 Clock sources and distribution. Types of Reset sources. Handling Interrupts in MSP430. Writing efficient Interrupt Service Routine (ISR).

**Unit 4:** Interfacing Seven Segment Displays and Liquid Crystal Displays with MSP430. Low Power Modes in MSP430. Introduction to MSP430 Timer Module and it's Modes of Operation.Generating Pulse Width Modulation (PWM) using Timer Capture Mode. ADC operation in MSP430. Interfacing analog inputs. Generating random numbers using LFSR and other methods. Adding DAC to MSP430. Custom Waveform generation using MSP430.

**Unit 5:** Timer Capture Modes. Measuring frequency and time period of external signals and events. Serial Communication Protocols: UART, SPI, I2C. Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication. Advanced Coding Exercises based on Interrupt driven Programming. Building an Electronics Project. Circuit Prototyping techniques. Designing Single Purpose Computers using Finite State Machine with Datapath (FSMD) approach. MSP430 Based Project Design and Implementation. Recap of Course Coverage.

**Books and references:**

1. Designing Embedded Hardware, John Catsoulis. 2nd edition. Shroff Publishers and Distributors. ISBN-10: 9788184042597
2. Embedded System Design: A Unified Hardware / Software Introduction. Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X



3. MSP430 Microcontroller Basics. John H. Davies. Elsevier. ISBN-10: 9789380501857.  
Programming Embedded Systems in C and C++. Micheal Barr. Shroff Publishers and  
Distributors. ISBN-10: 817366076X

**(19A02603d) DESIGN OF PHOTOVOLTAIC SYSTEMS**  
**(PROFESSIONAL ELECTIVE-II)**

**Unit 1** : The PV cell, Series and Parallel interconnection

**Unit2** : Energy from sun, incident energy estimation, sizing PV

**Unit3** : Maximum Power Point Tracking, MPPT algorithms

**Unit4** : PV-Battery interfaces, Peltier cooling, PV and water pumping

**Unit 5** : PV-grid interface-I, PV-grid interface-II and life cycle costing

**Books and References:**

1. Chenming, H. and White, R.M., Solar Cells from B to Advanced Systems, McGraw Hill Book Co, 1983
2. Ruschenbach, HS, Solar Cell Array Design Hand Varmostrand, Reinhold, NY, 1980
3. Proceedings of IEEE Photovoltaics Specialists Conferences, Solar Energy Journal.

**(19A01604a) INDUSTRIAL WASTE AND WASTE WATER MANAGEMENT  
OPEN ELECTIVE-II**

**Course Objectives:**

- To teach Health and Environment Concerns in waste water management
- To teach material balance and design aspects of the reactors used in waste water treatment.
- To impart knowledge on selection of treatment methods for industrial waste water
- To teach common methods of treatment in different industries
- To provide knowledge on operational problems of common effluent treatment plant

**UNIT –I**

**Industrial water Quantity and Quality requirements:**

Boiler and cooling waters–Process water for Textiles, Food processing, Brewery Industries, power plants, fertilizers, sugar mills Selection of source based on quality, quantity and economics. Use of Municipal wastewater in Industries – Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, Elutriation, Removal of Colour, Odour and Taste.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Learn the procedures for assessment of quality of Industrial water
- Suggest different processes of handling waste water

**UNIT –II**

**Basic theories of Industrial Wastewater Management:** Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis -Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes-Volume and Strength reduction – Neutralization and Equalization, Segregation and proportioning- recycling, reuse and resources recovery

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Measure industrial waste water flow
- Characterize waste water
- Suggest techniques for treatment of waste water.

### **UNIT –III**

**Industrial wastewater disposal management:** Discharges into Streams, Lakes and oceans and associated problems, Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes- Effluent Disposal Method

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand options for waste water disposal.
- Explain functioning of common effluent treatment plants

### **UNIT – IV**

**Process and Treatment of specific Industries-1:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand the character of waste water from Steel plants and refineries
- Suggest suitable waste water treatment techniques

### **UNIT – V**

**Process and Treatment of specific Industries-2:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Pharmaceutical Plants

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand the character of waste water from tanneries and distilleries
- Suggest suitable waste water treatment techniques

#### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Design treatment methods for any industrial wastewater.
- Examine the manufacturing process of various industries.
- Assess need for common effluent treatment plant for an industry
- Test and analyze BOD, COD, TSS and MPN in waste water.

**TEXT BOOK**

1. M. N. Rao and A. K. Dutta, “Wastewater Treatment”, Oxford & IBH, New Delhi.
2. K.V. S. G. Murali Krishna, “Industrial Water and Wastewater Management”.

**REFERENCES**

1. A. D. Patwardhan, “Industrial Wastewater treatment”, PHI Learning, Delhi
2. Metcalf and Eddy Inc., “Wastewater Engineering”, Tata McGraw Hill co., New Delhi.
3. G. L. Karia & R.A. “Christian Wastewater Treatment- Concepts and Design Approach”, Prentice Hall of India.

(19A01604b) BUILDING SERVICES AND MAINTAINANCE

OPEN ELECTIVE-II

**Course Objectives:**

- To impart knowledge in concepts of building maintenance
- To insists the student to observe various practices of good building maintenance
- To teach the importance safety in buildings
- To demonstrate the use of ventilation in buildings.
- To give the list of different types of machineries in buildings

**UNIT – I**

PLUMBING SERVICES: Water supply system- fixing of pipes in buildings – maintenance of buildings- water meters-sanitary fittings-design of building drainage- gas supply systems

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand water supply system
- Understand the building drainage system.

**UNIT – II**

VENTILATION: Necessity of ventilation – functional requirements – systems of ventilation-natural ventilation-artificial ventilation-air conditioning-systems of air conditioning-essentials of air conditioning-protection against fire caused by air conditioning systems.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand concepts of ventilation
- Understand concepts of air conditioning

**UNIT – III**

THERMAL INSULATION: Heat transfer system-thermal insulating materials-methods of thermal insulation-economics of thermal insulation-thermal insulation of exposed walls, doors, windows and roofs.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand methods of insulation
- Understand materials of insulation

#### **UNIT – IV**

**FIRE SAFETY:** Causes of fire in buildings-fire safety regulations-characteristics of fire resisting materials- fire resistant construction-heat and smoke detectors-fire alarms-fire fighting pump and water storage.

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understand safety regulations of fire system
- Know about the implementation and usage of various fire resistant materials in building construction

#### **UNIT – V**

**MACHINERIES IN BUILDINGS:** Lifts-essential requirements-design considerations-escalators-essential requirements-electrical installations in buildings-lighting in buildings-methods of electrical wiring-earthing

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Understanding of different machineries of buildings
- Understanding of electrical installation of buildings

#### **Course Outcomes:**

Student will be able to understand

- Concepts of plumbing, drainage system and gas supply system
- Concepts of ventilation and air conditioning
- Concepts of thermal insulation and economics of thermal insulation
- Concepts of fire safety in buildings and fire resistant construction
- Concepts of different machineries of buildings

#### **TEXT BOOKS:**

1. B.C.Punmia, Er. Ashok K jain, Arun K Jain “Building construction”, Laxmi publications pvt.ltd. New Delhi.
2. Janardhan Jah, S.K Sinha, “Building construction”, Khanna publishers

3. Rangwala, "Building construction", Charoathar publishing house.

**REFERENCE BOOKS:**

1. David V Chaddrton, "Building services engineering", Outledge
2. P.C Varghees "Building construction", Printice hall india



(19A03604a) INTRODUCTION TO MECHATRONICS

OPEN ELECTIVE

**Course Objectives:**

- Familiarize the technologies behind modern mechatronic systems.
- Explain fundamentals for the development of fully automated system.
- Develop a robotic or automated systems focusing on the hardware and software integration.
- Demonstrate the development and design of mechatronic system and MEMS.

**UNIT – I**

**Introduction:** Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the role of mechatronics in industry.(12)
- Identify the application of mechatronics in automation industry.(13)

**UNIT – II**

**Sensors:** Static characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Classify various types of sensors. (12)
- Choose sensors for particular application. (13)
- Measure different quantity's using sensors. (14)

**UNIT – III**

**Actuators:** Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric

actuators, Shape memory alloys, Selection criteria for actuators.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Classify various actuation systems. (I2)
- Choose the criterion for different actuators. (I1)

## **UNIT – IV**

**Microprocessors, Microcontrollers and Programmable Logic Controllers:** Architecture of of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the architecture of microprocessors, microcontrollers and PLC. (L2)
- Formulate various programs using PLC. (L6)

## **UNIT – V**

Design of mechatronics systems, Mechatronics design elements, Traditional mechatronics systems, Embedded systems, Procedure for designing a mechatronic systems.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understanding design of mechatronics . (L2)
- Various Mechatronics systems. (L4)
- Design Aspects of Mechatronic systems. (L2)

### **Course Outcomes**

Upon successful completion of this unit, the student will be able to:

- Explain mechatronics systems in industry. (I2)
- Identify mechatronic systems encountered in practice. (I3)
- Examine the components of a typical mechatronic system. (I4)
- Compare the various techniques used for development of mems. (I4)
- Develop programs using plc. (I6)

### **Text books:**

1. Er R. Rajput, “ A Text book of Mechatronics”, S.Chand,2<sup>nd</sup> edition-2016.
2. James J Allen, “Micro Electro Mechanical Systems Design”, CRC Press Taylor & Francis group, 2005.

**Reference Text books:**

1. WBolton, "Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering", 3<sup>rd</sup> edition, Pearson Education Press, 2005.
2. Devadas Shetty and Richard A Kolk, "Mechatronic System Design", 2<sup>nd</sup> edition, Cengage learning, 2010.
3. Clarence W. de Silva, "Mechatronics an Integrated Approach", CRC Press, 2004.
4. Ganesh S Hedge, "Mechatronics", Jones & Bartlett Learning, 2010.

(19A03604b) OPTIMIZATION TECHNIQUES THROUGH MATLAB

OPEN ELECTIVE-II

Course Objectives

- Introduce basics of MATLAB
- Familiarize the fundamentals of optimization
- Explain single variable optimization using various methods
- Implement multi variable optimization using various methods
- Train various evolutionary algorithms.

UNIT -I

**Introduction to MAT LAB:** Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

**Learning Outcomes:**

After completion of this unit, students will be able to

- Write simple codes in MATLAB. (L3)
- Plot the data using MATLAB. (L3)
- Implement optimization models in MATLAB. (L3)

UNIT -II

**Introduction to Optimization:** Statement of an optimization problem, Classifications of optimization Problems: Single variable optimization, Multi variable optimization with no constraints, Multi variable optimization with equality constraints, Multi variable optimization with inequality constraints, Convex and Concave programming.

**Learning Outcomes:**

After completion of this unit, students will be able to

- Build optimization problem. (I1)
- Solve various optimization problems(I3)
- Compare convex and concave programming (I4)

UNIT -III

**Single Variable Optimization:** Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

**Learning Outcomes:**

After completion of this unit, students will be able to

- Understand various methods involving single variable optimization. (I2)

- Develop codes in matlab for different methods. (13)
- Identify methods for solving a single variable optimization problem. (13)

#### UNIT- IV

**Multi Variable Optimization:** Conjugate gradient method, Newton's method, Powell's method, Fletcher- Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

#### Learning Outcomes:

After completion of this unit, students will be able to

- Apply various methods involving multi variable optimization. (12)
- Develop codes in matlab for solving various multi variable optimization problems. (13)
- Choose methods for solving a multi variable optimization problem. (13)

#### UNIT -V

**Evolutionary Algorithms:** Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

#### Learning Outcomes:

After completion of this unit, students will be able to

- Apply different types of genetic algorithms. (13)
- Model optimization problems using genetic algorithms in matlab. (13)
- Compare different genetic algorithms for performance. (15)

#### Course Outcomes:

After completion of this course the student can be able to

- Use optimization terminology and concepts, and understand how to classify an optimization problem.(14)
- Apply optimization methods to engineering problems.(13)
- Implement optimization algorithms.(13)
- Compare different genetic algorithms. (15)
- Solve multivariable optimization problems. (14)

#### TEXT BOOKS:

1. Rao V.Dukkipati, MATLAB: “An Introduction with Applications”, Anshan, 2010.
2. Achille Messac, “Optimization in practice with MATLAB”, Cambridge University Press, 2015.
3. Jasbir S Arora, “Introduction to optimum design”, 2<sup>nd</sup> edition. Elsevier, 2004.

**REFERENCES:**

1. Cesar Perez Lopez, "MATLAB Optimization Techniques", Academic press, Springer publications, 2014.
2. Steven C.Chapra, "Applied Numerical Methods with MATLAB for Engineers and scientists": 4<sup>th</sup> edition, McGraw-Hill Education, 2018.

(19A04604a) **BASICS OF VLSI**  
**OPEN ELECTIVE-II**

**Course Objectives:**

The objectives of the course are to

- Learn and Understand IC Fabrication process steps required for various MOS circuits
- Understand and Experience VLSI Design Flow
- Learn Transistor-Level CMOS Logic Design
- Understand VLSI Fabrication and Experience CMOS Physical Design
- Learn to Analyze Gate Function and Timing Characteristics

**UNIT – I**

**Introduction:** Introduction to MOS Technology – MOS, PMOS, NMOS, CMOS and BiCMOS technologies, fabrication fundamentals: Oxidation, Lithography, Diffusion, Ionimplantation, Metallization and Encapsulation.

**Basic Electrical Properties:** Basic Electrical Properties of MOS, CMOS and BiCMOS Circuits,  $I_{DS}$ - $V_{DS}$  relationships, MOS transistor threshold Voltage,  $g_m$ ,  $g_{ds}$ , figure of merit  $\omega_0$ , Pass transistor, NMOS inverter, Various pull - ups, Determination of pull-up to pulldown ratio ( $Z_{pu} / Z_{pd}$ ), CMOS Inverter analysis and design, BiCMOS inverters, Latch-up in CMOS circuits.

**Learning Outcomes:**

After completion of this unit, students will be able to

- Demonstrate a clear understanding of CMOS fabrication flow and technology scaling (L2)
- Analyze the electrical properties of MOS and BiCMOS circuits (L3)
- Design MOSFET based logic circuit (L4)

**UNIT – II**

**VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layouts, Lambda based design rules, Contact cuts, CMOS Lambda based design rules, Layout Diagrams for logic gates, Transistor structures, wires and vias, Scaling of MOS circuits- Scaling models, scaling factors, scaling factors for device parameters, Limitations of Scaling.

### **Learning Outcomes:**

After completion of this unit, students will be able to

- Understand the design rules and layout diagram for logic gates, limitations of scaling (L1)
- Draw the Layout of simple MOS circuit using Lambda based design rules (L2)

### **UNIT – III**

**Gate Level Design and Layout:** Architectural issues, Switch logic networks: Gate logic, Alternate gate circuit: Pseudo-NMOS Dynamic CMOS logic. Basic circuit concepts, Sheet Resistance  $R_s$  and its concept to MOS, Area Capacitance Units, Calculations, The delay unit  $T$ , Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers

### **Learning Outcomes:**

After completion of this unit, students will be able to

- Apply basic circuit concepts to MOS circuits. (L2)
- Estimate the propagation delays in CMOS circuits (L3).

### **UNIT – IV**

**Subsystem Design:** Subsystem Design, Shifters, Adders, ALUs, Multipliers: Array multiplier, Serial/Parallel multiplier, Parity generator, Comparators, Zero/One Detectors, Up/Down Counter, Memory elements: SRAM, DRAM, ROM, Serial Access Memories.

### **Learning Outcomes:**

After completion of this unit, students will be able to

- Apply the Lambda based design rules for subsystem design (L2)
- Design of Adders, Multipliers and memories etc (L4)
- Design digital systems using MOS circuits (L4)

### **UNIT – V**

**Semiconductor Integrated Circuit Design:** PLDs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Programmable Logic Array Design Approach.

### **Learning Outcomes:**

After completion of this unit, students will be able to

- Analyze various architectures and device technologies of PLDs (L3)
- Design simple logic circuit using PLA, PAL, FPGA and CPLD. (L4)



**Course Outcomes:**

- Learn the basic fabrication process of MOS transistors, study CMOS inverter circuits, basic circuit concepts such as Sheet Resistance, Area Capacitance and Delay calculation, Field programmable gate arrays and realization techniques, CPLDs and FPGAs for implementing the various logic functions.
- Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality.
- Analyze the performance of CMOS Inverter circuits
- Compare various Scaling models and understand the effect of scaling on device parameters

**TEXT BOOKS:**

1. Kamran Eshraghian, “Essentials of VLSI circuits and systems”, EshraghianDouglasand A. Pucknell, PHI, 2005 Edition
2. Wayne Wolf, “Modern VLSI Design”, 3rd Edition, Pearson Education, 1997.

**REFERENCE BOOKS:**

1. John .P. Uyemura, “CMOS logic circuit Design”, Springer, 2007.
2. Neil H. E Weste, “CMOS VLSI Design – A Circuits and Systems Perspective”, 3<sup>rd</sup> edition, DavidHarris, Ayan Banerjee, Pearson, 2009.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– III-II Sem** **L T P C**  
**3 0 0 3**  
**(19A04604b) PRINCIPLES OF COMMUNICATION SYSTEMS**  
**OPEN ELECTIVE-II**

**Course Objectives:**

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

**UNIT-I:**

**Amplitude Modulation**

Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of noise, Fourier transform, carrier modulation and frequency division multiplexing (L1).
- Apply the concept of amplitude modulation to solve engineering problems (L2).
- Analyse various amplitude modulation schemes (L3).
- Evaluate various amplitude modulation schemes in real time applications (L3).

**UNIT-II:**

**Angle Modulation**

Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of angle modulation and its components (L1).
- Apply the concept of frequency modulation to solve engineering problems (L2).
- Analyse angle modulation schemes (L3).
- Evaluate frequency modulation scheme in real time applications (L3).

### **UNIT-III:**

#### **Pulse Modulation**

Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing (L1).
- Analyse various pulse modulation schemes (L3).

### **UNIT-IV:**

#### **Digital Modulation**

Binary Amplitude Shift Keying, Binary Phase Shift Keying and QuadraturePhase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various digital modulation schemes (L1).
- Analyze various digital modulation schemes (L3).

### **UNIT-V:**

#### **Communication Systems**

Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various communication systems (L1).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

**Course Outcomes:**

- Understand the concept of various modulation schemes and multiplexing (L1).
- Apply the concept of various modulation schemes to solve engineering problems (L2).
- Analyse various modulation schemes, and evaluate various modulation scheme in real time applications (L3).

**TEXT BOOKS:**

1. Herbert Taub, Donald L Schilling and Goutam Saha, “Principles of Communication Systems”, 3<sup>rd</sup>Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

**REFERENCES:**

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4<sup>th</sup> Edition, Oxford University Press, 2017.
  2. K. Sam Shanmugam “Digital and Analog Communication Systems”, Wiley India Edition, 2008.
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**Blooms’ Learning levels:**

L1: Remembering and Understanding

L2: Applying

L3: Analyzing, Evaluating

(19A05604a) FUNDAMENTALS OF VR/AR/MR

Open Elective-II

(Common to CSE & IT)

**Course Objectives:**

This course is designed to:

- Explore the history of spatial computing and design interactions
- Understand the foundational principles describing how hardware, computer vision algorithms function
- Learn Virtual reality animation and 3D Art optimization
- Demonstrate Virtual reality
- Introduce to the design of visualization tools

UNIT-I

**How Humans interact with Computers:** Common term definition, introduction, modalities through the ages (pre- 20<sup>th</sup> century, through world war-II, post world war-II, the rise of personal computing, computer miniaturization), why did we just go over all of this?, types of common HCI modalities, new modalities, the current state of modalities for spatial computing devices, current controllers for immersive computing systems, a note on hand tracking and hand pose recognition.

**Designing for our Senses, Not our Devices:** Envisioning a future, sensory technology explained, who are we building this future for?, sensory design, five sensory principles, Adobe's AR story.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Explain common modalities and their pros and cons.(L2)
- Demonstrate Mapping modalities to current industry inputs(L2)
- Explore the importance of design with spatial computing(L5)

UNIT-II

**Virtual Reality for Art:** A more natural way of making 3D art, VR for animation.

**3D art optimization:** Introduction, draw calls, using VR tools for creating 3D art, acquiring 3D models vs making them from scratch.

**How the computer vision that makes augmented reality possible works:** Who are we?, a brief history of AR, how and why to select an AR platform, mapping, platforms, other development considerations, the AR cloud.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Utilize VR tools for creating 3D Animations(L3)
- Analyze how and why to Select an AR Platform(L4)

### UNIT-III

**Virtual reality and augmented reality:** cross platform theory: Why cross platform? The role of game engines, understanding 3D graphics, portability lessons from video game design, simplifying the controller input.

**Virtual reality toolkit:** open source framework for the community: What is VRTK and why people use it?, the history of VRTK, welcome to the steam VR unity toolkit, VRTK v4, the future of VRTK, success of VRTK.

**Three virtual reality and augmented reality development practices:** Developing for virtual reality and augmented reality, handling locomotion, effective use of audio, common interaction paradigms.

#### Learning Outcomes:

At the end of the unit, students will be able to:

- Explain why the design approach should be considered at a holistic high level based on the goal of the experience(L2)
- Build VR solutions using Virtual reality toolkit(L6)
- Interpret the development practices in three Virtual reality and Augmented reality development(L2)

### UNIT-IV

**Data and machine learning visualization design and development in spatial computing:** Introduction, understanding data visualization, principles for data and machine learning visualization design and development in spatial computing, why data and machine learning visualization works in spatial computing, 2D data visualization vs 3D data visualization in spatial computing, interactivity in data visualizations and in spatial computing, animation, failures in data visualization, good data visualization design optimize 3D spaces, data representations, info graphics, and interactions, defining distinctions in data visualization and big data for machine, how to create data visualization: data visualization creation pipeline, webXR, data visualization challenges in XR, data visualization industry use case examples of data visualization, 3D reconstruction and direct manipulation of real world data, data visualization is for everyone, hands on tutorials, how to create data visualization, resources.

#### Learning Outcomes:

At the end of the unit, students will be able to:

- Understand, define, and set data and machine visualization design and development principles in embodied reality(L1)
- Demonstrate best practices, and practical tools to create beautiful and functional data visualizations.(L2)

## UNIT-V

**Character AI and Behaviors:** Introduction, behaviors, current practice: Reactive AI, more intelligence in the system, Deliberative AI, machine learning.

**The virtual and augmented reality health technology ecosystem:** VR/AR health technology application design, standard UX isn't intuitive, tutorial: insight Parkinson's experiment, companies, case studies from leading Academic institutions.

### Learning Outcomes:

At the end of the unit, students will be able to:

- Design a behavioral AI system for a video game(L6)
- Identify issues related to design of virtual reality (VR) and augmented reality (AR) experiences deployed in a health-care context(L3)
- Explain the use of motion data from controllers to reduce the visible tremor of a Parkinson's patient in a virtual environment(L2)

### Course outcomes

Upon completion of the course, the students should be able to:

- Explain how the humans interact with computers (L2)
- Apply technical and creative approaches to make successful applications and experiences. (L3)
- Design audio and video interaction paradigms (L6)
- Design Data visualization tools (L6)
- Apply VR/MR/AR in various fields in industry (L3)

### Text book

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, "Creating Augmented & Virtual Realities", 1<sup>st</sup> edition, O'REILLY, 2019.

### References

1. Steve Aukstakalnis, "Practical Augmented Reality", Pearson Education, 2017.

**(19A05604b) DATA SCIENCE**  
**Open Elective-II**  
**(Common to CSE & IT)**

**Course Objectives**

This course is designed to:

- Understand the approaches for handling data related problems
- Explore the mathematical concepts required for Data science
- Explain the basic concepts of data science.
- Elucidate various Machine Learning algorithms.
- Introduce Natural Language Processing and Recommender Systems

**UNIT- I**

Introduction to Data Science, A Crash Course in Python, Visualising Data.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Describe the importance of data analysis (L1).
- Identify the key connectors of Data Science (L4).
- Interpret and Visualize the data using bar charts, line charts and scatter plots (L3).

**UNIT-II**

Linear Algebra, Statistics, Probability, Hypothesis and Inference, Gradient Descent.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Identify the Correlation between two vectors (L4).
- Test a given hypothesis (L3).
- Compute mean, median and mode for the given data (L3).

**UNIT-III**

Getting Data, Working with Data, Machine Learning, k-Nearest Neighbors, Naïve Bayes.

**Learning Outcomes:**

At the end of the unit, students will be able to:

- Compute dimensionality reduction using PCA (L3).



- Differentiate supervised and unsupervised learning methods (L4).
- Describe overfitting, under fitting, bias, variance and goodness of learning (L1).
- Solve classification problem using k-nearest neighbour classifier (L3).
- Apply Naïve Bayes classifier to solve decision making problem (L3).

#### **UNIT-IV**

Simple Linear Regression, Multiple Regression, Logistic Regression, Decision Trees, Neural Networks.

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Describe gradient descent approach, maximum likelihood estimation and method of least squares (L1).
- Apply SVM to determine a hyperplane with maximum margin (L3).
- Determine decision tree for given data (L5).
- Describe Perceptron and Back Propagation (L3).

#### **UNIT-V**

Clustering, Natural Language Processing, Network Analysis, Recommender Systems.

Database and SQL, MapReduce

#### **Learning Outcomes:**

At the end of the unit, students will be able to:

- Determine Clusters in data using k-means and Hierarchical Clustering methods (L5).
- Apply basic SQL Operations using NotQuiteABase (L3).
- Compare User-Based and Item-Based Collaborative Filtering (L2).
- Describe Grammer and MapReduce (L1).

#### **Course Outcomes:**

After completion of this course the student would be able to

- Visualize the data using bar charts, line charts and scatter plots (L4).
- Analyse Correlation between two data objects (L4).
- Demonstrate feature selection and dimensionality reduction.(L2)
- Solve decision making problems using k-NN, Naïve Bayes, SVM and Decision Trees (L3).
- Determine Clusters in data using k-means and Hierarchical Clustering methods (L3).
- Design basic SQL Operations using NotQuiteABase (L6)
- Demonstrate the way to use machine learning algorithms using python. (L2)

**Text Books:**

1. Data Science from Scratch, First Principles with Python - Joel Grus, O'Reilly, First Edition.

**Reference Books:**

1. The Data Science Handbook, Field Cady, WILEY.
2. An Introduction to Data Science, Jeffrey M. Stanton, Jeffrey Stanton, 2012

**(19A27604a) FOOD TOXICOLOGY**  
**OPEN ELECTIVE II**

**PREAMBLE**

This text covers about toxins and their relation in food. Examination, identification and prevention of toxins.

**Course Objectives**

- To know the various toxins and their evaluation.
- To understand their tolerance and control measures.

**UNIT – I**

Principles of Toxicology: classification of toxic agents; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity. Evaluation of toxicity: risk vs. benefit: experimental design and evaluation: prospective and retrospective studies: Controls :Statistics (descriptive, inferential): animal models as predictors of human toxicity: Legal requirements and specific screening methods: LD50 and TD50: in vitro and in vitvo studies; clinical trials.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Classification of toxic agents; characteristics of exposure;
- Spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity.
- Evaluation of toxicity: risk vs. benefit: experimental design and evaluation:
- Prospective and retrospective studies: Controls: Statistics (descriptive, inferential): animal models as predictors of human toxicity:
- Legal requirements and specific screening methods: LD50 and TD50: in vitro and in vitvo studies; clinical trials.

**UNIT – II**

Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins), natural occurrence, toxicity and significance, determination of toxicants in foods and their management.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin

- Microbial toxins (e.g., bacterial toxins, fungal toxins and algal toxins), natural occurrence, toxicity and significance
- Determination of toxicants in foods and their management

### **UNIT – III**

Food allergies and sensitivities: natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies; food sensitivities (anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions); Safety of genetically modified food: potential toxicity and allergenicity of GM foods. Safety of children consumables.

#### **Learning outcomes:**

At the end of unit, students will be able to understand the following

- Natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies
- Food sensitivities (anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions)
- Potential toxicity and allergenicity of gm foods. Safety of children consumables.

### **UNIT – IV**

Environmental contaminants and drug residues in food: fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite green in fish and  $\beta$ - agonists in pork); other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Fungicide and pesticide residues in foods; heavy metal and their health impacts
- Use of veterinary drugs (e.g. Malachite green in fish and  $\beta$ - agonists in pork); other contaminants in food, radioactive contamination of food
- Food adulteration and potential toxicity of food adulterants.

### **UNIT – V**

Food additives and toxicants added or formed during food processing: safety of food additives; toxicological evaluation of food additives; food processing generated toxicants: nitroso-compounds, heterocyclic amines, dietary Supplements and toxicity related to dose: common dietary supplements; relevance of the dose; possible toxic effects.

## **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Safety of food additives; toxicological evaluation of food additives;
- Nitroso-compounds, heterocyclic amines, dietary supplements and toxicity related to dose
- Common dietary supplements; relevance of the dose; possible toxic effects.

## **Course Outcomes**

By the end of course

- Student will gain knowledge on principles of toxicity and characteristics of toxins and their classification. Examination and prevention of toxins in foods and etc.

## **TEXT BOOKS**

1. Helferich, W., and Winter, C.K “Food Toxicology”,. CRC Press, LLC. Boca Raton, FL. 2007.
2. Shibamoto, T., and Bjeldanes, L. “Introduction to Food Toxicology”, 2009, 2<sup>nd</sup> Edition. Elsevier Inc., Burlington, MA.
3. Watson, D.H. “Natural Toxicants in Food”, CRC Press, LLC. Boca Raton, FL1998.

## **REFERENCES**

1. Duffus, J.H., and Worth, H.G. J. “Fundamental Toxicology”, The Royal Society of Chemistry. 2006.
2. Stine, K.E., and Brown, T.M. “Principles of Toxicology”, 2<sup>nd</sup> Edition. CRC Press. 2006.
3. Tönu, P. “Principles of Food Toxicology”. CRC Press, LLC. Boca Raton, FL. 2007.

**(19A27604b) FOOD PLANT EQUIPMENT DESIGN  
OPEN ELECTIVE - II**

**PREAMBLE**

This text focuses on materials used for food plant equipment and factors considered for design of various equipment.

**Course Objectives:**

- To understand the material properties and codes used.
- To know the design considerations.
- To study the design of evaporators, dryers, crystallizers and etc.

**UNIT – I**

Materials and properties: Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes. Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings
- Corrosion prevention linings equipment, choice of materials, material codes
- Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor
- Temperature effects, radiation effects, effects of fabrication method, economic considerations

**UNIT – II**

Design of pressure and storage vessels: Operating conditions, design conditions and stress; Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories. Design of heat exchangers: Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of pressure and storage vessels includes operating conditions, design conditions and stress
- Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories
- Design of heat exchangers like shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort

### **UNIT – III**

Design of evaporators and crystallizers: Design of single effect and multiple effect evaporators and its components; Design of rising film and falling film evaporators and feeding arrangements for evaporators; Design of crystallizer and entrainment separator

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of evaporators like single effect and multiple effect evaporators and its components; rising film and falling film evaporators and feeding arrangements for evaporators;
- Design of crystallizer and entrainment separator

### **UNIT – IV**

Design of agitators and separators: Design of agitators and baffles; Design of agitation system components and drive for agitation. Design of centrifuge separator; Design of equipment components, design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems. Design of freezing equipment: Design of ice-ream freezers and refrigerated display system

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of agitators and baffles like Design of agitation system components and drive for agitation.
- Design of centrifuge separator like equipment components, design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems.
- Design of freezing equipment like ice-ream freezers and refrigerated display system

### **UNIT – V**

Design of dryers: Design of tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer. Design of extruders: Cold and hot extruder design, design of screw and barrel, design of twin screw extruder. Design of fermenters: Design of fermenter vessel, design problems

## **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Design of dryers like tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer
- Design of extruders like Cold and hot extruder design, design of screw and barrel, design of twin screw extruder.
- Design of fermenter vessel, design problems

## **Course Outcomes**

By the end of the course, the students will

- acquires knowledge on theoretical aspects to be design considerations for a food plant equipment and designing of evaporators, separators, storage vessels and etc.

## **TEXT BOOKS**

1. Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas, "Food plant design", CRC press 2005.
2. George D. Saravacos and Zacharias B. Maroulis, "Food Plant Economics", CRC Press 2007.

## **REFERENCES**

1. Peters M., Timmerhaus K. & Ronald W., "Plant Design & Economics for Chemical Engineers", McGraw Hill.
2. James R Couper, "Process Engg. Economics (Chemical Industries) CRC Press 3. Aries & Newton, Chemical Engg. Cost Estimation", McGraw Hill.



**(19A54604a) WAVELET TRANSFORMS AND ITS APPLICATIONS**

**OPEN ELECTIVE-II**

**Course Objective:**

This course provides the students to understand Wavelet transforms and its applications.

**UNIT-I-**

**Wavelets**

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform The Discrete-Time and Continuous Wavelet Transforms.

**Learning Outcomes:**

Students will be able to

- Understand wavelets and wavelet expansion systems.
- Find wavelet transforms in continuous as well as discrete domains.

**UNIT-II-**

**A Multiresolution Formulation of Wavelet Systems**

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

**Learning Outcomes:**

Students will be able to

- Illustrate the multi resolution analysis, scaling function.
- Implement parseval theorem.

**UNIT-III-**

**Filter Banks and the Discrete Wavelet Transform :** Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - - Different Points of View.

**Learning Outcomes:**

Students will be able to

- Form fine scale to coarse scale analysis.

- Perform decimating synthesis.
- Find the lattices and lifting.

#### **UNIT-IV**

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

#### **Learning Outcomes:**

Students will be able to

- Perform multi resolution versus time frequency analysis.
- Perform numerical complexity of discrete wavelet transforms.

#### **UNIT-V**

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

#### **Learning Outcomes:**

Students will be able to

- Understand the orthogonal bases and Biorthogonal Bases.
- Find the Frames and Tight Frames using Fourier series.

#### **Course Outcomes:**

After the completion of course, students will be able to

- Understand wavelets and wavelet expansion systems.
- Illustrate the multi resolution analysis and scaling functions.
- Form fine scale to coarse scale analysis.
- Find the lattices and lifting.
- Perform numerical complexity of discrete wavelet transforms.
- Find the frames and tight frames using fourier series.

#### **TEXT BOOKS:**

1. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).
2. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).

#### **REFERENCE BOOKS:**

1. Raghuvver Rao, "Wavelet Transforms", Pearson Education, Asia.

**(19A52604a) SOFT SKILLS**  
**(OPEN ELECTIVE-II)**

**Course Objectives**

- To develop awareness in students of the relevance and importance of soft skills
- To provide students with interactive practice sessions to make them internalize soft skills
- To develop Time management, Positive thinking & Decision making skills
- To enable to manage stress effectively
- To enable them to develop employability skills

**SYLLABUS**

**UNIT – I**

**INTRODUCTION**

Definition – Scope – Importance- – Methods of improving soft skills – Limits- Analysis – Interpersonal and intrapersonal skills - Verbal and Non-verbal skills.

**Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of soft skills
- Identify the methods of improving soft skills
- Analyze various soft skills in different situations
- Distinguish various soft skills
- Apply various soft skills in day to day life and in workplace

**UNIT – II INTRAPERSONAL SKILLS**

Knowing self/temperaments/traits - Johari windows – quotient skills(IQ, EQ, SQ), creativity, decision-making-Attitude – Confidence Building - Positive Thinking –Time Management – Goal setting.

**Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand self and its temperament.
- Apply various techniques to know the self.

- Develop positive thinking
- Develop creative thinking and decision-making skills
- Apply self-knowing tools in day to day and professional life.

### **UNIT – III**

#### **INTERPERSONAL SKILLS**

Leadership Skills – Negotiation skills – Team-building – Crisis Management – Event Management – Ethics and Etiquettes.

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of interpersonal skills
- Analyze various tactics in negotiation skills.
- Develop team building spirit.
- Develop crisis management
- Apply interpersonal skills through etiquettes.

### **UNIT – IV**

#### **VERBAL SKILLS**

Importance of verbal skills in corporate climate, Listening skills –Mother Tongue Influence (MTI) - Speaking skills – Public speaking - Oral presentations - Writing skills –E-mail etiquettes – Memos - Indianism

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Understand the importance of verbal skills in corporate climate.
- Explain the need of listening skills.
- Explore MTI and suggest remedies to avoid it.
- Interpret various contexts of speaking.
- Apply verbal skills in personal and professional life.

### **UNIT – V NON-VERBAL SKILLS**

Importance of body language in corporate culture – body language-Facial expressions – eye contact – posture – gestures – Proxemics – Haptics – Dress Code – Paralanguage –Tone, pitch, pause& selection of words

#### **Learning Outcomes:**

At the end of the module, the learners will be able to

- Comprehend the importance of non-verbal communication.
- Expound the need of facial expressions, postures and gestures.
- Analyze proxemics, haptics etc.
- Understand the importance of dress code.
- Apply various techniques to use para language

### **Course Outcomes**

- Recognize the importance of verbal and non verbal skills
- Develop the interpersonal and intrapersonal skills
- Apply the knowledge in setting the SMART goals and achieve the set goals
- Analyze difficult situations and solve the problems in stress-free environment
- Create trust among people and develop employability skills

### **Text Books**

1. Meenakshi Raman & Shalini Upadhyay “ Soft Skills”, Cengage Learning, 2018.
2. S. Balasubramaniam, “Soft Skills for Interpersonal Communication”, Orient Black Swan, 2017.

### **References**

1. Barun K. Mitra, “Personality Development and Soft Skills”, –OXFORD Higher Education 2018.
2. Alka Wadkar, “Life Skills for Success“, Sage Publications 2016.
3. Robert M Sheffield, “Developing Soft Skills”, Pearson, 2010.
4. Diana Booher, “Communicate With Confidence”, Tata McGrawhill, 2012.

**(19A51604a) CHEMISTRY OF POLYMERS AND ITS APPLICATIONS**

**Course Objectives:**

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

**Unit – I : Polymers-Basics and Characterization**

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: condensation, addition, radical chain, ionic and coordination and copolymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Classify the polymers (L3)
- Explain polymerization mechanism (L2)
- Differentiate addition, condensation polymerizations (L2)
- Describe measurement of molecular weight of polymer (L2)

**Unit – II : Synthetic Polymers**

Addition

and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization.

Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications.

Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, XRD.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Differentiate Bulk, solution, Suspension and emulsion polymerization (L2)
- Describe fibers and elastomers (L2)
- Identify the thermosetting and thermo polymers (L3)
- Characterize the properties of polymers by IR, NMR, XRD etc.,

### **Unit – III : Natural Polymers & Modified cellulotics**

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulotics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEAK.

#### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Describe the properties and applications of polymers (L2)
- Interpret the properties of cellulose, lignin, starch, rosin, latex etc., (L2)
- Discuss the special plastics of PES, PAES, PEEK etc., (L3)
- Explain modified cellulotics (L2)

### **Unit-IV: Hydrogels of Polymer networks and Drug delivery**

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, **Applications** of hydrogels in drug delivery.

Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

#### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Identify types of polymer networks (L3)
- Describe methods involve in hydrogel preparation (L2)
- Explain applications of hydrogels in drug delivery (L2)
- Demonstrate the advanced drug delivery systems and controlled release (L2)

## **Unit – V : Surface phenomena**

Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Demonstrate electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles etc., (L2)
- Explain photoelectron spectroscopy (L2)
- Discuss ESCA and Auger spectroscopy to the study of surfaces (L3)
- Differentiate micelles and reverse micelles (L2)

### **Course Outcomes**

At the end of the course, the student will be able to:

- Understand the state of art synthesis of Polymeric materials
- Understand the hydro gels preparation, properties and applications in drug delivery system.
- Characterize polymers materials using IR, NMR, XRD.
- Analyze surface phenomenon fo micelles and characterise using photoelectron spectroscopy, ESCA and Auger spectroscopy.

### **References :**

1. A Text book of Polymer science, Billmayer
2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra



**HUMANITIES ELECTIVE-I**

**(19A52602a) ENTREPRENEURSHIP & INCUBATION**

**COURSE OBJECTIVES :**

The objective of this course is

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

**Syllabus**

**UNIT-I**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Understand the concept of Entrepreneur and Entrepreneurship in India
- Know Entrepreneurship process and emergence of Entrepreneurship
- Analyze the differences between Entrepreneur and Intrapreneur
- Develop a creative mind set and personality
- Understand recent trends in Entrepreneurship across the globe

**UNIT-II**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the process of starting a new venture
- Analyze the sources of new methods in generating business idea
- Evaluate market feasibility, financial feasibility and technical feasibility
- Design and draw business plans in project preparation and prepare project reports

### **UNIT-III**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the various sources of finance to start a new venture
- Contrast & compare between Long term & Short term finance sources
- Analyze the role of banks and other financial institutions in promoting entrepreneurship in India
- Evaluate the need and importance of MSMEs in the growth of country

### **UNIT-IV**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Understand the role of government in promoting women entrepreneurship
- Know various incentives, subsidies and grants available to women entrepreneurs
- Analyze the role of export-oriented units
- Know about the tax concessions available for Women entrepreneurs
- Prepare to face the issues and challenges.

## UNIT-V

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

### Learning Outcomes:

At the end of the Unit, the learners will be able to:

- Understand the importance of business incubation
- Apply brilliant ideas in the process of business incubation
- Analyze the process of business incubation/incubators.
- Contrast & Compare between business incubation and business incubators.
- Design their own business incubation/incubators as viable-business unit.

### Course Outcomes:

At the end of the course, students will be able to

- Understand the concept of Entrepreneurship and challenges in the world of competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
- Evaluate the role of central government and state government in promoting Entrepreneurship.
- Create and design business plan structure through incubations.

## TEXT BOOKS

1. D F Kuratko and T V Rao, "Entrepreneurship" - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : [login.cengage.com](http://login.cengage.com))
- 2 . Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013

## REFERENCES

1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2<sup>nd</sup> Edition, Oxford, 2012.
3. B.Janakiramand M.Rizwanal "Entrepreneurship Development: Text & Cases", Excel Books, 2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

## **E-RESOURCES**

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. <http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship>
3. [http://nptel.ac.in/courses/122106032/Pdf/7\\_4.pdf](http://nptel.ac.in/courses/122106032/Pdf/7_4.pdf)
4. <http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50>

**(19A52602b) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

**Course Objectives :**

The objective of this course is

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To know the various types of Market Structures & pricing methods and its strategies
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

**Syllabus**

**UNIT I -**

**INTRODUCTION TO MANAGERIAL ECONOMICS DEMAND**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

**Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the nature and scope of Managerial Economics and its importance
- Understand the concept of demand and its determinants
- Analyze the Elasticity and degree of elasticity
- Evaluate Demand forecasting methods
- Design the process of demand estimation for different types of demand

**UNIT -II**

**THEORY OF PRODUCTION AND COST ANALYSIS**

**Production Function** – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale – **Cost & Break Even Analysis** - Cost concepts and

Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the production function, Input-Output relationship and different cost concepts
- Apply the least-cost combination of inputs
- Analyze the behavior of various cost concepts
- Evaluate BEA for real time business decisions
- Develop profit appropriation for different levels of business activity

## **UNIT –III**

### **INTRODUCTION TO FORMS OF BUSINESS ORGANIZATIONS AND MARKETS**

**Market structures** - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises-Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination - Pricing Methods and Strategies.

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the structure of markets, features of different markets and forms of business organizations
- Apply the price output relationship in different markets
- Analyze the optimum output levels to maximize profit in different markets
- Evaluate price-output relationship to optimize cost, revenue and profit
- Interpret Pricing Methods and Strategies

## **UNIT -IV**

**CAPITAL AND CAPITAL BUDGETING** Concept of Capital - Significance - Types of Capital - Components of Working Capital - Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Cash Budget - **Capital Budgeting** – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Know the concept of capital budgeting and its importance in business
- Contrast and compare different investment appraisal methods
- Analyze the process of selection of investment alternatives using different appraisal methods

- Evaluate methods of capital budgeting for investment decision making and for maximizing returns
- Design different investment appraisals and make wise investments

## UNIT –V

### INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis* - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

#### Learning Outcomes:

At the end of the Unit, the learners will be able to

- Know the concept, convention and significance of accounting
- Apply the fundamental knowledge of accounting while posting the journal entries
- Analyze the process and preparation of final accounts and financial ratios
- Evaluate the financial performance of an enterprise by using financial statements

#### Data Books Required:

Present Value Factors table

#### Course Outcomes:

At the end of the course, students will be able to

- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
- Apply concepts of production, cost and revenues for effective business decisions
- Students can analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Prepare the accounting statements and evaluate the financial performance of business entity.

#### TEXT BOOKS:

1. Varshney & Maheswari: “Managerial Economics”, Sultan Chand, 2013.
2. Aryasri: “Business Economics and Financial Analysis”, 4<sup>th</sup> edition, MGH, 2019

#### REFERENCES:

1. Ahuja Hl “Managerial economics” 3<sup>rd</sup> edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: “Managerial Economics and Financial Analysis”, New Age International,. 2013.

3. Joseph G. Nellis and David Parker: "Principles of Business Economics", 2<sup>nd</sup> edition, Pearson, New Delhi.
4. Domnick Salvatore: "Managerial Economics in a Global Economy", Cengage, 2013.



**Course Objectives :**

The objectives of this course are

- To make the student understand the principles of business ethics
- To enable them in knowing the ethics in management
- To facilitate the student role in corporate culture
- Impart knowledge about the fair trade practices
- Encourage the student in knowing them about the corporate governance

**Syllabus**

**BUSINESS ETHICS AND CORPORATE GOVERNANCE**

**UNIT -I**

**Introduction** – Meaning - Nature and Scope – Loyalty and Ethical Behaviour, Values across Cultures; Business Ethics – Ethical Practices in Management. Types of Ethics – Characteristics – Factors influencing , Business Ethics – Importance of Business Ethics - Arguments for and against business ethics Basics of business ethics Corporate Social Responsibility – Issues of Management – Crisis Management

**Learning Outcomes:**

After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Know about the factors influencing business ethics
- Understand the corporate social responsibility of management

**UNIT –II**

**ETHICS IN MANAGEMENT**

Introduction – Ethics in HRM – Marketing Ethics – Ethical aspects of Financial Management- Technology Ethics and Professional ethics. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

**Learning Outcomes:**

After completion of this unit student will

- Understand the meaning of Marketing Ethics
- Analyze Differentiate between Technical ethics and professional ethics
- Know about the ethical value system
- Understand the Code and culture

### **UNIT-III**

#### **ROLE OF CORPORATE CULTURE IN BUSINESS**

Meaning – Functions – Impact of corporate culture – cross cultural issues in ethics, Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind. The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the corporate culture in business
- Analyze Ethical Value System Know about the ethical value system
- Know Universalism, Utilitarianism, Distributive Justice
- Differentiate Ethical Values in different Cultures

### **UNIT- IV**

Law and Ethics – Relationship between Law and Ethics, Other Bodies in enforcing Ethical Business Behavior, Impact of Laws on Business Ethics; Social Responsibilities of Business – Environmental Protection, Fair Trade Practices, Fulfilling all National obligations under various Laws, Safeguarding Health and wellbeing of Customers.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand Law and Ethics
- Analyze Social Responsibilities of Business
- Know Environmental Protection and Fair Trade Practices
- Implementing National Safeguarding Health and wellbeing of Customers

### **UNIT –V**

#### **CORPORATE GOVERNANCE**

Meaning – scope - Issues, need, corporate governance code, transparency & disclosure, role of auditors, board of directors and shareholders; Global issues of governance, accounting and regulatory frame work, corporate scams, committees in India and abroad, corporate social responsibility composition of BODs - Cadbury Committee - various committees - reports on corporate governance - Benefits and Limitations of Corporate Governance with living examples.

### **Learning Outcomes:**

After completion of this unit student will

- Understand corporate governance code
- Analyze role of auditors, board of directors and shareholders
- Know accounting and regulatory frame work
- Implementing corporate social responsibility

### **Course Outcomes:**

At the end of the course, students will be able to

- Understand business ethics and ethical practices in management.
- Understand the role of ethics in management
- Apply the knowledge in cross cultural ethics
- Analyze law and ethics
- Evaluate corporate governance

### **TEXT BOOKS:**

1. Murthy CSV: “Business Ethics and Corporate Governance”, HPH
2. Bholanath Dutta, S.K. Podder – “Corporation Governance”, VBH.

### **REFERENCE BOOKS:**

1. Dr. K. Nirmala, KarunakaraReaddy : “Business Ethics and Corporate Governance”, HPH
2. H.R.Machiraju: “Corporate Governance”
3. K. Venkataramana, “Corporate Governance”, SHBP.
4. N.M.Khandelwal : “Indian Ethos and Values for Managers”

**(19A52602d) ENTERPRISE RESOURCE PLANNING**

**Course Objectives :**

The objectives of this course are

- To provide a contemporary and forward-looking on the theory and practice of
- Enterprise Resource Planning
- To enable the students in knowing the Advantages of ERP
- To train the students to develop the basic understanding of how ERP enriches the
- Business organizations in achieving a multidimensional growth.
- Impart knowledge about the historical background of BPR
- To aim at preparing the students, technologically competitive and make them ready to self-upgrade with the higher technical skills.

**Syllabus**

**UNIT-I**

**Introduction to ERP:** Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM),

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of ERP
- Explain various Business modeling
- Know the contemporary technology like SCM, CRM
- Understand the OLAP

**UNIT-II**

**Benefits of ERP:** Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design-making Capability

**Learning Outcomes:**

After completion of this unit student will

- Understand the Advantages of ERP

- Explain the challenges associated with ERP System
- Analyze better customer satisfaction
- Differentiate Improved Information Accuracy and Design-making Capability

### **UNIT-III**

**ERP Implementation Lifecycle:** Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the implementation of ERP life cycle
- Explain the challenges associated with implementing ERP system
- Analyze the need of re-engineering
- Know the recent trends in team training testing and go-live

### **UNIT-IV**

**BPR:** Historical background: Nature, significance and rationale of business process reengineering (BPR), Fundamentals of BPR. Major issues in process redesign: Business vision and process objectives, Processes to be redesigned, Measuring existing processes,

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the business process reengineering
- Explain the challenges associated with BPR
- Analyze the need of process redesign
- Differentiate between process to be redesign and measuring existing process

### **UNIT-V**

**IT in ERP:** Role of information technology (IT) and identifying IT levers. Designing and building a prototype of the new process: BPR phases, Relationship between BPR phases. MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the role of IT
- Explain the challenges in Designing and building a prototype of the new process
- Analyze the need of MIS
- Differentiate between DSS and EIS

**Course outcomes:**

At the end of the course, students will be able to

- Understand the basic use of ERP Package and its role in integrating business functions.
- Explain the challenges of ERP system in the organization
- Apply the knowledge in implementing ERP system for business
- Evaluate the role of IT in taking decisions with MIS
- Create reengineered business processes with process redesign

**TEXT BOOKS:**

1. Pankaj Sharma. “Enterprise Resource Planning”. Aph Publishing Corporation, New Delhi, 2004.
2. Alexis Leon, “Enterprise Resource Planning”, IV Edition, Mc.Graw Hill, 2019

**REFERENCE BOOKS:**

1. Marianne Bradford “Modern ERP”, 3<sup>rd</sup> edition.
2. “ERP making it happen Thomas f. Wallace and Michael
3. Directing the ERP Implementation Michael w pelphrey

**Course Objectives :**

The objectives of this course are

- To provide Knowledge on logistics and supply chain management
- To enable them in designing the distribution network
- To train the students in knowing the supply chain Analysis
- Impart knowledge on Dimensions of logistic
- To know the recent trends in supply chain management

**Syllabus**

**UNIT-1**

**Introduction to Supply Chain Management**

Supply chain - objectives - importance - decision phases - process view -competitive and supply chain strategies - achieving strategic fit – supply chain drivers - obstacles – framework - facilities -inventory-transportation-information-sourcing-pricing.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the meaning and objectives of supply chain management
- Explain supply chain drivers
- Know the steps involved in SCM frame work
- Understand transportation information and pricing

**UNIT-2**

**Designing the distribution network**

Role of distribution - factors influencing distribution - design options - e-business and its impact – distribution networks in practice –network design in the supply chain - role of network -factors affecting the network design decisions modeling for supply chain. Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs tailored transportation.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the different distribution network

- Explain the factors influencing network design in the supply chain
- Know the Role of transportation
- Analyze design options and their trade-offs

### **UNIT-3**

#### **Supply Chain Analysis.**

Sourcing - In-house or Outsource - 3rd and 4th PLs - supplier scoring and assessment, selection - design collaboration - Procurement process - Sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of supply chain Analysis
- Explain design collaboration
- Know procurement process -sourcing planning and analysis
- Understand seasonal demand, bulk and spot contracts

### **UNIT-4**

#### **Dimensions of Logistics**

A macro and micro dimension - logistics interfaces with other areas - approach to analyzing logistics systems - logistics and systems analysis - techniques of logistics system analysis - factors affecting the cost and importance of logistics. Demand Management and Customer Service Outbound to customer logistics systems - Demand Management –Traditional Forecasting - CPFRRP - customer service - expected cost of stock outs - channels of distribution.

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand dimensions of logistics
- Explain logistics interfaces with other areas
- Know techniques of logistics system analysis
- Understand Demand Management

### **UNIT-5**

**Recent Trends in Supply Chain Management**-Introduction, New Developments in Supply Chain Management, Outsourcing Supply Chain Operations, Co-Maker ship, The Role of E-Commerce in Supply Chain Management, Green Supply Chain Management, Distribution Resource Planning, World Class Supply Chain Management



## **Learning Outcomes:-**

After completion of this unit student will

- Understand the recent trend in supply chain management
- Explain The Role of E-Commerce in Supply Management
- Know Green Supply Chain Management
- Understand Distribution Resource Planning

## **Course Outcomes:**

At the end of the course, students will be able to

- Understand the strategic role of logistic and supply chain management in the cost reduction and offering best service to the customer
- Understand Advantages of SCM in business
- Apply the knowledge of supply chain Analysis
- Analyze reengineered business processes for successful SCM implementation
- Evaluate Recent trend in supply chain management

## **TEXT BOOKS:**

1. Sunil Chopra and Peter Meindl, Supply Chain Management – “Strategy, Planning and Operation”, 3<sup>rd</sup> Edition, Pearson/PHI, 2007.
2. Supply Chain Management by Janat Shah Pearson Publication 2008.

## **REFERENCE BOOKS:**

1. A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, Cengage Learning, 1/e
2. Donald J Bowersox, Dand J Closs, M Bixby Coluper, “Supply Chain Logistics Management”, 2<sup>nd</sup> edition, TMH, 2008.
3. Wisner, Keong Leong and Keah-Choon Tan, “Principles of Supply Chain Management A Balanced Approach”, Cengage Learning, 1/e
4. David Simchi-Levi et al, “Designing and Managing the Supply Chain” – Concepts

**(19A02605)CONTROL SYSTEMS & SIMULATION LAB**

**Objectives:** This course introduces

**COURSE OBJECTIVES**

- Determination of transfer functions of various systems and control of it by different methodologies.
- To provide knowledge in the analysis and design of controllers and compensators.
- The characteristics of servo mechanisms which are helpful in automatic control systems.
- To know the stability analysis using MATLAB.

**Course Outcomes:**

At the end of the course the student will be able to

- Get the knowledge of feedback control and transfer function of DC servo motor.
- Model the systems and able to design the controllers and compensators.
- Get the knowledge about the effect of poles and zeros location on transient and steady state behaviour of second order systems and can implement them to practical systems and MATLAB
- Determine the performance and time domain specifications of first and second order systems.

**Any Eight of the following experiments are to be conducted:**

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order system
7. Lag and lead compensation – Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor

**Any two simulation experiments are to be conducted:-**

1. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits.

2. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
3. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
4. State space model for classical transfer function using MATLAB – Verification.

**REFERENCE BOOKS:**

1. M.H.Rashid, “Simulation of Electrical and electronics Circuits”, using PSPICE ,M/s PHI Publications.
2. PSPICE A/D user’s manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user’s manual and – Mathworks, USA.

**(19A02601P)DIGITAL COMPUTE PLATFORMS LAB**

The student will understand about

- Assembly language programming on 8086 Microprocessors
- Interfacing of various devices with 8086
- MASAM Programming
- Interfacing 8051 Microcontroller with its peripheral devices.

**Course Outcomes:**

The student able to perform:

- Assembly language programming on 8086 Microprocessors.
- Interfacing of various devices with 8086.
- MASAM Programming.
- Interfacing 8051 Microcontroller with its peripheral devices

**PART-A: List of Programs using MASAM/ALP:**

1. Programs for 16 bit arithmetic operations for 8086 (using various addressing modes) .
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086

**PART-B: List of experiments using 8086 and 8051 modules:**

1. Interfacing ADC and DAC to 8086.
2. Parallel communication between two microprocessors using 8255.
3. Serial communication between two microprocessor kits using 8251.
4. Interfacing to 8086 and programming to control stepper motor.
5. Programming using arithmetic, logical and bit manipulation instructions of 8051
6. Program and verify Timer/Counter in 8051.
7. Program and verify interrupt handling in 8051.
8. UART operation in 8051.
9. Communication between 8051 kit and PC.
10. Interfacing LCD to 8051.
11. Interfacing matrix or keyboard to 8051.

Note: List of programs in PART-A are mandatory and in PART-B at least Eight experiments must be performed

## Reference Books:

1. Ray A. K., Bhurchandi K. M., “Advanced Microprocessor and Peripherals”, 3<sup>rd</sup> Edition, Tata McGraw-Hill Publications, 2013.
2. Douglas V Hall, “Microprocessor and Interfacing “, 2<sup>nd</sup> Edition, Tata McGraw hill, 1992
3. Srinivasa Murthy, “Microprocessors and Microcontrollers Lab Manual”: 8086 & 8051 Kindle Edition.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

**L T P C**  
**3 0 0 0**

**(19A99501) MANDATORY COURSE: CONSTITUTION OF INDIA**

**COURSE OBJECTIVES :**The objective of this course is

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

**Syllabus**

**UNIT-I**

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

**Learning Outcomes:-**

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History and features of Indian constitution
- Learn about Preamble, Fundamental Rights and Duties

**UNIT-II**

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President’s Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

**Learning Outcomes:-**

After completion of this unit student will

- Understand the structure of Indian government

- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

### **UNIT-III**

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand the structure of state government
- Analyze the role of Governor and Chief Minister
- Explain the role of State Secretariat
- Differentiate between structure and functions of state secretariat

### **UNIT-IV**

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions- PRI -Zilla Parishath - Elected officials and their roles - CEO,Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

#### **Learning Outcomes:-**

After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration's role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Learn about the role of Zilla Parishath block level organization

### **UNIT-V**

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

#### **Learning Outcomes:-**

After completion of this unit student will

- Know the role of Election Commission
- Contrast and compare the role of Chief Election commissioner and Commissionerate

- Analyze the role of state election commission
- Evaluate various commissions viz SC/ST/OBC and women

### **Course Outcomes:**

At the end of the course, students will be able to

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

### **TEXT BOOKS**

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, "Indian Constitution", National Book Trust

### **REFERENCES:**

1. J.A. Siwach, "Dynamics of Indian Government & Politics".
2. H.M.Sreevai, "Constitutional Law of India", 4<sup>th</sup> edition in 3 volumes (Universal Law Publication)
3. J.C. Johari, "Indian Government and Politics", Hans India
4. M.V. Pylee, "Indian Constitution", Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

### **E-RESOURCES:**

1. [nptel.ac.in/courses/109104074/8](http://nptel.ac.in/courses/109104074/8)
2. [nptel.ac.in/courses/109104045/](http://nptel.ac.in/courses/109104045/)
3. [nptel.ac.in/courses/101104065/](http://nptel.ac.in/courses/101104065/)
4. [www.hss.iitb.ac.in/en/lecture-details](http://www.hss.iitb.ac.in/en/lecture-details)
5. [www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution](http://www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution)



(19A02701) MEASUREMENTS & SENSORS

**Course Objectives:**

The student has to acquire knowledge about:

- The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
- The measurements of RLC parameters using bridge principles.
- The principles of magnetic measurements
- The principle of working of CRO and its applications

**UNIT- I**

**MEASURING INSTRUMENTS**

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range – Numerical examples

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the operation of different instruments.
- Know the different types of errors and their compensation
- Distinguish between MC and MI type of instruments
- Know how control of torque is required in measurements
- Solve numerical examples and interchangeability of ammeters as voltmeters and vice-versa

**UNIT – II**

**MEASUREMENT OF POWER, POWER FACTOR AND ENERGY**

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter – Numerical examples

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the working principles and construction of different types of Energy meters
- Calculate the different parameters of the meters
- Distinguish between low and high power factor ranges in watt meters
- Know about occurrence of errors and need for compensation for precise and accurate measurement
- Distinguish between 3- $\phi$  power factor meters and Energy meters

### **UNIT – III**

#### **INSTRUMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS**

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations. DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.

Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples – Numerical Examples

#### **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the principles and working of various measuring instruments used to detect electrical circuit parameters R,L,C
- Design the various voltage and current measuring instruments for the various electric / magnetic field applications
- Distinguish between CTs and PTs
- Distinguish between DC and AC potentiometers
- Identify errors in measurements and to mitigate them for desired precision and accuracy

### **UNIT – IV**

#### **D.C & A.C BRIDGES**

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge – Numerical Examples

## **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the bridge configurations and their applications for various ranges of resistance measurement
- Compute the unknown parameters of Inductance using the bridges
- Compute the unknown parameters of Capacitance using the bridges
- Be able to select appropriate bridge configuration for measurement of R,L and C
- Identify errors in measurements and to mitigate them for desired precision and accuracy

## **UNIT – V**

### **CRO AND DIGITAL METERS**

Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns.

Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer.

## **Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the operation of CRO and its parts
- Know about various applications of CRO
- Understand various Lissajous patterns
- Know about Digital voltmeters and Distinguish between analog and digital meters
- Know about measurement of speed using Tachometer and to distinguish between analog and digital ones

## **Course Outcomes:**

- Able to Understand the working of various instruments and equipments used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors
- Able to analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements.
- Analyse the different operation of extension range ammeters and voltmeters, DC and AC bridge for measurement of parameters and different characteristics of periodic and aperiodic signals using CRO.
- Design and development of various voltage and current measuring meters and the varieties of issues coming up in the field of electrical measurements.

**TEXT BOOKS:**

1. A.K.Sawhney “Electrical & Electronic Measurement & Instruments” Dhanpat Rai & Co. Publications, 2007.
2. E.W. Golding and F.C. Widdis, “Electrical Measurements and measuring Instruments”, 5<sup>th</sup> Edition, Reem Publications, 2011.

**REFERENCE BOOKS:**

1. H. S. Kalsi, “Electronic Instrumentation”, 3<sup>rd</sup> Edition, Tata Mcgrawhill, 2011.
2. Reissland, “Electrical Measurements: Fundamentals, Concepts, Applications” –M.U, New Age International (P) Limited, 2010.
3. R. K. Rajput, “Electrical & Electronic Measurement & Instrumentation”, 2<sup>nd</sup> Edition, S. Chand & Co., 2<sup>nd</sup> Edition, 2013.

(19A02702) POWER SYSTEM PROTECTION

**Course Objectives:**

The objectives of the course are to make the students learn about:

- The different types of electromagnetic relays and microprocessor based relays
- The protection of Generators
- The protection of Transformers
- The protection of feeders and lines
- The technical aspects involved in the operation of circuit breakers
- Generation of over voltages and protection from them

**UNIT – I**

**Fuses and Circuit breakers:**

**Fuses:** Definitions, characteristics, types, HRC fuses.

**Circuit Breakers:** Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, Average and Max. RRRV, Current Chopping and Resistance Switching - CB Ratings and Specifications: Types and Numerical Problems. – Auto Reclosures. Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- To understand the purpose and operation of fuses.
- To understand the occurrence of arc and different types of circuit breakers
- To classify among different types of fuses and circuit breakers
- To do numerical examples for selecting ratings of fuses and CBs

**UNIT – II**

**RELAYS**

Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays and Their Flow Charts.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- To understand the operation of different types of relays
- To analyze the importance of zones of protection
- To be able to classify among electromagnetic relays
- To be able to classify among static relays
- To be able to classify among numerical relays

## **UNIT – III**

### **PROTECTION OF GENERATORS & TRANSFORMERS**

Protection of Generators against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection – calculation of percentage winding unprotected. **Protection of Transformers:** Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholtz Relay Protection, Numerical Problems.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- To understand various types of faults and abnormal conditions that occur in generators
- To understand various types of faults and abnormal conditions that occur in transformers
- To be able to calculate percentage winding and CT ratios
- To apply different protection schemes for the occurrence of faults in generators
- To apply different protection schemes for the occurrence of faults in transformers

## **UNIT – IV**

### **PROTECTION OF FEEDERS & LINES**

Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- To understand protection schemes of feeders
- To understand protection schemes of bus bars
- To elucidate the protection of transmission lines
- To understand about over current relays
- To know about what is meant by 3-zone protection

## **UNIT – V**

### **OVER VOLTAGES IN POWER SYSTEMS**

Generation of Over Voltages in Power Systems.-Protection against Lightning over Voltages - Valve Type and Zinc-Oxide Lightning Arresters - Insulation Coordination –BIL.

#### **Learning Outcomes:**

At the end of the unit, the student will be able to

- To understand the concept of Generation of over voltages
- To analyze various methods of protection for over voltages in power systems
- To know about Lightning arresters
- To understand about Insulation coordination

#### **Course Outcomes:**

At the end of the course the student should be able to:

- Distinguish between the principles of operation of electromagnetic relays, static relays and microprocessor based relays
- Determine the unprotected percentage of generator winding under fault occurrence
- Design the protection system for transformers
- Identify various types of the relays in protecting feeders, lines and bus bars
- Solve numerical problems for arc interruption and recovery in circuit breakers
- Demonstrate the protection of a power system from over voltages

#### **TEXT BOOKS:**

1. Badri Ram, D.N Viswakarma, “Power System Protection and Switchgear”, TMH Publications, 2011.
2. Sunil S Rao, “Switchgear and Protection”, Khanna Publishers, 1992.

#### **REFERENCE BOOKS:**

1. C.L.Wadhwa, “Electrical Power Systems”, New Age international (P) Limited, Publishers, 2012.
2. Y.G. Paithankar , “Transmission network Protection”, Taylor and Francis,2009.
3. Bhuvanesh Oza, “Power system protection and switch gear”, TMH, 2010.

**PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

**UNIT-I:**

**ECONOMIC OPERATION OF POWER SYSTEMS**

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

**Learning Outcomes:**

At the end of the unit, the student will be able to

- To know about basic Power System Operation and Control strategies
- To distinguish between generation and co-generation plants
- To understand economic load dispatch problem without losses of the Power System
- To understand economic load dispatch problem with losses of the Power System
- To know about computation of loss coefficients in Power Systems

**UNIT-II:**

**HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW**

**Hydro-thermal Coordination:** Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydro-thermal coordination, Short-term hydro-thermal scheduling. **Optimal Power Flow:** Optimal power flow problem formulation for loss and cost minimisation, Solution of optimal power



flow problem using Newton's method and Linear Programming technique – Numerical problems

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- To distinguish between hydro electric and hydro thermal plants
- To understand about characteristics of thermo-electric and hydro-thermal plants
- To understand about optimal power flow problem formulation with losses and minimisation of cost
- OPF problem solving using specified methods
- To do numerical exercises in solving OPF problems

## **UNIT-III:**

### **AUTOMATIC GENERATION CONTROL**

Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples

### **Learning Outcomes:**

At the end of the unit, the student will be able to

- To understand about speed governing mechanism modelling
- To identify control areas and block diagram representations
- To identify Load Frequency Control problems with and without control
- To understand about steady state and dynamic responses of single and two area system with tie-lines
- To do numerical problems of AGC problems

## **UNIT-IV:**

### **REACTIVE POWER CONTROL**

Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problems

## **Learning Outcomes:**

At the end of the unit, the student will be able to

- To know about understanding of Reactive Power problems in Power Systems
- To distinguish between compensated and uncompensated lines under no-load and load
- To distinguish between active and passive compensations
- To distinguish between shunt and series compensation in Reactive Power Control
- To do numerical problems and to understand the complexity of reactive power problems in power systems

## **UNIT-V:**

### **OPERATION OF MODERN POWER SYSTEMS**

Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems

## **Learning Outcomes:**

At the end of the unit, the student will be able to

- To understand the philosophy of power exchange in electricity market
- To know about transmission system pricing charges
- To know about distribution system pricing charges
- To understand the trend of Demand side management
- To solve numerical problems in above aspects

## **Course Outcomes:**

- To be able to understand to deal with problems in Power System as Power System Engineer
- To be able to Understand to deal with AGC problems in Power System
- To be able to understand to deal the problems in hydro electric and hydro thermal problems
- To understand the complexity of reactive power control problems and to deal with them
- To understand the necessity of deregulation aspects and demand side management problems in the modern power system era.

## **Text Books:**

1. Allen J. Wood and Bruce F. Wollenberg, "Power Generation, Operation and Control", 2<sup>nd</sup> edition, John Wiley & Sons, Inc., New York, 1996.
2. D P Kothari and I J Nagrath, "Power System Engineering", McGraw Hill Education India Pvt. Limited, Chennai, 3e, 2019.

**References:**

1. Olle I. Elgerd, "Electric Energy Systems Theory: An Introduction", TMH Publishing Company Ltd., New Delhi, 2<sup>nd</sup> edition, 1983.
2. T J E Miller, "Reactive Power Control in Electric Systems", John Wiley & Sons, New York, 1982.

**(19A02703b) SWITCHED MODE POWER CONVERTERS**

**PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

By the end of the course, the student will be able to:

- Understand basic concepts of DC-DC converters
- Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
- Apply various modulation and harmonic elimination techniques over the converters.
- Analyze the state space modelling of various types of converters.
- Design inductor and transformer for various power electronic applications.

**UNIT I**

**DC-DC CONVERTERS:**

Principles of stepdown and stepup converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

**Learning Outcomes:**

By the end of the unit, the student will be able to:

- Understand and analyze various types of DC-DC converters
- Understand state space modeling of DC-DC converters
- Distinguish between stepdown and stepup converters
- Apply the above concepts to solve numerical problems

**UNIT II:**

**SWITCHING MODE POWER CONVERTERS**

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

**Learning Outcomes:**

By the end of the unit, the student will be able to:

- Understand various types of converters
- Know about state space modelling of converters
- Understand about various control circuits & PWM techniques

- Apply the above concepts to solve numerical problems

### **UNIT III:**

#### **RESONANT CONVERTERS**

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

#### **Learning Outcomes:**

By the end of the unit, the student will be able to:

- Understand and analyze various types of resonant converters
- Classification of resonant converters
- know about output voltages and its waveforms for various configurations
- Distinguish between series and parallel resonant converters
- Apply the above concepts to solve numerical problems

### **UNIT IV:**

#### **DC-AC CONVERTERS**

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

#### **Learning Outcomes:**

By the end of the unit, the student will be able to:

- Understand and analyze different single phase and three phase inverters
- Understand various modulation techniques
- Understand various harmonic elimination techniques
- Understand various types of multilevel inverters with waveforms and their applications
- Apply the above concepts to solve numerical problems

### **UNIT V:**

#### **POWER CONDITIONERS, UPS & FILTERS**

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

## **Learning Outcomes:**

By the end of the unit, the student will be able to:

- Understand different types of power line disturbances, power conditioners, in detail working of UPS and its applications.
- Understand various types of filters with and without capacitors and selection of capacitors.
- Design inductor and transformer for various power electronic applications.
- Apply the above concepts to solve numerical problems.

## **Course Outcomes:**

- To be able to solve the problems and to design of various DC-DC converters
- To be able to understand advanced converters of SMPCs
- To understand the performance of resonant converters
- To understand various types and performance characteristics of 1- $\phi$  and 3- $\phi$  inverters with single/multi levels
- To understand about power conditioners, UPS and filters
- To know about the applications of the above in Power Systems, EVE, Renewable Energy Systems, etc.

## **Text Book:**

1. L. Umanand, "Power Electronics: Essentials and Applications", Wiley, 2009
2. M.H. Rashid, "Power Electronics handbook", Elsevier Publication, 2001.
3. V Ramanarayanan, "Course material on Switched Mode Power Conversion" Dept. of Electrical Engg. IISc. Bangalore.

## **REFERENCES:**

1. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 2012
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, "Power Electronics converters, Applications and design", 3<sup>rd</sup> Edition, John Wiley and Sons, 2006
3. M.H. Rashid, "Power Electronics circuits, devices and applications", 3<sup>rd</sup> Edition Prentice Hall of India New Delhi, 2007.

**(19A02703c) INSTRUMENTATION  
PROFESSIONAL ELECTIVE-III**

**Course Objectives:**

The student has to acquire knowledge about:

- Measuring system, Common errors, Objectives of Measuring systems
- Test signals and modulation phenomenon, Data acquisition system, various telemetry systems and various modulation systems
- Measuring various meters and analyzers
- Basic transducers and their usage in various measurements

**UNIT-I:**

**INSTRUMENT ERRORS**

Measuring Systems, Objectives of Measuring Instruments, definition of terms-Span & Range, Sensitivity, Threshold & Resolution, Accuracy, Precision & Reliability, Performance Characteristics - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical evaluation of measuring data – Numerical Problems

**Learning Outcomes:**

At the end of the unit student will be able to

- Understand the concept of generalized measurement system.
- Know about the static and dynamic characteristics.
- Solve problems related to statistical Analysis of Random Errors.
- Analyze the test signals and modulation phenomenon.
- Be able to solve Numerical problems

**UNIT-II:**

**DATA TRANSMISSION AND TELEMETRY**

Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation. Methods of Data Transmission – General Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram)

### **Learning Outcomes:**

At the end of the unit student will be able to

- Understand the concepts of different modulations and compare different types of modulations in telemetry system.
- Know about the various telemetry systems and basic operation of Data acquisition systems.
- Distinguish between pulse code and amplitude modulation techniques
- Distinguish between analog and digital Data Acquisition Systems

### **UNIT-III:**

#### **SIGNAL ANALYZERS**

Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

### **Learning Outcomes:**

At the end of the unit student will be able to

- Understand the principles of Wave Analyzers.
- Demonstrate the applications of Wave Analyzers.
- Be able to distinguish between harmonic and spectral wave analyzers
- Distinguish between peak, rms, impedance and Q-factor meters

### **UNIT-IV:**

#### **TRANSDUCERS**

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes.

### **Learning Outcomes:**

At the end of the unit student will be able to

- Understand the working principle, characteristics of various transducers
- Understand about applications of various transducers
- Distinguish between Resistive, Inductive and Capacitive transducers
- Distinguish between Piezo electric and Photo electric transducers
- Know about use of various transducers in different electrical field applications.



## **UNIT-V:**

### **MEASUREMENT OF NON-ELECTRICAL QUANTITIES**

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow, Liquid level

#### **Learning Outcomes:**

At the end of the unit student will be able to

- Learn about measurement the various non-electrical quantities such as pressure, temperature, displacement, velocity
- Understand the concepts of measuring of various non-electrical quantities
- Know about liquid level measurement
- Know about force and torque measurements
- Know the applications of transducers in various industries

#### **Course Outcomes:**

To know about

- Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques
- Various telemetry systems and basic operation of Data acquisition systems
- Various measuring meters and signal analyzers
- Transducers and their measurement of electrical and non-electrical quantities
- The application of the above as a prerequisite topics to SCADA in power systems, state estimation theory, etc.

#### **TEXT BOOKS:**

1. D.V.S Murthy, "Transducers and Instrumentation Prentice Hall of India",2004.
2. A.K.Sawhney, "A course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co.,2012.

#### **REFERENCE BOOKS:**

1. H.S.Kalsi "Electronic Instrumentation", Tata MCGraw-Hill Edition, 3<sup>rd</sup> edition.,2010.
2. A.D Helfrick and W.D.Cooper,Modern "Electronic Instrumentation and Measurement techniques" Pearson/Prentice Hall of India.,1990.
3. T. R. Padmanabhan, "Industrial Instrumentation – Principles and Design Springer", 3<sup>rd</sup> re print, 2009.

(19A04602T) DIGITAL SIGNAL PROCESSING

PROFESSIONAL ELECTIVE-III

**Course Objectives:**

- To provide background and fundamental material for the analysis and processing of digital signals.
- To familiarize the relationships between continuous-time and discrete time signals and systems.
- To study fundamentals of time, frequency and Z-plane analysis and to discuss the inter-relationships of these analytic method.
- To study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications.
- To introduce a few real-world signal processing applications.
- To acquaint with DSP processor.

**UNIT- I:**

**Discrete Fourier Transform:** Discrete Fourier series, Properties of Discrete Fourier series, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT.

**Fast Fourier Transforms:** Efficient computation of DFT algorithms - Radix 2-Decimation-in-Time & Decimation-in-Frequency algorithms, Inverse FFT, Illustrative problems.

**Learning Outcomes:**

At the end of the unit student will be able to

- Understand the concept of DFT and its properties.(L1)
- Find N-Point DFT/FFT for a given signal/sequence.(L2)

**UNIT- II:**

**IIR Digital Filters:** Review of analog filter design, Frequency transformation in the analog and digital domains, Design of IIR filters from Analog filters – Approximation of derivatives, Impulse invariance, Bilinear transformation, Design of Butterworth, Chebyshev filters, Illustrative problems.

**Realization of IIR Systems:** Structures for IIR systems–Direct form I& Direct form II, Transposed, Cascade form, Parallel form and Lattice structures, Signal flow graphs.

**Learning Outcomes:**

At the end of the unit student will be able to

- Understands signal flow graph and block diagram representations of difference equations that realize digital filters(L1)
- Realization of different structures for IIR filters(L2)
- Design of IIR filters using different techniques. (L4)

### **UNIT- III:**

**FIR Digital Filters:** Linear phase FIR filter, characteristic response, location of zeros, Design of FIR filter using Windowing Techniques - Rectangular, Hanning, Hamming, Kaiser, Bartlett, Blackman, Design of FIR filter by Frequency sampling technique, Illustrative problems.

**Realization of FIR Systems:** Structures for FIR systems - Direct form, Cascade form and Lattice structures. Comparison of FIR and IIR filters.

### **Learning Outcomes:**

At the end of the unit student will be able to

- Understand the concept of FIR filter(L1)
- Realization of different structures for FIR filters(L2)
- FIR filter design based on windowing methods.(L4)
- Compare FIR and IIR filters (L5)

### **UNIT -IV:**

**Architectures for Programmable DSP Devices:** Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues.

### **Learning Outcomes:**

At the end of the unit student will be able to

- Recognize the fundamentals of fixed and floating point architectures of various DSPs.(L1)
- Learn the architecture details and instruction sets of fixed and floating point DSPs.(L1)
- Illustrate the control instructions, interrupts, and pipeline operations.(L2)

### **UNIT- V:**

**Programmable Digital Signal Processors:** Introduction, Commercial Digital signal-processing Devices, Architecture of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control,

TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

### **Learning Outcomes:**

At the end of the unit student will be able to

- Illustrate the features of on-chip peripheral devices and its interfacing along with its programming details.(L2)
- Analyze and implement the signal processing algorithms in DSPs. (L3)

### **Course Outcomes**

- Understand the basic concepts of IIR and FIR filters, DSP building blocks to achieve high speed in DSP processor, DSP TMS320C54XX architecture and instructions.
- Compute the fast Fourier transforms and find the relationship with other transforms. Realization of digital filter structures.
- Design of FIR and IIR digital filters.
- Compare FIR and IIR filters.

### **TEXT BOOKS:**

1. John G. Proakis, Dimitris G. Manolakis, “Digital signal processing, principles, Algorithms and applications,” Pearson Education/PHI, 4th ed., 2007.
2. Avtar Singh and S. Srinivasan, “Digital Signal Processing,” Thomson Publications, 2004.

### **REFERENCES:**

1. Sanjit K Mitra, “Digital signal processing, A computer base approach,” Tata McGraw Hill, 3<sup>rd</sup> edition, 2009.
2. A.V.Oppenheim and R.W. Schaffer, & J R Buck, “Discrete Time Signal Processing,” 2<sup>nd</sup>, Pearson Education, 2012.
3. B. P. Lathi, “Principles of Signal Processing and Linear Systems,” Oxford Univ. Press, 2011.
4. B. Venkata Ramani and M.Bhaskar, “Digital Signal Processors, Architecture, Programming and Applications,” TMH, 2004.

**(19A02703d) APPLICATIONS OF POWER ELECTRONICS TO RENEWABLE ENERGY SOURCES (PEC-III)**

**Course Objectives:**

- To introduce certain areas for applications of Power Electronics in Renewable energy sources
- To understand about Power Quality issues and converters to be used in Renewable energy sources
- To introduce the concept of AC link Universal power converters
- To introduce high power electronic applications to Wind turbines
- To introduce the concept of electric air craft

**UNIT-I:**

**Introduction of certain Applications**

Introduction, Impact of power electronics in energy systems, challenges in power electronics to renewable energy systems, power electronics in energy, solar energy utilization, power electronics in wind energy utilization, power electronics for electric aircraft, power electronics in high power drive systems, high power electronic motor stand drives

**Learning Outcomes:**

At the end of the unit student will be able to

- To know about impact and challenges of Power Electronics to applications in Renewable Energy area
- To know about applications of Power Electronics in Solar Energy Systems
- To know about applications of Power Electronics in Wind Energy Systems
- To know about applications of Power Electronics in high power drive systems
- To know about applications of Power Electronics in electric aircrafts

**UNIT-II:**

**Power Quality and Converters**

AC-DC-AC Converters for Distributed Power Generation Systems & Power Quality problems:- Overview of Power Electronics Converters, Bidirectional AC-DC-AC Topologies, Filters, PWM for AC-DC-AC topologies, Control of converters, selection and sizing of the Converters, Matrix converter, and Multilevel Converters, Power Quality and Electromagnetic conservation, Power Quality Issues, Matting Methods and EMC related Phenomena in Electrical Power systems.

**Learning Outcomes:**

At the end of the unit student will be able to

- To know about Power Quality issues
- To know about AC-DC-AC converters for Distributed generation and Power Quality problems
- To understand about the selection and sizing of converters
- To know about the EMC and multi level converters
- To know about EMC applications in power systems

### **UNIT-III:**

#### **AC link Universal Power Converters**

Introduction, hard switching AC link universal power converter, soft switching AC link universal power converter, principle of operation of the soft switching AC link universal power converter, design procedure, analysis and applications

#### **Learning Outcomes:**

At the end of the unit student will be able to

- To know about advanced topic of AC link universal power converters
- To distinguish between soft and hard switching
- To know about principle of operation of soft switching converter
- To understand about analysis and design of UPC
- To know about applications of UPC

### **UNIT-IV:**

#### **High Power Electronics for Wind Turbines**

Power converters for wind turbines, power semiconductors for wind power converter, Power converters for Grid connected Wind Energy Conversion System and Grid connected Solar Energy Converter systems, Hybrid Systems, Types of Cogeneration processes.

#### **Learning Outcomes:**

At the end of the unit student will be able to

- To understand about high power drives for wind turbines
- To understand about high power drives for solar systems
- To distinguish between grid connected and off-grid connected systems
- To know about hybrid drive systems
- To know about co-generation processes

### **UNIT-V:**

#### **Power Electronics for More Electric Aircraft**

Introduction, electric aircraft, electric engine, electric power generation strategies, power electronics and power conversion, power distribution

### **Learning Outcomes:**

At the end of the unit student will be able to

- To get exposed to the concept of electric aircraft used in aerospace applications
- To know about electric engine used in electric aircraft
- To understand about power generation strategies in aircraft
- To know about applications of power electronics in electric aircraft
- To know about power distribution in electric aircraft

### **Course Outcomes:**

- To identify specific applications of Power Electronics in certain alternate sources
- To understand about Power Quality problems as applied to Power Systems and the converters to be used
- To learn about analysis of UPC and its design and application
- To be able to understand designing of high power drives for wind turbines
- To get exposed to principle of electric aircraft and applications of power converters to it

### **TEXT BOOKS:**

1. Kamal Al-Haddad, Mariusz Malinowski, Haitham Abu-Rub “Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications”, Wiley Publishers, 2014.

### **REFERENCE BOOKS:**

1. Ewald F. Fuchs, Mohammad A.S. Masoum, “Power Conversion of Renewable Energy Systems”, Springer, 2012
2. Mukund R. Patel, “Wind and Solar Power Systems: Design, Analysis, and Operation”, 2<sup>nd</sup> edition, Taylor & Francis, 2006

(19A01704a) AIR POLLUTION AND CONTROL  
OPEN ELECTIVE-III

**Course Objectives:**

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipments
- To identify the sources of noise pollution and their controlling methods

**UNIT I**

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the character of atmospheric pollutants and their effects

**UNIT II**

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Understand the composition and structure and structure of atmosphere
- To understand the maximum mixing depth and windrose diagram

**UNIT III**

General characteristics of stack emissions, plume behaviour, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO<sub>2</sub>, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

**Learning Outcomes:**

After completing this Unit, students will be able to



- To know about the general characteristics of stack emissions and their behavior
- To understand the monitoring of particulate matter and gaseous pollutants

#### **UNIT IV**

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

##### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the various air pollution control equipments

#### **UNIT V**

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

##### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the noise sources, mapping, prediction equations etc.,

##### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Identify the sources of air pollution
- Understand the composition and structure and structure of atmosphere.
- Know about the general characteristics of stack emissions and their behavior
- Know about the general characteristics of stake emission and their behavior
- Know about the noise sources, mapping, prediction equations etc.,

#### **REFERENCES:**

1. WarkK ., Warner C.F., and Davis W.T., “Air Pollution - Its Origin and Control”, Harper & Row Publishers, New York.
2. Lee C.C., and Lin S.D., “Handbook of Environmental Engineering Calculations”, McGraw Hill, New York.
3. Perkins H.C., “Air Pollution”, McGraw Hill.
4. Crawford M., “Air Pollution Control Theory”, TATA McGraw Hill.
5. Stern A.C., “Air Pollution”, Vol I, II, III.
6. Seinfeld N.J., “Air Pollution”, McGraw Hill.
7. Stern A.C. Vol. V, “Air Quality Management”.
8. M N Rao and HVN Rao, “Air Pollution” Tata McGraw Hill publication

(19A01704b) **BASICS OF CIVIL ENGINEERING**  
**OPEN ELECTIVE-III**

**Course Objectives:**

- To identify the traditional materials that are used for building constructions
- To know the principles of building planning
- To know the causes of dampness in structures and its preventive measures
- To know about the low cost housing techniques
- To know the basic principles of surveying

**UNIT I**

Traditional materials: Stones- Types of stone masonry -Brick-types of brick masonry- lime Cement – Timber – Seasoning of timber - their uses in building works

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the characteristics of different building materials.

**UNIT II**

Elements of building planning- basic requirements-orientation-planning for energy efficiency-planning based on utility-other requirements.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To understand the principles of planning in buildings

**UNIT III**

Dampness and its prevention: Causes of dampness- ill effects of dampness-requirements of an ideal material for damp proofing-materials for damp proofing –methods of damp proofing.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the causes of dampness in buildings and its ill effects
- To know about the general characteristics of ideal material for damp proofing

## **UNIT IV**

Cost effective construction techniques in mass housing schemes: Minimum standards – Approach to cost effective mass housing schemes- cost effective construction techniques.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the various cost effective techniques in mass housing schemes.

## **UNIT V**

Introduction to Surveying: Object and uses of surveying- Primary divisions in surveying- Fundamental principles of surveying- Classification of surveying-plans and maps-scales-types of graphical scales- units and measurements

### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the objects of surveying and its classification.

### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Identify the traditional building materials that are used in building construction.
- Plan the buildings based on principles of planning.
- Identify the sources of dampness and its ill effects on buildings and its prevention.
- Know the cost effective construction in mass housing schemes.
- Know the importance of surveying in planning of the buildings.

### **Text books:**

1. S.S.Bhavikatti, “Basic civil engineering”, New age international publishers.
2. S.S.Bhavikatti, “Building Construction:”, Vikas Publishing house, New Delhi.
3. G.C.Sahu and Joygopal jena, “Building materials and Construction”, McGraw Hill Education.

### **Reference books:**

1. N.Subramanian, “Building Materials testing and sustainability”, Oxford university press.

(19A03704a) FINITE ELEMENT METHODS  
OPEN ELECTIVE-III

**Course Objectives:**

- Familiarize basic principles of finite element analysis procedure.
- Explain theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, dynamic problem.
- Learn to model complex geometry problems and solution techniques.

**UNIT – I**

Introduction to finite element methods for solving field problems, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, The Rayleigh-Ritz method, Formulation of Finite Element Equations.

**One dimensional problems:** Finite element modeling coordinates and shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Understand the concept of nodes and elements.(12)
- Understand the general steps of finite element methods.(12)
- Understand the role and significance of shape functions in finite element formulations (12)
- Formulate and solve axially loaded bar problems. (16)

**UNIT - II**

**Analysis of trusses:** Stiffness Matrix for plane truss element. Stress Calculations and Problems.

**Analysis of beams:** Element Stiffness Matrix for two noded, two degrees of freedom per node beam element and simple problems.

**Learning Outcomes:**

At the end of the unit, the student will be able to

- Explain the use of the basic finite elements for structural applications using truss and beam. (12)
- Formulate and analyze truss and beam problems. (16)

### UNIT - III

Finite element modeling of two dimensional stress analysis - constant strain triangles-quadrilateral element-treatment of boundary conditions. Estimation of load Vector, Stresses.Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.Two dimensional four noded Isoparametric elements and problems.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Explain the formulation of two – dimensional elements (Triangular and Quadrilateral Elements). (L2)
- Apply the formulation techniques to solve two – dimensional problems using triangle and quadrilateral elements. (L3)
- Formulate and solve axisymmetric problems.(L6)

### UNIT - IV

**Steady state heat transfer analysis:** One dimensional analysis of slab and fin, two dimensional analysis of thin plate.

Analysis of a uniform shaft subjected to torsion loading.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Explain the application and use of the Finite Element Methods for heat transfer problems. (L2)
- Formulate and solve heat transfer problems. (L6)
- Analyse the

### UNIT V

**Dynamic analysis:** Formulation of finite element model,element –mass matrices,evaluation of Eigen values and Eigen vectors for a stepped bar truss.

**3D Problems:**Finite Element formulation- Tetrahedron element-Stiffness matrix.

#### Learning Outcomes:

At the end of the unit, the student will be able to

- Understand problems involving dynamics using Finite Element Methods.
- Evaluate the Eigen values and Eigen Vectors for steeped bar.
- Develop the stiffness matrix for tetrahedron element.

## **Course Outcomes:**

Upon successful completion of this course you should be able to

- Understand the concepts behind variational methods and weighted residual methods in FEM.
- Identify the application and characteristics of FEA elements such as bars, beams, and isoparametric elements, and 3-D element.
- Develop element characteristic equation procedure and generation of global stiffness equation will be applied.
- Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
- Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow.

## **TEXT BOOKS**

1. Chandraputla, Ashok & Belegundu, "Introduction to Finite Element in Engineering", Prentice Hall.
2. S.S.Rao, "The Finite Element Methods in Engineering", 2<sup>nd</sup> Edition, Elsevier Butterworth - Heinemann 2011.

## **REFERENCE BOOKS**

1. J N Reddy, "An introduction to the Finite Element Method", McGraw – Hill, New York, 1993.
2. R D Cook, D S Malkus and M E Plesha, "Concepts and Applications of Finite Element Analysis", 3<sup>rd</sup> Edition, John Wiley, New York, 1989.
3. K J Bathe, "Finite Element Procedures in Engineering Analysis", Prentice-Hall, Englewood Cliffs, 1982.
4. T J R Hughes, "the Finite Element Method, Prentice", Hall, Englewood Cliffs, NJ, 1986.
5. C Zienkiewicz and R L Taylor, "the Finite Element Method", 3<sup>rd</sup> Edition. McGraw-Hill, 1989.

(19A03704b) **PRODUCT MARKETING**  
**OPEN ELECTIVE-III**

**Course Objectives:**

- Introduce the basic concepts of Product marketing.
- Familiarize with market information systems and research
- Understand the nature and importance of industrial market
- Discuss the major stages in new product development
- Identify the factors affecting pricing decisions

**UNIT I:**

**Introduction (7 Hours)**

Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, Characteristics affecting Consumer behaviour, Types of buying decisions, buying decision process, Classification of consumer products, Market Segmentation Concept of Marketing Myopia. Importance of marketing in the Indian Socio economic system.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Define Marketing. (L1)
- Discuss marketing philosophies. (L2)
- Sketch the buying decision process. (L3)
- Understand the importance of marketing in the Indian socio economic system. (L2)

**UNIT II:**

**Marketing of Industrial Products (6 Hours)**

Components of marketing information system–benefits & uses marketing research system, marketing research procedure, Demand Estimation research, Test marketing, Segmentation Research - Cluster analysis, Discriminate analysis. Sales forecasting: objective and subjective methods. Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behavior, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Identify the components of marketing information system. (L2)
- List the advantages and uses of marketing research system. (L1)
- Demonstrate sales forecasting. (L3)
- Explain the major factors influencing industrial buying behaviour. (L2)

### **UNIT III:**

#### **Product Management And Branding (7 Hours)**

The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of ‘New – product; major stages in new – product development product life cycle. Branding: Reasons for branding, functions of branding features of types of brands, kinds of brand name.

#### **Learning Outcomes:**

At the end of this student, the student will be able to

- Identify the factors influencing change in product mix. (L2)
- Sketch various stages in product life cycle. (L2)
- Recall the features of a product and product policies. (L1)
- Demonstrate on features, functions and reasons of branding. (L3)

### **UNIT IV:**

#### **Pricing And Pacakaging (7Hours)**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions Labeling: Types, functions advantages and disadvantages, Packaging: Meaning, growth of packaging, function of packaging, kinds of packaging.

#### **Learningt Outcomes:**

At the end of this student, the student will be able to

- List the factors affecting pricing decisions. (L1)
- Explain the procedure for price determination. (L2)
- Employ Pricing strategies and decisions. (L3)
- Understand the functions of labelling and packaging. (L2)

### **UNIT V:**

#### **Product Promotion (6Hours)**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions. Advertising and sales



promotion: Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. Personal Selling : Objectives of personal selling, qualities of good salesman, types of salesman, major steps in effective selling

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Discuss the procedures for price determination. (L2)
- Explain the objectives of advertisement function of advertising. (L2)
- List the advantages and disadvantages of advertising. (L1)
- Describe the major steps in effecting selling. (L2)

### **Course Outcomes:**

At the end of the course, the student will be able to

- Understand basic marketing management concepts and their relevance to business development. (L2)
- Prepare a questionnaire for market research. (L5)
- Design marketing research plan for business organizations. (L5)
- Optimize marketing mix to get competitive advantage. (L4)

### **Text Books:**

1. Philip Kotler, “Principles of Marketing”, Prentice – Hall.
2. Philip Kotler, “Marketing Management”, Prentice – Hall.

### **Reference Books:**

1. Wiliam J Stanton, “Fundamentals of Marketing”, McGraw Hill
2. R.S.N. Pillai and Mrs.Bagavathi, “Marketing”, S. Chand & Co. Ltd
3. Rajagopal, “Marketing Management Text & Cases”, Vikas Publishing House

**(19A04704a) INTRODUCTION TO MICROCONTROLLERS & APPLICATIONS**  
**OPEN ELECTIVE-III**

**Course Objectives:**

This course will enable students to:

- Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
- Write 8051 Assembly level programs using 8051 instruction set.
- Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051.

**UNIT – I**

**8051 Microcontroller:**

Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the importance of Microcontroller and acquire the knowledge of Architecture of 8051 Microcontroller. (L1)
- Analyze interface required memory of RAM & ROM. (L3)

**UNIT – II**

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Explain different types instruction set of 8051. (L1)
- Develop the 8051 Assembly level programs using 8051 instruction set. (L3)

**UNIT – III**

**8051 Stack, Stack and Subroutine instructions.** Simple Assembly language program examples to use subroutine instructions. 8051 Timers and Counters – Operation and

Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Describe Stack and Subroutine of 8051. (L1)
- Design Timer /counters using of 8051. (L4)

### **UNIT –IV**

**8051 Serial Communication-** Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.**8051 Interrupts.** 8051 Assembly language programming to generate an external interrupt using a switch.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Acquire knowledge of Serial Communication and develop serial port programming. (L1)
- Develop an ALP to generate an external interrupt using a switch. (L3)

### **UNIT – V**

8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Apply and Interface simple switches, simple LEDs, ADC 0804 and LCD to using 8051 I/O ports. (L2)
- Design Stepper Motor and f motor interfacing of 8051. (L4)

### **Course outcomes:**

- Understand the importance of Microcontroller and Acquire the knowledge of Architecture of 8051 Microcontroller.
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
- Develop the 8051 Assembly level programs using 8051 instruction set.
- Design the Interrupt system, operation of Timers/Counters and Serial port of 8051.

**TEXT BOOKS:**

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; “The 8051 Microcontroller and Embedded Systems – using assembly and C”, PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson/Cengage Learning.

**REFERENCE BOOKS:**

1. Manish K Patel, “The 8051 Microcontroller Based Embedded Systems”, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE) – IV-I Sem** **L T P C**  
**3 0 0 3**  
**(19A04704b) PRINCIPLES OF DIGITAL SIGNAL PROCESSING**  
**OPEN ELECTIVE-III**

**Course Objectives:**

- To explain about signals and perform various operations on it.
- To understand discrete time signals and systems.
- To solve Laplace transforms and z-transforms for various signals.
- To find Discrete Fourier Transform of a sequence by using Fast Fourier Transform.
- To design and realize IIR and FIR filters.

**UNIT- I:**

**INTRODUCTION TO SIGNALS**

Classification of Signals: Analog, Discrete, Digital, Deterministic & Random, Periodic & Aperiodic, Even & Odd, Energy & Power signals. Basic operations on signals: Time shifting, Time scaling, Time reversal, Amplitude scaling and Signal addition. Elementary Signals: Unit step, Unit ramp, Unit parabolic, Impulse, Sinusoidal function, Exponential function, Gate function, Triangular function, Sinc function and Signum function.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Define basic signals and its operations, Classify discrete time signals and systems. (L1)
- Understand various basic operations on signals (L1)

**UNIT – II:**

**DISCRETE TIME SIGNALS AND SYSTEMS**

**Discrete Time Signals:** Elementary discrete time signals, Classification of discrete time signals: power and energy signals, even and odd signals. Simple manipulations of discrete time signals: Shifting and scaling of discrete-time signals.

**Discrete Time Systems:** Input-Output description of systems, Block diagram representation of discrete time systems, Linear Constant Coefficient Difference Equations, Classification of discrete time systems: linear and nonlinear, time-invariant and variant systems, causal and non causal, stable and unstable systems.

**Learning Outcomes:**

At the end of this student, the student will be able to

- Define basic signals and its operations, Classify discrete time signals and systems. (L1)
- Understand various basic operations on signals (L1)

### **UNIT- III:**

#### **LAPLACE TRANSFORMS AND Z- TRANSFORMS**

**Laplace Transforms:** Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of Region of Convergence (ROC), Constraints on ROC for various classes of signals, Properties of Laplace transforms.

**Z-Transforms:** Concept of Z-transform of a discrete sequence, Region of convergence in Z-Transform, constraints on ROC for various classes of signals, inverse Z-transform, properties of Z-Transforms.

#### **Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the basic concepts of Laplace and Z transforms (L1)
- Apply the transform techniques to solve the problems (L2)

### **UNIT – IV:**

#### **FAST FOURIER TRANSFORMS**

Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Radix-2 Fast Fourier Transforms (FFT), Decimation in Time and Decimation in Frequency FFT Algorithms: radix-2 DIT-FFT, DIF-FFT, and Inverse FFT: IDFT-FFT.

#### **Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the importance of DTFT, DFT, FFT and their inverse transforms with respect to signals and systems (L1)
- Analyze the Decimation in time and frequency algorithms (L3)

### **UNIT – V:**

#### **IIR AND FIR DIGITAL FILTERS**

**IIR DIGITAL FILTERS:** Analog filters approximations: Butterworth and Chebyshev, Design of IIR digital filters from analog filters. Realization of IIR filters: Direct form-I, Direct form-II, cascade form and parallel form.

**FIR DIGITAL FILTERS:** Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques: Rectangular window, Triangular or Bartlett

window, Hamming window, Hanning window, Blackman window. Realization of FIR filters: Linear phase and Lattice structures.

### **Learning Outcomes:**

At the end of this student, the student will be able to

- Understand the importance of IIR and FIR digital Filters (L1)
- Realize IIR filters and analyze various windowing techniques in FIR filters (L2)
- Design IIR and FIR filters (L4)

### **Course outcomes:**

- Define basic signals and its operations, Classify discrete time signals and systems.
- Solve Laplace Transform and z-Transform for various signals, Calculate DFT of a given sequence by using Fast Fourier Transform.
- Analyze the continuous and discrete signals and systems
- Design and realize IIR and FIR filters from the given specifications.

### **TEXT BOOKS:**

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 2008.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications", 4<sup>th</sup> edition , Pearson Education/PHI, 2007.
3. A.V. Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", 2<sup>nd</sup> edition., PHI.

### **REFERENCES:**

1. A.V. Oppenheim, A.S. Will sky and S.H. Nawab, "Signals and Systems", PHI, 2<sup>nd</sup> Edition, 2013.
2. A. Anand Kumar, "Signals and Systems", PHI Publications, Third Edition, 2013
3. P. Ramesh Babu. "Digital Signal Processing".
4. Andreas Antoniou, "Digital signal processing", Tata McGraw Hill, 2006.
5. R S Kaler, M Kulkarni,, Umesh Gupta, "A Text book on Digital Signal processing" –I K International Publishing House Pvt. Ltd.
6. M H Hayes, Schaum's Outlines, "Digital Signal Processing", Tata Mc-Graw Hill, 2007.

**(19A05704a) FUNDAMENTALS OF GAME DEVELOPMENT**

**(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Get familiarized with the various components in a game and game engine.
- Explore the leading open source game engine components.
- Elaborate on game physics.
- Introduce to the game animation.
- Expose to network-based gaming issues.

**Unit – 1: Introduction to Game**

What is a Game? The Birth of Games, The Rise of Arcade Games, The Crash and Recovery, The Console Wars, Online Games and Beyond.

**The Game Industry:** Game Industry Overview, Game Concept Basics, Pitch Documentation, pitching a Game to a Publisher, Managing the developer-Publisher Relationship, Legal Agreements, Licenses, Console Manufacturers Approval.

**Roles on the Team:** Production, Art, Engineering, Design, Quality Assurance Testing, Team Organization, Corporate.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Demonstrate online games and beyond. [L2]
- Outline the process carried out in the Game Industry [L2]
- Inspect the roles on the Team[L4]

**Unit – 2: Teams**

Project Leadership, Picking Leads, Team Building, Team Buy-in and Motivation.

**Effective Communication:** Written Communication, Oral Communication, Nonverbal Communication, Establishing Communication Norms, Communication Challenges.

**Game Production Overview:** Production Cycle, Preproduction, Production, Testing, Postproduction.

**Learning Outcomes:**

After completing this Unit, students will be able to



- Build a team and pick a leader. [L6]
- Develop Effective communication. [L3]
- Outline the Game Production cycle [L2]

### **Unit – 3: Game Concept**

Introduction, Beginning the Process, Defining the Concept, Game Programming Basics, Prototyping, Risk Analysis, Pitch Idea, Project Kickoff.

**Characters, setting, and Story:** Story Development, Gameplay, Characters, Setting, Dialogue, Cinematics, Story Documentation.

**Game Requirements:** Define Game Features, Define Milestones and Deliverables, Evaluate Technology, Define Tools and Pipeline, Documentation, Approval, Game Requirements Outline

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Design a game. [L6]
- Demonstrate the game play. [L2]
- Identify the Game requirements [L3]

### **Unit – 4 : Game Plan**

Dependencies, Schedules, Budgets, Staffing, Outsourcing, Middleware, Game Plan Outline.

**Production Cycle:** Design Production Cycle, Art Production Cycle, Engineering Production Cycle, Working Together.

**Voiceover and Music:** Planning for Voiceover, choosing a Sound Studio, Casting Actors, Recording Voiceover, Voiceover Checklist, Planning for Music, Working with a Composer, Licensing Music.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the Game plan. [L2]
- Define the production cycle. [L1]
- Make use of voiceover and music in game development. [L3]

### **Unit – 5 :Localization**

Creating International Content, Localization-Friendly Code, Level of Localization, Localization Plan, Testing, Localization Checklist.

**Testing and Code Releasing:** Testing Schedule, Test Plans, Testing Pipeline, Testing Cycle, External Testing, Determining Code Release, Code Release Checklist, Gold Masters, Postmortems.

**Marketing and Public Relations:** Software Age Ratings, Working with Marketing, Packaging, Demos, Marketing Assets, Game Builds, Working with Public Relations, Asset Deliverable Checklist.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Explain the importance of localization. [L2]
- Summarize Testing and code releasing [L2]
- Illustrate Marketing and public relations. [L2]

**Course Outcomes:**

Upon completion of the course, the students should be able to:

- Design games for commercialization (L6)
- Predict the trends in game development (L5)
- Design Game Plan and production cycle (L6)
- Dramatize the game playing environment (L4)

**Text Book:**

1. Heather Maxwell Chandler, and Rafael Chandler, “Fundamentals of Game Development”, Jones& Bartlett Learning, 2011.

**References:**

1. Flint Dille and John Zuur Platten, The Ultimate guide to Video Game Writing, Loan Eagle publisher, 2008.
2. Adams, Fundamentals of Game Design, 3<sup>rd</sup> edition, Pearson Education India, 2015.

**(19A05704b) CYBER SECURITY**  
**(Common to CSE & IT)**

**Course Objectives:**

This course is designed to:

- Understand essential building blocks and basic concepts of cyber security
- Explore Web security and Network security
- Explain the measures for securing the networks and cloud
- Understand privacy principles and policies
- Describe the legal issues and ethics in computer security

**UNIT I**

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography.

Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security[L2]
- Interpret the design of the malicious code [L2]

**UNIT II**

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the attacks on browser, Web and email. [L2]
- Explain the security aspects of Operating Systems. [L3]

**UNIT III**

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses:

Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management .

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Identify the network security threats and attacks. [L3]
- Design the Counter measures to defend the network security attacks. [L6]
- Analyze the security tools and techniques for Cloud computing [L4]

### **UNIT IV**

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed.

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. [L2]
- Explain how to handle incidents and deal with Disaster. [L2]

### **UNIT V**

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Adapt legal issues and ethics in computer security. [L6]
- Elaborate on the Emerging topics. [L6]

### **Course Outcomes:**

Upon completion of the course, the students should be able to:

- Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection (L2)

- Assess the vulnerabilities and threats posed by criminals, terrorist and nation state to national infrastructure (L5)
- Identify the nature of secure software development and operating systems (L3)
- Demonstrate the role security management in cyber security defense (L2)
- Adapt the legal and social issues at play in developing solutions. (L6)

**Text Books:**

- 1) Pfleeger, C.P., Security in Computing, Prentice Hall, 2010, 5th edition.
- 2) Schneier, Bruce. Applied Cryptography, Second Edition, John Wiley & Sons, 1996

**Reference Books:**

- 1) Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice, McGraw-Hill, 2013.
- 2) Whitman, Michael E. and Herbert J. Mattord. Roadmap to Information Security for IT and Infosec Managers. Boston, MA: Course Technology, 2011.

**(19A27704a) CORPORATE GOVERNANCE IN FOOD INDUSTRIES**  
**OPEN ELECTIVE III**

**PREAMBLE**

This text focuses on corporate governance, business ethics and emerging trends in food industries.

**Course Objectives**

- To understand the concepts of corporate governance in view of food industry

**UNIT – I**

Corporate Governance- A Conceptual Foundation: Concept, nature, issues and importance of corporate governance, origin and development of corporate governance, concept of corporate management, Different models of corporate governance, corporate governance in family business, corporate governance failure with examples.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Concept, nature, issues and importance of corporate governance
- origin and development of corporate governance, concept of corporate management
- Different models of corporate governance
- corporate governance in family business, corporate governance failure with examples

**UNIT – II**

Role Players: Role of various players viz. Role of shareholders their rights and responsibilities, Role of board of directors in corporate governance- executive and non executive directors, independent and nominee directors, Role of Auditors, audit committee, media.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Role of shareholders their rights and responsibilities
- Role of board of directors in corporate governance- executive and non executive directors, independent and nominee directors
- Role of Auditors, audit committee, media.

**UNIT – III**

Corporate governance in India and the Global Scenario: Corporate Governance practices /codes in India, UK, Japan, USA. Contributions of CII-recommendations on corporate governance by different committees in India, SEBI guidelines, Kumar Manglam Birla Committee, Naresh Chandra committee Report, OECD Principles, Cadbury Committee

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Corporate Governance practices /codes in India, UK, Japan, USA.
- Contributions of CII-recommendations on corporate governance by different committees in India, SEBI guidelines,
- Have detail study of committees like Kumar Manglam Birla Committee, Naresh Chandra committee Report, OECD Principles, Cadbury Committee

## **UNIT – IV**

Emerging trends: Emerging Trends and latest developments in Corporate Governance. Corporate Governance initiative in India and Abroad, Corporate Governance Rating- Role of rating agencies in corporate governance. ICRA Corporate governance rating method for examining the quality and effectiveness of corporate governance.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Emerging Trends and latest developments in Corporate Governance.
- Corporate Governance initiative in India and Abroad,
- Corporate Governance Rating- Role of rating agencies in corporate governance
- ICRA Corporate governance rating method for examining the quality and effectiveness of corporate governance.

## **UNIT – V**

Business ethics and corporate governance. Social responsibility and corporate governance. Corporate governance and value creation. Political economy of corporate governance.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Business ethics and corporate governance.
- Social responsibility and corporate governance.
- Corporate governance and value creation.
- Political economy of corporate governance.

## **Course Outcomes:**

By the end of the course, the students will

- Attain knowledge on system of corporate governance in food industries.
- Get to know about business ethics and values.

## **TEXT BOOKS**

1. Subhash Chandra Das, “Corporate Governance in India”, PHI Pvt. Ltd., New Delhi(2008),
2. Dennis Campbell, “Susan Woodley TrendsandDevelopments In Corporate Governance”. (2004)

## **REFERENCES**

1. Jayati Sarkar. “Corporate Governance in India”. Sage Publications, New Delhi,2012.
2. Vasudha, Joshi “Corporate Governance The Indian Scenario”. Foundations Books Pvt. Ltd. New Delhi. 2012,



**(19A27704b) PROCESS TECHNOLOGY FOR CONVENIENCE & RTE FOODS**  
**OPEN ELECTIVE III**

**PREAMBLE**

This text focuses on various aspects and technologies involved in processing of convenience and Read-to-eat foods.

**Course Objectives:**

- To understand the importance and demand for convenience foods in present day scenario
- To learn the various technical aspects of convenience and Read-to-eat foods.

**UNIT – I**

Overview of grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes Coated grains-salted, spiced and sweetened Flour based snack– batter and dough based products; savoury and farsans; formulated chips and wafers, papads.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Role of cereal based ingredients in snacks industries.
- Various technologies and equipments involved in Snacks industries

**UNIT – II**

Technology for fruit and vegetable based snacks: chips, wafers, papads etc. Technology of ready to eat fruits and vegetable based food products like, sauces, fruit bars, glazed candy etc. Technology of ready to eat canned value added fruits/vegetables and mixes and ready to serve beverages etc.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Role of Fruits and vegetables in convenience products.
- Processing of various Fruit and vegetable based products.

**UNIT – III**

Technology of ready- to- eat baked food products, drying, toasting roasting and flaking, coating, chipping. Extruded snack foods: Formulation and processing technology, colouring, flavouring and packaging. Technology for coated nuts – salted, spiced and sweetened products- chikkis, Sing bhujia.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Various methods involved in processing of ready to eat baked products
- Various methods involved in processing of extruded snack foods
- Technology involved in processing different coated nuts

### **UNIT IV**

Technology for ready-to-cook food products- different puddings and curried vegetables etc. Technology for ready-to-cook and ready to eat meat and meat food products. Technology for preparation of instant cooked rice, carrot and other cereals based food products.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Technology involved in processing different ready to cook food products
- Technology involved in processing different ready to cook and ready to eat meat and meat products
- Technology involved in processing different instant cooked cereal products

### **UNIT – V**

Technology of ready to eat instant premixes based on cereals, pulses etc. Technology for RTE puffed snack- sand puffing, hot air puffing, explosion puffing, gun puffing etc. Technology for preparation of traditional Indian dairy products.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Technology involved in processing different ready to eat instant premixes based on cereals and pulses and etc.
- Technology involved in processing different RTE puffed snacks
- Technology involved in processing different traditional dairy products

### **Course Outcomes:**

By end of the course students will understand

- Technology for processing ready to eat and ready cook different products and equipment used for manufacturing of RTE products

### **TEXT BOOKS**

1. Edmund WL. "Snack Foods Processing". AVI Publ.
2. Kamaliya M.K and Kamaliya K.B. 2001. Vol.1 and 2, "Baking Science and Industries", M.K.Kamaliya Publisher, Anand.

### **REFERENCES**

1. Frame ND . "Technology of Extrusion Cooking". Blackie Academic1994. .
2. Gordon BR. "Snack Food", AVI Publ, 1997.
3. Samuel AM. "Snack Food Technology", AVI Publ. 1976.

**(19A54704a) NUMERICAL METHODS FOR ENGINEERS**  
**OPEN ELECTIVE-III**  
**(ECE , CSE, IT & CIVIL)**

**Course objectives:**

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

**UNIT-I:**

**Solution of Algebraic & Transcendental Equations:**

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

**Learning Outcomes:**

Students will be able to

- Calculate the roots of equation using Bisection method and Iterative method.
- Calculate the roots of equation using Regula falsi method and Newton Raphson method.
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Siedal method.

**UNIT-II:**

**Curve Fitting**

Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.

**Learning Outcomes:**

Students will be able to

- understand curve fitting
- understand fitting of several types of curves

**UNIT-III:**

**Interpolation**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

### **Learning Outcomes:**

Students will be able to

- Understand the concept of interpolation.
- Derive interpolating polynomial using Newton's forward and backward formulae.
- Derive interpolating polynomial using Lagrange's formulae.
- Derive interpolating polynomial using Gauss forward and backward formulae.

### **UNIT-IV:**

#### **Numerical Integration**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

### **Learning Outcomes:**

Students will be able to

- Solve integral equations using Simpson's 1/3 and Simpson's 3/8 rule.
- Solve integral equations using Trapezoidal rule.

### **UNIT-V:**

#### **Solution of Initial value problems to Ordinary differential equations**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

### **Learning Outcomes:**

Students will be able to

- Solve initial value problems to ordinary differential equations using Taylor's method.
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods.

### **Course Outcomes:**

After the completion of course, students will be able to

- Apply numerical methods to solve algebraic and transcendental equations.
- Understand fitting of several kinds of curves.
- Derive interpolating polynomials using interpolation formulae.
- Solve differential and integral equations numerically.

**Text Books:**

3. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.
4. Ronald E. "Probability and Statistics for Engineers and Scientists", Walpole,PNIE.
5. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

**Reference Books:**

3. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier.

(19A51704a) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS

Course Objectives:

- To understand synthetic principles of Nanomaterials by various methods
- And also characterise the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

**Unit I:**

**Introduction:** Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

**Synthetic Methods: Bottom-Up approach:-** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Classify the nanostructure materials (L2)
- Describe scope of nano science and technology (L2)
- Explain different synthetic methods of nano materials (L2)
- Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material (L3)

UNIT-II

**Top-Down approach:-** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Describe the top down approach (L2)
- Explain aerosol synthesis and plasma arc technique (L2)
- Differentiate chemical vapour deposition method and electrodeposition method (L2)
- Discuss about high energy ball milling (L3)

### UNIT-III

**Techniques for characterization:** Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

#### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Discuss different techniques for characterization of nanomaterial (L3)
- Explain electron microscopy techniques for characterization of nanomaterial (L3)
- Describe BET method for surface area analysis (L2)
- Apply different spectroscopic techniques for characterization (L3)

### UNIT-IV

**Studies of Nano-structured Materials:** Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self-assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

#### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Explain synthesis and properties and applications of nanomaterials (L2)
- Discuss about fullerenes and carbon nanotubes (L3)
- Differentiate nanomagnetic materials and thermoelectric materials (L2)
- Describe liquid crystals (L2)

### UNIT.V

Engineering Applications of Nanomaterials

#### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Illustrate applications of nanomaterials (L2)
- Discuss the magnetic applications of nanomaterials (L3)



- list the applications of non-linear optical materials (L1)
- Describe the applications fullerenes, carbon nanotubes (L2)

### **Course Outcome**

At the end of the course, the student will be able to:

- Understand the state of art synthesis of nano materials
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
- Analyze nanoscale structure in metals, polymers and ceramics
- Analyze structure-property relationship in coarser scale structures
- Understand structures of carbon nano tubes

### **TEXT BOOKS:**

1. **NANO: The Essentials** : T Pradeep, McGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology**: B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

### **REFERENCE BOOKS:**

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures & Nanomaterials; Synthesis, Properties & Applications**: Guozhong Cao, Imperial College Press, 2007.
3. **Nanomaterials Chemistry**, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.

**HUMANITIES ELECTIVE-II**

**(19A52701a) ORGANISATIONAL BEHAVIOUR**

**Course Objectives :**

The objectives of this course are

- To make the student understand about the organizational behavior
- To enable them to develop self motivation, leadership and management
- To facilitate them to become powerful leaders
- Impart knowledge about group dynamics
- To make them understand the importance of change and development

**Syllabus**

**UNIT-I**

Organizational Behavior - Introduction to OB - Meaning and definition, scope - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning - Personality Types

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of Organizational Behavior
- Contrast and compare Individual & Group Behavior and attitude
- Analyze Perceptions
- Evaluate personality types

**UNIT-II**

Motivation and Leading - Theories of Motivation - Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory - Leading - Leading Vs Managing

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of Motivation
- Understand the Theories of motivation
- Explain how employees are motivated according to Maslow's Needs Hierarchy
- Compare and contrast leading and managing

**UNIT-III**

Leadership and Organizational Culture and Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management - Evaluating Leader - Women and Corporate leadership.

### **Learning Outcomes:**

After completion of this unit student will

- Know the concept of Leadership
- Contrast and compare Traits theory and Managerial Grid
- Know the difference between Transactional and Transformational Leadership
- Evaluate the qualities of good leaders
- Emerge as the good leader

### **UNIT – IV**

Group Dynamics - Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization – Conflict resolution

### **Learning Outcomes:**

After completion of this unit student will

- Know the concept of Group Dynamics
- Contrast and compare Group behavior and group development
- Analyze Group decision making
- Know how to resolve conflicts in the organization

### **UNIT - V**

Organizational Change and Development - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization’s change and development

### **Learning Outcomes:**

- After completion of this unit student will
- Know the importance of organizational change and development
- Apply change management in the organization
- Analyze work stress management
- Evaluate Managerial implications of organization

### **Course outcomes:**

At the end of the course, students will be able to

- Understand the nature and concept of Organizational behavior

- Apply theories of motivation to analyze the performance problems
- Analyze the different theories of leadership
- Evaluate group dynamics
- Develop as powerful leader

**TEXT BOOKS:**

1. Luthans, Fred, “Organisational Behaviour” , McGraw-Hill, 12 Th edition 2011
2. P Subba Rao, Organisational Behaviour, Himalya Publishing House 2017

**REFERENCES BOOKS:**

1. McShane, “Organizational Behaviour”, TMH 2009
2. Nelson, “Organisational Behaviour”, Thomson, 2009.
3. Robbins, P.Stephen, Timothy A. Judge, “Organisational Behaviour”, Pearson 2009.
4. Aswathappa, “Organisational Behaviour”, Himalaya, 2009

(19A52701b) MANAGEMENT SCIENCE

**Course objectives :**

The objectives of this course are

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

**Syllabus**

**UNIT- I**

**INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

**Learning Outcomes:**

At the end if the Unit, the learners will be able to

- Understand the concept of management and organization
- Apply the concepts & principles of management in real life industry.
- Analyze the organization chart & structure for an enterprise.
- Evaluate and interpret the theories and the modern organization theory.

**UNIT II**

**OPERATIONS MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques -

EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

### **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Understand the core concepts of Management Science and Operations Management
- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Evaluate Materials departments & Determine EOQ
- Analyze Marketing Mix Strategies for an enterprise.
- Create and design advertising and sales promotion

## **UNIT III**

### **HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

### **Learning Outcomes:**

At the end if the Unit, the learners will

- Understand the concepts of HRM in Recruitment, Selection, Training & Development
- Apply Managerial and operative Functions
- Analyze the need of training
- Evaluate performance appraisal
- Design the basic structure of salaries and wages

## **UNIT IV STRATEGIC & PROJECT MANAGEMENT**

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

## **Learning Outcomes:**

At the end of the Unit, the learners will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques
- Creative in completing the projects within given time

## **UNIT V**

### **CONTEMPORARY ISSUES IN MANAGEMENT**

The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

## **Learning Outcomes:**

At the end if the Unit, the learners will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in modern
- Analyze CRM, MRP, TQM
- Evaluate Six Sigma concept and SCM

## **Course Outcomes:**

At the end of the course, students will be able to

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

## **TEXT BOOKS:**

1. A.R Aryasri, "Management Science", TMH, 2013

2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

**REFERENCES:**

1. Koontz & Weihrich, "Essentials of Management", 6<sup>th</sup> edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.
4. Samuel C.Certo, "Modern Management", 9<sup>th</sup> edition, PHI, 2005



(19A52701c) BUSINESS ENVIRONMENT

**Course Objectives :**

The objectives of this course are

- To make the student understand about the business environment
- To enable them in knowing the importance of fiscal and monetary policy
- To facilitate them in understanding the export policy of the country
- Impart knowledge about the functioning and role of WTO
- Encourage the student in knowing the structure of stock markets

**Syllabus**

**UNIT – I**

**An Overview of Business Environment** – Types of Environment - Internal & External - Micro and Macro environment - Competitive structure of industries - Environmental analysis - Scope of business - Characteristics of business - Process & limitations of environmental analysis.

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of Business environment
- Explain various types of business environment
- Know about the environmental analysis of business
- Understand the business process

**UNIT – II**

**FISCAL POLICY** - Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - **MONETARY POLICY** - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends - Role of Finance Commission.

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of public revenue and public Expenditure
- Explain the functions of RBI and its role
- Analyze the Monetary policy in India
- Know the recent trends and the role of Finance Commission in the development of our country

- Differentiate between Fiscal and Monetary Policy

### **UNIT – III**

**INDIA'S TRADE POLICY** - Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - **BALANCE OF PAYMENTS** – Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the role of Indian international trade
- Understand and explain the need for Export and EXIM Policies
- Analyze causes for Disequilibrium and correction measure
- Differentiate between Bilateral and Multilateral Trade Agreements

### **UNIT – IV**

**WORLD TRADE ORGANIZATION** - Nature and Scope - Organization and Structure - Role and functions of WTO in promoting world trade - Agreements in the Uruguay Round – TRIPS, TRIMS, and GATT - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the role of WTO in trade
- Analyze Agreements on trade by WTO
- Understand the Dispute Settlement Mechanism
- Compare and contrast the Dumping and Anti-dumping Measures.

### **UNIT – V**

**MONEY MARKETS AND CAPITAL MARKETS** - Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - Stock Exchanges - Investor protection and role of SEBI.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the components of Indian financial system
- Know the structure of Money markets and Capital markets
- Analyze the Stock Markets

- Apply the knowledge in future investments
- Understand the role of SEBI in investor protection.

### **Course Outcomes:**

At the end of the course, students will be able to

- Understand various types of business environment.
- Understand the role of WTO
- Apply the knowledge of Money markets in future investment
- Analyze India's Trade Policy
- Evaluate fiscal and monetary policy
- Develop a personal synthesis and approach for identifying business opportunities

### **TEXT BOOKS:**

1. Francis Cherunilam (2009), "International Business": Text and Cases, Prentice Hall of India.
2. K. Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition. HPH 2016.

### **REFERENCE BOOKS:**

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

**Course objectives :**

The objectives of this course are

- To introduce the concepts of strategic management and understand its nature in
- competitive and organizational landscape
- To provide an understanding of internal and external analysis of a firm/individual
- To provide understanding of strategy formulation process and frame work
- Impart knowledge of Corporate culture
- Encourage the student in understanding SWOT analysis BCG Matrix

**Syllabus**

**UNIT: I**

**Introduction of Strategic Management:** meaning, nature, importance and relevance. The Strategic Management Process: – Corporate, Business and Functional Levels of strategy. Vision, mission and purpose –Business definition, objectives and goals – Stakeholders in business and their roles in strategic management. Balance scorecard.

**Learning Outcomes:**

After completion of this unit student will

- Understand the meaning and importance of strategic management
- Explain Strategic Management Process and Corporate, Business
- Know about the Business definition, objectives and goals
- Understand Stakeholders their roles in strategic management

**UNIT: II**

**External and Internal Analysis:** The Strategically relevant components of a Company's External Environment Analysis, Industry Analysis - Porter's Five Forces model – Industry driving forces – Key Success Factors. Analyzing a company's resources and competitive position

**Learning Outcomes:**

After completion of this unit student will

- Understand the components of a Company's environment
- Explain External Environment Analysis, Industry Analysis

- Know how to analyze industry competition through the Porter's Five Forces model
- Analyze Key Success Factors in a company's competitive position

### **UNIT: III**

**Competitive Strategies:** Generic Competitive Strategies: Low cost, Differentiation, Focus. Grand Strategies: Stability, Growth (Diversification Strategies, Vertical Integration Strategies, Mergers, Acquisition & Takeover Strategies, Strategic Alliances & Collaborative Partnerships), Retrenchment, Outsourcing Strategies. Tailoring strategy to fit specific industry – Life Cycle Analysis - Emerging, Growing, Mature & Declining Industries.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the Competitive Strategies
- Explain Stability, Growth Mergers, Acquisition & Takeover Strategies
- Know about the Retrenchment, Outsourcing Strategies
- Differentiate Life Cycle Analysis, Mature & Declining Industries

### **UNIT: IV**

**Strategy Implementation and control** - Strategy implementation; Organization Structure – Matching structure and strategy. Behavioral issues in implementation – Corporate culture – Mc Kinsey's 7s Framework. Functional issues – Functional plans and policies – Financial, Marketing, Operations, Personnel, IT.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the Organization Structure
- Explain Matching structure and strategy
- Know about the Corporate culture
- Analyze Functional plans and policies

### **Unit: V**

**Strategy Evaluation:** Strategy Evaluation – Operations Control and Strategic Control- Relationship between a Company's Strategy and its Business Model.- SWOT analysis – Value Chain Analysis – Benchmarking- Portfolio Analysis: BCG Matrix – GE 9 Cell Model.

#### **Learning Outcomes:**

After completion of this unit student will

- Understand the Operations Control and Strategic Control
- Explain Company's Strategy and its Business Model
- Know about the SWOT analysis

- Analyze BCG Matrix and GE 9 Cell Model

### **Course Outcomes:**

At the end of the course, students will be able to

- Understand the relevance and importance of strategic management
- Explain industry driving forces
- Analyze the competitive strategy
  
- Evaluate strategy implementation and control
- Create SWOT Analysis

### **Suggested Text Books and References**

#### **TEXT BOOKS:**

1. Arthur A. Thompson Jr., AJ Strickland III, John E Gamble, “Crafting and Executing Strategy”, 18th edition, Tata McGraw Hill, 2012.
2. Subba Rao P, “Business Policy and Strategic Management” –HPH

#### **REFERENCES:**

1. Robert A. Pitts & David Lei, “Strategic Management: Building and Sustaining Competitive Advantage” 4th edition, Cengage Learning.
2. Hunger, J. David, “Essentials of Strategic Management” 5<sup>th</sup> edition, Pearson.
3. Ashwathappa, “Business Environment for Strategic Management”, HPH.

**Course Objectives:**

- To provide knowledge on emerging concept on E-Business related aspect.
- To understand various electronic markets models which are trending in India
- To give detailed information about electronic payment systems net banking.
- To exact awareness on internet advertising, market research strategies and supply chain management.
- To understand about various internet protocols-security related concept.

**SYLLABUS**

**UNIT – I**

**Electronic Business:** Definition of Electronic Business - Functions of Electronic Commerce (EC) - Advantages of E-Commerce – E-Commerce and E-Business Internet Services Online Shopping-Commerce Opportunities for Industries.

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of E-Business
- Contrast and compare E-Commerce E-Business
- Analyze Advantages of E-Commerce
- Evaluate opportunities of E-commerce for industry

**UNIT – II**

**Electronic Markets and Business Models:**E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models-Business to Business(B2B)-Business to Customers(B2C)-Business to Government(B2G)-Auctions-B2B Portals in India

**Learning Outcomes:**

After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze Advantages of portals
- Explain the B2B,B2C and B2G model

## **UNIT – III**

**Electronic Payment Systems:** Digital Payment Requirements-Designing E-payment System-Electronic Fund Transfer (EFT)-Electronic Data Interchange (EDT)-Credit Cards-Debit Cards-E-Cash-Electronic Cheques -Smart Cards-Net Banking-Digital Signature.

### **Learning Outcomes:**

After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and EDT
- Analyze debit card and credit card
- Explain the on Digital signature

## **UNIT – IV**

**E-Security:** Internet Protocols - Security on the Internet –Network and Website Security – Firewalls –Encryption – Access Control – Secure Electronic transactions.

### **Learning Outcomes:**

After completion of this unit student will

- Understand E-Security
- Contrast and compare security and network
- Analyze Encryption
- Evaluate electronic transitions

## **UNIT – V**

**E-Marketing:** Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Online Market Research– Data mining and Marketing Research Marketing Strategy On the Web – E-Customer Relationship Management(e-CRM) –E- Supply Chain Management.(e-SCM) –New Trends in Supply Chain Management.

### **Learning Outcomes:**

After completion of this unit student will

- Understand the concept of online marketing
- Analyze advantages of online marketing
- Compare the e-CRM and e-SCM
- Explain the New trends in supply chain management



**Course Outcomes:**

- They will be able to identify the priority of E-Commerce in the present globalised world.
- Will be able to understand E-market-Models which are practicing by the organization
- Will be able to recognize various E-payment systems & importance of net banking.
- By knowing E-advertisement, market research strategies, they can identify the importance of customer role.
- By understanding about E-security, they can ensure better access control to secure the information.

**TEXT BOOKS:**

3. C.S.V Murthy “E-Commerce”, Himalaya publication house, 2002.
4. P.T.S Joseph, “E-Commerce”, 4<sup>th</sup> Edition, Prentice Hall of India 2011

**REFERENCES:**

5. KamaleshKBajaj,DebjaniNa, “E-Commerce”, 2<sup>nd</sup> Edition TataMcGrwHills 2005
6. Dave Chaffey – “E-Commerce E-Management”, 2<sup>nd</sup>Edition, Pearson, 2012.
7. Henry Chan, “E-Commerce Fundamentals and Application”, Raymond Lee,Tharm Wiley India 2007
8. S. Jaiswall “E-Commerce”, Galgotia Publication Pvt Ltd 2003.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– IV-I Sem** **L T P C**  
**0 0 3 1.5**  
**(19A02705) POWER SYSTEMS & SIMULATION LAB**

**Course Objectives:**

The objectives of this course include

- To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransient reactance's.
- To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
- To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
- To develop the SIMULINK model for single area load frequency problem.

**Course Outcomes:**

After completion of the course the student will able to

- Get the practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactance's. Get the practical knowledge on how to draw the equivalent circuit of three winding transformer.
- Get the knowledge on development of MATLAB program for formation of Y and Z buses.
- Get the knowledge on development of MATLAB programs for Gauss-Seidel and Fast Decouple Load Flow studies.
- Get the knowledge on development of SIMULINK model for single area load frequency problem.

**List of Experiments**

**CYCLE - I**

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. LG Fault Analysis on an un loaded alternator
3. LL Fault Analysis on conventional phases
4. LLG Fault Analysis
5. LLLG Fault Analysis
6. Determination of Sub transient reactance of silent pole synchronous machine
7. Equivalent circuit of three winding transformer.

**CYCLE – II**

8.  $Y_{Bus}$  formation using MATLAB
9.  $Z_{Bus}$  formation using MATLAB

10. Gauss-Seidel load flow analysis using MATLAB
11. Fast decoupled load flow analysis using MATLAB
12. Develop a Simulink model for a single area load frequency problem and simulate the same.

**Note: In Cycle-I at least four experiments to be conducted, In Cycle-II at least four programs to tested. Both the cycles put together at least 10 experiments must be carried out.**

(19A02706) MEASUREMENTS LAB

**Course Objective:**

This laboratory deals with the practical exercises for:

- Calibration of various electrical measuring instruments
- Accurate determination of inductance and capacitance using AC Bridges
- Measurement of coefficient of coupling between two coupled coils
- Measurement of resistance for different range of resistors using bridges

**Course Outcomes:**

At the end of the course, the student will be able to:

- Calibrate various electrical measuring instruments
- Accurately determine the values of inductance and capacitance using AC bridges
- Compute the coefficient of coupling between two coupled coils
- Accurately determine the values of very low resistances

**The following experiments are required to be conducted as compulsory experiments:**

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance
5. Determination of Coefficient of coupling between two mutually coupled coils
6. Schering Bridge & Anderson bridge
7. Measurement of 3-phase reactive power with single-phase wattmeter
8. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods

**In addition to the above eight experiments, atleast any two of the experiments from the following list are required to be conducted:**

9. Maxwell's bridge and DeSauty bridge
10. Calibration of LPF wattmeter – by Phantom loading
11. Wheatstone bridge – measurement of medium resistances
12. LVDT and capacitance pickup – characteristics and Calibration
13. Resistance strain gauge – strain measurement and Calibration
14. Transformer turns ratio measurement using AC Bridge
15. AC Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– IV-II Sem** **L T P C**  
**3 0 0 3**  
**(19A02801a) ELECTRICAL DISTRIBUTION SYSTEM AUTOMATION**  
**(PEC-IV)**

**Course Objectives:**

- To know about fundamental aspects of distribution system
- To understand principle of distribution substations
- To know about classification of various loads
- To understand difference between conventional load flow studies of power system and distribution system load flow
- To know about evaluation of voltage droop and power loss calculations
- To know about distribution automation and management system, SCADA

**UNIT-I:**

**DISTRIBUTION SYSTEM FUNDAMENTALS**

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

**Learning Outcomes:-**

After completion of this unit student will

- To understand various distribution system classifications
- To know more about primary feeders rating, types
- To know about substation location, bus schemes, etc.
- To know about factors effecting the primary feeder loading

**UNIT-II:**

**DISTRIBUTION SYSTEM SUBSTATIONS AND LOADS**

**Substations:** Rating of a distribution substation for square and hexagonal shaped distribution substation service area, K constant, Radial feeder with uniformly and non-uniformly distributed loading. **Loads:** Various types of loads, Definitions of various terms related to system loading, detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors.

### **Learning Outcomes:-**

After completion of this unit student will

- To know about uniformly distributed loading in distribution substations
- To know about non-uniform distributed loading in distribution substations
- To know about classification of various types of loading
- To understand about modelling of various types of loads and shunt capacitor

### **UNIT-III:**

#### **DISTRIBUTION SYSTEM LOAD FLOW**

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems

### **Learning Outcomes:-**

After completion of this unit student will

- To know about various distribution line models
- To know about step voltage regulator
- To know about line drop compensator
- To evaluate distribution load flow pattern using sweeping algorithms

### **UNIT-IV:**

#### **VOLTAGE DROP AND POWER LOSS CALCULATION**

Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, types of three-phase capacitor-bank connections, Economic justification for capacitors – Numerical problems

### **Learning Outcomes:-**

After completion of this unit student will

- To know about analysis of various distribution system configurations
- To know how to calculate percent power loss calculations
- To know about methods of calculating distribution feeder cost
- To understand about economic justification of capacitors
- To understand about installation of capacitors at various locations

### **UNIT-V:**

#### **DISTRIBUTION AUTOMATION**

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management, decision support applications, substation automation, control feeder automation, database structures and interfaces.

### **Learning Outcomes:-**

After completion of this unit student will

- To know about basic concept of automation of distribution systems
- To know about various distribution management /automation systems and functions
- To know about Supervisory Control And Data Acquisition System
- To know about automation of feeders, substations, etc.
- To understand about database structures and interfacing

### **Course Outcomes:**

- To understand basics of distribution systems and substations
- To understand about modelling of various loads
- To perform distribution load flow solutions
- To evaluate power loss and feeder cost
- To know the principles of SCADA, Automation distribution system and management

### **Text Books:**

3. William H. Kersting, "Distribution System Modelling and Analysis", CRC Press, Newyork, 2002.
4. Turan Gonen, "Electric Power Distribution System Engineering", McGraw-Hill Inc., New Delhi, 1986.

### **Reference Books:**

1. James Northcote-Green and Robert Wilson, "Control and automation of electrical power distribution systems", CRC Press (Taylor & Francis), New York, 2007.

**(PEC-IV)**

**Course Objectives:**

- To know about FPGA architecture features and fabrics
- To understand about FPGA based systems and basics of VLSI technology
- To learn about logic implementation and design aspects of FPGA
- To understand about performance analysis of sequential machines
- To learn about architectures and multi-FPGA large scale systems

**UNIT-I:**

**FPGA ARCHITECTURE AND FABRICS**

Programmable Logic Devices-Types-PLA, PAL, FPGA-architectures, SRAM-based FPGAs, Permanently Programmed FPGAs, Chip I/O. Circuit Design of FPGA Fabrics. Architecture of FPGA Fabrics.

**Learning Outcomes:**

After completion of this unit student will

- To know about basic programmable logic devices and types
- To learn about FPGA architecture
- To understand about permanently programmed FPGAs
- To learn about circuit design aspects of FPGA

**UNIT-II:**

**FPGA-BASED SYSTEMS AND VLSI TECHNOLOGY**

Introduction, Basic Concepts, Digital Design and FPGAs. FPGA-based system design. Manufacturing Processes, Deriving Transistor Characteristics, CMOS Logic Gates, Wires, Registers and RAM, Packages and Pads.

**Learning Outcomes:**

After completion of this unit student will

- To learn about basic concepts of FPGA based systems
- To know about digital design aspects of FPGA based systems
- To know about fundamentals of VLSI technology
- To learn about various CMOS logic gates
- To understand about structures of components of VLSI technology



### **UNIT-III:**

#### **COMBINATIONAL LOGIC**

The Logic Design Process. Hardware Description Languages, combinational network delay. Power and energy optimization, arithmetic logic, logic implementation for FPGAs. Physical Design for FPGAs. The Logic Design Process.

#### **Learning Outcomes:**

After completion of this unit student will

- To distinguish between HDL and VHDL
- To know about various delay specifications and combinational logic gates
- To know about classification and principles of various arithmetic logic gates
- To know about developing of logic implementation and synthesizing for FPGAs
- To learn about physical design aspects of FPGAs

### **UNIT-IV:**

#### **SEQUENTIAL MACHINES**

The sequential machine design process. Sequential design styles. Rules for Clocking. Performance Analysis. Power Optimization.

#### **Learning Outcomes:**

After completion of this unit student will

- To learn about design process of sequential logic machines
- To know and compare various sequential design processes
- To know about various rules for clocking using flip-flops, latches
- To distinguish between flip-flop based and latch based performance analysis of sequential machines
- To know about principles of power optimization in sequential logic machines

### **UNIT-V:**

#### **LARGE SCALE SYSTEMS**

Architectures and Large Scale Systems, Behavioral Design, Design Methodologies. Design Example. Buses, Platform FPGAs, Multi-FPGA Systems, Novel Architectures.

#### **Learning Outcomes:**

After completion of this unit student will

- To distinguish between Microprocessor based and large scale system based buses
- To identify various platforms for FPGAs
- To distinguish between single and multiple FPGA systems

- To learn about constraints, interconnecting and partitioning of multiple FPGA systems
- To know about novel architectures of sequential logic machine building and fabrics

**Course Outcomes:**

- To be able to understand about features of FPGA and its fabrics
- To understand and develop FPGA based systems and various logic gates of VLSI technology
- To understand about various combinational logic gates for implementation in FPGAs
- To understand and develop sequential logic machines and analyze the performance
- To be able to distinguish and develop single and multi FPGA systems

**TEXT BOOKS**

1. Wayne Wolf, “FPGA Based System Design”, Prentice Hall, 2004.
2. Wayne Wolf, “Modern VLSI Design”, Pearson Education 2002.

**REFERENCE BOOKS**

1. Michael D Ciletti, “Advanced Digital Design with verilog HDL”, Pearson Education 2005
2. Samir Palnitkar, “Verilog HDL”, Pearson Education 2005.
3. J Bhaskar, “A Verilog HDL Primer”, 2<sup>nd</sup> edition, B S Publications, 2007.
4. Kevin Skahill “VHDL for Programmable Logic”, Pearson Education, 2004

**(PEC-IV)**

**Course Objectives:**

- To get exposed to a few Intelligent Control Techniques
- To learn about Artificial Neural Network based Estimators
- To learn about Fuzzy Logic Control System as one of the ICT
- To learn about a few evolutionary algorithms
- To implement the various ICTs for linear and non-linear systems as case studies

**UNIT-I:**

**Fundamentals of AI**

AI trend in Engineering applications, Need for AI, Approaches to intelligent control; Architectures for intelligent control; Symbolic reasoning system; rule-based systems; Knowledge representation; Expert systems.

**Learning Outcomes:**

After completion of this unit student will

- To get exposed to fundamentals of AI
- To understand about architecture of Intelligent Control
- To understand about rule based systems
- To learn about knowledge representation and symbolic reasoning system
- To know about the concepts of expert systems

**UNIT-II:**

**ANN based Controllers and Estimators**

Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; simple perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron – Back Propagation algorithm; Learning and Training the neural network-Supervised and unsupervised learning concepts; BAM networks, Hopfield network; Self-organizing network and Recurrent network; Neural Network based controllers and estimators design.

**Learning Outcomes:**

After completion of this unit student will

- To learn about basic concepts of ANN

- To develop mathematical models for various controllers of single and multilayer perceptrons
- To get exposed to learning and training the Neural Networks
- To distinguish between Supervised and Unsupervised learning concepts
- To be able to design ANN based controllers and estimators

### **UNIT-III:**

#### **Fuzzy Logic Control System**

Motivation and basic definitions; Crisp sets, Fuzzy sets, difference between crisp and fuzzy sets, Fuzzy properties, operations and relations; Fuzzy logic system and its components; Membership functions and methods for assignment of membership function values, Fuzzy knowledge and rule bases; Fuzzy modelling and control schemes for linear and nonlinear systems; Fuzzy estimators.

#### **Learning Outcomes:**

After completion of this unit student will

- To learn about fundamentals of Fuzzy Logic Control systems
- To be able to understand knowledge and rule bases in Fuzzy Logic Systems
- To understand about the Fuzzy modelling and control schemes
- To develop the Fuzzy modelling and control schemes for Linear systems
- To develop the Fuzzy modelling and control schemes for non-linear systems

### **UNIT-IV:**

#### **Evolutionary Algorithms**

Genetic Algorithm: Introduction - basic concepts, application, Adaptive Neuro-fuzzy Inference System (ANFIS), Neuro-Genetic, Fuzzy-Genetic systems. Ant colony optimization, Particle swarm optimization (PSO) – basic concepts and design procedures.

#### **Learning Outcomes:**

After completion of this unit student will

- To learn about basic concepts of evolutionary algorithms
- To learn about ANFIS
- To learn about Fuzzy-Genetic systems
- To learn about Neuro-Genetic systems
- To learn about a few optimization techniques
- To be able to design the systems with suitable evolutionary algorithms for specific requirements

## **UNIT-V:**

### **Case Studies**

Identification and control of linear and nonlinear dynamic systems using Neural Networks; Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox; optimization for controller design in case of constrained and unconstrained optimization issues.

### **Learning Outcomes:**

After completion of this unit student will

- To identify case studies related to linear and non-linear dynamic systems
- To be able to implement control strategies with Neural Networks for the identified systems
- To be able to implement controllers using MATLAB Fuzzy Logic tool box
- To be able to implement optimization techniques for controller design with constrained and unconstrained conditions
- To be able to design systems with various tool boxes in MATLAB environment

### **Course Outcomes:**

- To get familiarity of various Intelligent Control Techniques
- To be able to design the controllers and estimators using ANN
- To be able to model and develop control schemes with Fuzzy Logic rule bases
- To be able to implement an evolutionary algorithm suitable to optimize and design a given system specifications
- To be able to use MATLAB tool boxes for implementation of various ICTs for system modelling, control schemes and to design estimators

### **TEXT BOOKS:**

1. Padhy.N.P.; “Artificial Intelligence and Intelligent Systems”; Oxford University Press, 2005
2. Jacek. M. Zurada; "Introduction to Artificial Neural Systems", Jaico Publishing House, 1<sup>st</sup> Edition, 1994
3. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, 3<sup>rd</sup> Edition, WILEY Publications, 2011
4. S.N. Sivanandam and S.N. Deepa, “Introduction to Genetic Algorithms”, Springer Publications, 2008

### **REFERENCIS:**

1. J.S.R. Jang, C.T.Sun and E. Mizutami, “Neuro-Fuzzy & Soft Computing”, Pearson India Education Services Pvt. Ltd.
2. Laurere Fauselt, “Fundamentals of Neural Networks”, Pearson India Education Services Pvt. Ltd.

**(19A04604b) PRINCIPLES OF COMMUNICATION SYSTEMS**  
**PEC-IV**

**Course Objectives:**

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

**UNIT-I:**

**Amplitude Modulation**

Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of noise, Fourier transform, carrier modulation and frequency division multiplexing (L1).
- Apply the concept of amplitude modulation to solve engineering problems (L2).
- Analyse various amplitude modulation schemes (L3).
- Evaluate various amplitude modulation schemes in real time applications (L3).

**UNIT-II:**

**Angle Modulation**

Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of angle modulation and its components (L1).
- Apply the concept of frequency modulation to solve engineering problems (L2).
- Analyse angle modulation schemes (L3).
- Evaluate frequency modulation scheme in real time applications (L3).

**UNIT-III:**

## **Pulse Modulation**

Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing (L1).
- Analyse various pulse modulation schemes (L3).

## **UNIT-IV:**

### **Digital Modulation**

Binary Amplitude Shift Keying, Binary Phase Shift Keying and QuadraturePhase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various digital modulation schemes (L1).
- Analyze various digital modulation schemes (L3).

## **UNIT-V:**

### **Communication Systems**

Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of various communication systems (L1).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

### **Course Outcomes:**

- Understand the concept of various modulation schemes and multiplexing (L1).
- Apply the concept of various modulation schemes to solve engineering problems (L2).

- Analyse various modulation schemes, and evaluate various modulation scheme in real time applications (L3).

**TEXT BOOKS:**

1. Herbert Taub, Donald L Schilling and Goutam Saha, “Principles of Communication Systems”, 3<sup>rd</sup>Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

**REFERENCES:**

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4<sup>th</sup> Edition, Oxford University Press, 2017.
  2. K. Sam Shanmugam “Digital and Analog Communication Systems”, Wiley India Edition, 2008.
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**Blooms’ Learning levels:**

L1: Remembering and Understanding

L2: Applying

L3: Analyzing, Evaluating



(19A02801d) ENERGY STORAGE SYSTEMS  
(PEC-IV)

**Course Objectives:**

- To understand the need for energy storage
- To understand about the fundamentals of ESS
- To know about types, features and benefits of ESS
- To know about various management and control including market potential of ESS
- To study about various applications of ESS

**UNIT – I:**

**Fundamentals of ESS**

Definitions, Characteristics of ESS, Electricity and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies

**Learning Outcomes:**

At the end of the unit, the student should be able to

- To know about the fundamentals of ESS
- To know about emerging needs and roles of ESS
- To know about various classifications of ESS
- To understand about roles of energy storage technologies

**UNIT – II:**

**Types and features of ESS Technologies**

Mechanical storage systems, Electromechanical storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability

**Learning Outcomes:**

At the end of the unit, the student should be able to

- To understand about various types of ESS technologies
- To understand about standards for ESS
- To learn about power and discharge duration of ESS
- To know about preliminaries of ESS operating cost
- To understand about power quality issues and reactive power capability of ESS

## **UNIT – III:**

### **Storage Benefits**

Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- To know various storage benefits
- To distinguish between application specific benefits and identical benefits
- To know about dynamic operating benefits
- To understand about electric service power quality and reliability issues
- To learn about energy benefits from storage systems

## **UNIT – IV:**

### **EES Market and Management**

Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity

### **Learning Outcomes:**

At the end of the unit, the student should be able to

- To understand about management of ESS technologies
- To distinguish between internal and external configuration of ESS
- To know about battery SCADA system and storage modularity
- To understand about market potential estimations
- To distinguish between demand change and time-of-use energy cost management

## **UNIT – V:**

### **Applications of EES**

Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications

**Learning Outcomes:**

At the end of the unit, the student should be able to

- To know about various ESS
- To distinguish between power, capacity, energy applications of ESS
- To distinguish between electric supply and ancillary applications
- To distinguish between end user/utility customer applications
- To understand about the importance of distributed energy storage applications

**Course Outcomes:**

- To get exposed to latest technology of ESS
- To understand the Principle, features and benefits of ESS
- To understand about marketing and management strategies of ESS in working environment in future
- To distinguish wide variety of applications of EES for practical applications
- To know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy sources

**Text Books:**

1. James M. Eyer, Joseph J. Iannucci and Garth P. Corey, “Energy Storage Benefits and Market Analysis”, Sandia National Laboratories, 2004.
2. IEC Market Strategy Board, “ The Electrical Energy Storage” White paper.

**Reference Book:**

1. Jim Eyer, Garth Corey, “Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories”, Feb 2010.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– IV-II** **L T P C**  
**3 0 0 3**  
**(19A01802a) DISASTER MANGEMENT**  
**OPEN ELECTIVE-IV**

**Course Objectives:**

The objective of this course is to:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
- Understand the ‘relief system’ and the ‘disaster victim.’
- Describe the three planning strategies useful in mitigation.
- Identify the regulatory controls used in hazard management.
- Describe public awareness and economic incentive possibilities.
- Understand the tools of post-disaster management.

**SYLLABUS**

**UNIT-I:**

Natural Hazards And Disaster Management: Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the natural hazards and its management
- To understand about the global warming, cyclones and tsunamis

**UNIT-II:**

Man Made Disaster And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terroristism -threat in mega cities, rail and air craft’s accidents, and Emerging infectious diseases & Aids and their management.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the fire hazards and solid waste management
- To understand about the emerging infectious diseases and aids their management.

### **UNIT-III:**

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the regulations of building codes and land use planning related to risk and vulnerability.
- To understand about the financial management of disaster and related losses

### **UNIT-IV:**

Role Of Technology In Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations-roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the technological aspects of disaster management
- To understand about the factors for disaster reduction

### **UNIT-V:**

Education and Community Preparedness: Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To impart the education related to risk reduction in schools and communities

#### **Course Outcomes:**

Upon the successful completion of this course, the students will be able to:

- Affirm the usefulness of integrating management principles in disaster mitigation work
- Distinguish between the different approaches needed to manage pre- during and post-disaster periods
- Explain the process of risk management
- Relate to risk transfer

### **TEXT BOOKS**

1. Rajib shah & R R Krishnamurthy “Disaster Management” – Global Challenges and Local Solutions’ Universities press. (2009),
2. Tushar Bhattacharya, “Disaster Science & Management” Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Jagbir Singh “Disaster Management” – Future Challenges and Opportunities’ I K International Publishing House Pvt. Ltd. (2007),

### **REFERENCE BOOKS**

1. Harsh. K . Gupta “Disaster Management edited”, Universities press, 2003.

(19A01802b) GLOBAL WARMING AND CLIMATE CHANGES  
OPEN ELECTIVE-IV

**Course Objectives:**

The objective of this course is to:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

**UNIT I**

**EARTH'S CLIMATE SYSTEM:**

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

**Learning Outcomes:**

After completing this Unit, students will be able to

- To identify the importance of Ozone and effect of green house gases
- To know the effect of global warming

**UNIT II**

**ATMOSPHERE & ITS COMPONENTS:** Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the layers of atmosphere and their characteristics

**UNIT III**

**IMPACTS OF CLIMATE CHANGE :** Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

**Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the causes of climate change and its effects on various sectors.

#### **UNIT IV**

**OBSERVED CHANGES AND ITS CAUSES:** Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the causes of climate change and carbon credits, effect of change in temperature and climate on india.

#### **UNIT V**

**CLIMATE CHANGE AND MITIGATION MEASURES:** CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposalbiomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

#### **Learning Outcomes:**

After completing this Unit, students will be able to

- To know about the clean technology, use of renewable energy, mitigation technologies and their practices.

#### **Course Outcomes**

Upon the successful completion of this course, the students will be able to:

- An ability to apply knowledge of mathematics, science, and engineering
- Design a system, component or process to meet desired needs with in realistic constraints such as economic ,environmental ,social ,political ,ethical ,health and safety , manufacturability and sustainability
- An ability to identify, formulate, and solve engineering problems



## REFERENCE BOOKS

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Private limited 2007.
2. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press ,Cambridge,2006.
3. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge university press ,2003.
5. David Archer, Global Warming: Understanding the Forecast, 2 nd ed. (Wiley, 2011
6. John Houghton, Global Warming: The Complete Briefing, 5th Edition, 2015, Cambridge Univ. Press. Useful

(19A03802a) ENERGY CONSERVATION AND MANAGEMENT

OPEN ELECTIVE-IV

**Course Objective:**

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance.
- Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

**UNIT I**

**Introduction:** Energy – Power – Past & Present Scenario Of World; National Energy Consumption Data – Environmental Aspects Associated With Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role Of Energy Managers. Instruments For Energy Auditing.

**Learning Outcomes**

At the end of this unit, the student will be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (I2)
- Outline energy auditing requirements, tools and methods. (I2)
- Identify the function of energy manager. (I3)

**UNIT II**

**Electrical Systems:** Components Of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept Of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types Of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

**Learning Outcomes**

At the end of this unit, the student will be able to

- Outline components of electricity billing, transmission and distribution. (I2)
- Analyze performance characteristics of transformers, capacitors, and electric motors. (I4)
- Examine power factor improvements, and electric motor efficiency. (I4)
- Evaluate lighting systems. (I4)

### UNIT III

**Thermal Systems:** Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories.

#### Learning Outcomes

At the end of this unit, the student will be able to

- Determine efficiency of boilers, furnaces and other thermal systems. (15)
- Recommend energy conservation measures in thermal systems. (15)
- Justify steam systems in energy conservation. (14)

### UNIT IV

**Energy Conservation In Major Utilities:** Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration And Air Conditioning Systems – Cooling Towers – D.G. Sets.

#### Learning Outcomes

At the end of this unit, the student will be able to

- Explain energy conservation measures in major utilities. (12)
- Apply performance test criteria for fans, pumps, compressors, hvac systems. (13)
- Assess energy conservation in cooling towers and d.g. sets. (15)

### UNIT V

**Energy Management:** Principles of Energy Management, Energy demand estimation, Organising and Managing Energy Management Programs, Energy pricing.

#### Learning Outcomes

At the end of this unit, the student will be able to

- Describe principles of energy management. (12)
- Assess energy demand and forecast. (15)
- Organize energy management programs. (16)
- Design elements of energy pricing. (16)

#### Course Outcomes:

At the end of this course, the student will be able to:

- Explain energy utilization and energy auditing methods.(12)
- Analyze electrical systems performance of electric motors and lighting systems.(14)
- Examine energy conservation methods in thermal systems.(14)
- Estimate efficiency of major utilities such as fans, pumps, compressed air systems, hvac and d.g. Sets. (14)
- Elaborate principles of energy management, programs, energy demand and energy

pricing. (16)

**TEXT BOOKS:**

1. Energy Manager Training Manual (4 Volumes) Available At [www.energymanagertraining.com](http://www.energymanagertraining.com), A Website Administered By Bureau Of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government Of India, 2004.

**REFERENCES:**

1. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design And Management For Energy Conservation", Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., "The Efficient Use Of Energy" Butterworths, London, 1982
4. Murphy. W.R. And G. Mc KAY, "Energy Management", Butterworths, London 1987.
5. Turner, W. C., Doty, S. and Truner, W. C., "Energy Management Hand book", 7th edition, Fairmont Press, 2009.
6. De, B. K., "Energy Management audit & Conservation", 2<sup>nd</sup> Edition, Vrinda Publication, 2010.
7. Smith, C. B., "Energy Management Principles", Pergamon Press, 2007.

**(19A03802b) NON-DESTRUCTIVE TESTING**  
**OPEN ELECTIVE-IV**

**Course Objectives**

- Introduce basic concepts of non destructive testing.
- Familiarize with characteristics of ultrasonic test, transducers, rejection and effectiveness.
- Describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- Explain the principles of infrared and thermal testing, applications and honey comb and sandwich structures case studies.
- Impart NDE and its applications in pressure vessels, casting and welded constructions.

**UNIT I**

**Introduction to non-destructive testing:** Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

**Learning outcomes:**

At the end of this unit, the student will be able to

- Explain non destructive testing techniques (L2)
- Summarize the basic concepts of Radiographic test ( L2)
- Outline the concepts of sources of X and Gamma Rays ( L2)
- Explain the radiographic techniques ( L2)
- Discuss the safety aspects of industrial radiography. ( L4)

**UNIT II**

**Ultrasonic test:** Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

**Learning outcomes:**

At the end of this unit, the student will be able to

- Explain the principle of ultrasonic test. ( l2)

- Analyze the performance of wave propagation, reflection, refraction, diffraction and sound field in ultrasonic test. (14 )
- Discuss the characteristics of ultrasonic transducers. (14)
- Outline the limitations of ultrasonic testing. (12 )

### UNIT III

**Liquid Penetrant Test:** Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

**Eddy Current Test:** Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

**Magnetic Particle Test:** Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

#### Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate the procedure of Liquid Penetrant, eddy current and magnetic particle tests.( L2)
- Outline the limitations of Penetrant, eddy current and magnetic particle tests. (L2 )
- Explain the effectiveness of Penetrant, eddy current and magnetic particle tests. ( L2)
- Apply the applications of Magnetic particle test. ( L3)

### UNIT IV

**Infrared And Thermal Testing:** Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

#### Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss the fundamentals of thermal testing. (16 )
- Explain the techniques of liquid crystals, active and passive. (12)
- Illustrate thermal inspection methods. ( 12)
- Outline the limitations of thermal testing. (12 )
- Explain the applications of honey comb and sandwich structures. (12)

## UNIT V

**Industrial Applications of NDE:** Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

### Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate applications of NDE. ( L2)
- Explain the applications of Railways, Nuclear and chemical industries. ( L2)
- Outline the limitations and disadvantages of NDE. (L2 )
- Explain the applications of NDA of pressure vessels, casting and welding constructions ( L2)

### Course Outcomes

At the end of the course, student will be able to

- Explain various methods of non-destructive testing. (I3)
- Apply relevant non-destructive testing method different applications. (I3)
- Explain the applications of railways, nuclear and chemical industries. ( I2)
- Outline the limitations and disadvantages of nde. (I2 )
- Explain the applications of nda of pressure vessels, casting and welding constructions ( I2)

### TEXT BOOKS:

1. J Prasad, GCK Nair , “Non destructive test and evaluation of Materials”, Tata mcgraw-Hill Education Publishers, 2008.
2. Josef Krautkrämer, Herbert Krautkrämer, “Ultrasonic testing of materials”, 3<sup>rd</sup> edition, Springer-Verlag, 1983.
3. X. P. V. Maldague, “Non destructive evaluation of materials by infrared thermography”, 1<sup>st</sup> edition, Springer-Verlag, 1993.

### REFERENCES:

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, “Non-destructive, Hand Book, Ultrasonic Testing”, 3<sup>rd</sup> edition, Amer Society for Nondestructive, 2007.
2. ASTM Standards, Vol 3.01, Metals and alloys

### Social Relevant Projects

1. Solid waste conversion into energy (Gasification)
2. Plastic waste into fuel.
3. Bio-gas digester.
4. Development of mechanisms for farmers.

5. Smart irrigation for saving water.
6. Mechanized water segregation.
7. Applications of solar technologies for rural purpose.
8. Power generation from wind turbine.
9. Applications of drones for agriculture.
10. Solar drying.



(19A04802a) INTRODUCTION TO IMAGE PROCESSING

OPEN ELECTIVE-IV

**Course Objectives:**

- To interpret fundamental concepts of digital image processing.
- To exemplify image enhancement.
- To interpret fundamental concepts of color image processing.
- To assess image compression techniques for digital images.
- To summarize segmentation for digital images.

**UNIT-I:**

**INTRODUCTION TO DIGITAL IMAGE PROCESSING**

**Introduction:** Digital image representation, Fundamental steps in image processing, Elements of digital image processing, Elements of visual perception, Simple image model, Sampling and Quantization, Basic relationships between pixels, Image transformations.

**Applications:** Medical imaging, Robot vision, Character recognition, Remote sensing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the fundamental concepts of image processing, Sampling process and basis relationships between pixels (L1)
- Explain the elements of Digital Image Processing (L2)

**UNIT-II:**

**IMAGE ENHANCEMENT**

Need for image enhancement, Point processing, Histogram processing, Spatial filtering- Smoothing and Sharpening.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the need for enhancement process (L1)
- Explain the terminology involved in enhancement process (L2)

**UNIT-III:**

## **COLOR IMAGE PROCESSING**

Colour fundamentals, Colour models, Color transformations, Pseudo colour image processing, Full colour image processing.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the need for enhancement process (L1)
- Explain the terminology involved in enhancement process (L2)

## **UNIT-IV:**

### **IMAGE COMPRESSION**

Redundancies, Fidelity criteria, Image compression model, Lossless compression: Huffman coding, Arithmetic coding. Lossy compression: Lossy Predictive Coding, JPEG Compression Standard.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the need for image compression (L1)
- Explain the image compression and various types of compression techniques (L2)

## **UNIT-V:**

### **IMAGE SEGMENTATION**

Detection of discontinuities: point, line and edge detection, Edge linking and Boundary detections: Local Processing, Global processing via Hough transform, Thresholding, Region oriented segmentation: Region growing, Region splitting and merging.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the principle of image segmentation and its importance (L1)
- Explain the image compression and various types of compression techniques (L2)
- Analyze the various terminologies involved in image segmentation like edge, boundary detection etc. (L3)

### **Course Outcomes:**

- Interpret fundamental concepts of digital and color image processing.
- Exemplify image enhancement.

- Analyze the various terminologies involved in image segmentation like edge, boundary detection etc. Assess image compression techniques for digital images.
- Summarize segmentation techniques for digital images.

**TEXT BOOKS:**

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, 3<sup>rd</sup> Edition, Pearson Education, 2011.

**REFERENCE BOOKS:**

1. S Jayaraman, S Esakkirajan and T Veerakumar, “Digital Image Processing”, TMH, 2011.
2. S. Sridhar, “Digital Image Processing”, 2<sup>nd</sup> Edition, Oxford Publishers, 2016.

**(19A04802b) PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS**  
**OPEN ELECTIVE-IV**

**Course Objectives:**

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyse cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

**UNIT-I:**

**Introduction to Cellular Mobile Systems**

Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concepts and operation of cellular systems (L1).
- Analyze the characteristics of mobile radio environment (L3).

**UNIT-II:**

**Cellular Radio System Design**

General description of the problem, Concept of frequency reuse channels, Cochannel interference reduction, Desired C/I ratio, Cell splitting and sectoring.

**Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand the concept of frequency reuse and cochannel interference in cellular systems (L1).
- Apply the concept of cellular systems to solve engineering problems (L2).
- Analyze the design problems of cellular systems (L3).
- Design of cellular patterns based frequency reuse factor (L5).

### **UNIT-III:**

#### **Handoffs and Dropped Calls**

Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Intersystem handoff. Introduction to dropped call rate.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand why handoff is required (L1).
- Apply handoff techniques to solve engineering problems (L2).
- Compare various types of handoffs (L3).

### **UNIT-IV:**

#### **Multiple Access Techniques for Wireless Communications**

Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand various types of multiple access techniques (L1).
- Apply the concept of multiple access to solve engineering problems (L2).
- Compare various types of multiple access techniques (L3).

### **UNIT-V:**

#### **Digital Cellular Systems**

Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

#### **Learning Outcomes:**

At the end of the unit, the student should be able to

- Understand operation of various types of digital cellular systems (L1).
- Compare various types of digital cellular systems (L3).
- Evaluate suitability of a cellular system in real time applications (L4).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

## Course Outcomes:

At the end of the course, the student should be able to

- Understand the concepts and operation of cellular systems (L1)
- Apply the concepts of cellular systems to solve engineering problems (L2).
- Analyse cellular systems for meaningful conclusions, Evaluate suitability of a cellular system in real time applications (L3).
- Design cellular patterns based on frequency reuse factor (L4).

## TEXT BOOKS:

2. William C. Y. Lee, “Mobile Cellular Telecommunications”, 2<sup>nd</sup>Edition, McGraw-Hill International, 1995.
3. Theodore S. Rappaport, “Wireless Communications – Principles and Practice”, 2<sup>nd</sup>Edition, PHI, 2004.

## REFERENCES:

3. Aditya K. Jagannatham “Principles of Modern Wireless Communications Systems – Theory and Practice”, McGraw-Hill International, 2015.

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## Blooms’ Learning levels:

L1: Remembering and Understanding

L2: Applying

L3: Analyzing, Evaluating

L4: Designing, Creating

(19A04802c) INDUSTRIAL ELECTRONICS  
OPEN ELECTIVE-IV

**Course Objectives:**

This course will enable students to:

- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries
- Describe the Ultrasonics and its application.

**UNIT I**

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open-circuited p-n junction, Diode resistance, Zener diode, Photoconductors and junction photo diodes, Photo voltaic effect, Light emitting diodes(LED).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the importance of Electronics and semiconductor devices in industry, operation of semiconductor devices (L1)
- Describe the working of semiconductor diodes (L1)

**UNIT II**

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor- $\alpha$ , Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Lettersymbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the working of Transistor and its different configurations (L1)
- Describe the working of CE, CC, CB configurations (L1)

### UNIT III

**AC to DC converters-** Introduction, Classification of Rectifiers, Half wave Rectifiers, Fullwave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

### UNIT IV

**Resistance welding controls:** Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding. **Induction heating:** Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. **Dielectric heating:** Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

#### Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the principle of operation of Resistance welding, Induction heating and Dielectric heating (L1)
- Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry (L2)

### UNIT V:

**Ultrasonics:** Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of Ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying



### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the principle of operation of Ultrasonics and its applications (L1)
- Analyze the thermal effects of Ultrasonics, soldering and welding by ultrasonics,Ultrasonic Drying in the industry (L3)

### **Course Outcome:**

- Understand the semi-conductor devices and their switching characteristics.
- Apply the Ultrasonic waves with different applications
- Analyze the thermal effects of Ultrasonics, soldering and welding by ultrasonics,Ultrasonic Drying in the industry, Interpret the characteristics of AC to DC converters,
- Develop the practical applications Electronics in industries.

### **TEXT BOOKS:**

1. G. K. Mithal, "Industrial Electronics", Khanna Publishers, Delhi, 2000.
2. J.Gnanavadeivel, R.Dhanasekaran, P.Maruthupandi, "Industrial Electronics",Anuradha Publications, 2011.

### **REFERENCE BOOKS:**

1. F. D. Petruzulla, "Industrial Electronics", McGraw Hill, Singapore, 1996.
2. M. H. Rashid, "power Electronics Circuits, Devices and Application", PHI, 3<sup>rd</sup>edition, 2004.
3. G. M. Chute and R. D. Chute, "Electronics in Industry", McGraw Hill Ltd,Tokyo, 1995.

(19A04802d) ELECTRONIC INSTRUMENTATION  
OPEN ELECTIVE-IV

**Course Objectives:**

**This course will enable students to:**

- To introduce various measuring instruments and their functionality
- To teach various measurement metrics for performance analysis
- To explain principles of operation and working of different electronic instruments
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers

**UNIT – I**

**Measurement and Error:** Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. (Text 2)

**Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. (Text 1)

**Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter. (Text 1)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the importance of measurement system (L1)
- Examine the characteristics of different Instruments (L2)
- Illustrate different types of errors that may occur in instruments during measurements (L2)

**UNIT – II**

**Digital Voltmeters:** Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, -Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, (Text 1)

**Digital Instruments:** Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, (Text 1)

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain working of digital measuring Instruments (L2)
- Compare the various measuring techniques for measuring voltage (L4)

### **UNIT – III**

**Oscilloscopes:** Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text 1)

**Signal Generators:** Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, (Text 1)

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe functions of basic building of CRO (L1)
- Measure parameters viz. Amplitude, frequency and time period using CRO (L2)
- Classify signal generators and describe its characteristics (L2)

### **UNIT – 4**

**Measuring Instruments:** Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger. (Text 1)

**Bridges:** Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge. (Text 1)

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe function of various measuring Instruments. (L1)
- Describe how unknown capacitance and inductance can be measured using bridges (L1)
- Select appropriate bridge for measuring R, L and C parameters (L2)

### **UNIT – 5**

**Transducers:** Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor. (Text 1)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the importance of transducer (L1)
- Illustrate different measuring techniques in transducers to measure physical quantities.(L2)
- Select the appropriate transducer for the measurement of physical parameters (L2)

**Course outcomes:**

- Learn different types of errors in measurement, calibration process and standards, various methods for measurement of non-electrical quantities, Understand the different methods for measurement of various electrical quantities.
- Familiarize the dynamics of instrument systems, various passive and active transducers
- Compare the various measuring techniques for measuring voltage (L4)

**TEXT BOOKS:**

- H. S. Kalsi, “Electronic Instrumentation”, McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
- A. D. Helfrick and W.D. Cooper, “Modern Electronic Instrumentation and Measuring Techniques”, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

**REFERENCE BOOKS:**

- David A. Bell, “Electronic Instrumentation & Measurements”, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
- A. K. Sawhney, “Electronics and Electrical Measurements”, Dhanpat Rai & Sons. ISBN -81-7700-016-0

**(19A05802a) BLOCKCHAIN TECHNOLOGY**

**Course Objectives:**

This course is designed to:

- Understand the philosophy of Blockchain and the cutting edge technology behind its functions
- Illustrate how to setup Ethereum tools
- Explain the key vocabulary and concepts used in Blockchain for Business

**UNIT-I**

**Blockchain concepts:** Blockchain, Blockchain application example: Escrow, Blockchain stack, from web 2.0 to the next generation decentralized web, domain specific Blockchain application, Blockchain benefits and challenges.

**Blockchain application templates:** Blockchain application components, design methodology for Blockchain applications, Blockchain applications templates

**Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the benefits and challenges of Block chain(L2)
- Design the Blockchain applications(L6)

**UNIT-II**

**Setting up Ethereum development tools:** Ethereum clients,Ethereum languages, TestRPC, Mist Ethereumwalle, meta mask, web3 JavaScript API, truffle.

**Ethereum Accounts:** Ethereum Accounts, keypairs, working with EOA Accounts, working with contract accounts.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Illustrate the use of Ethereum development tools(L2)
- Create Ethereum accounts and work with them (L6)

**UNIT-III**

**Smart contracts:** Smart contract, structure of a contract, setting up and interacting with a contract using Geth client, setting up and interacting with a contract using Mist Wallet

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Make use of smart contracts(L3)
- Distinguish setting up and interacting with a contract using Geth client and Mist Wallet.(L4)

### UNIT-IV

**Smart contracts (continued):** Smart contract examples, Smart contract patterns.

**Decentralized Applications:** implementing Dapps, case studies,

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Illustrate the Smart contract examples and patterns(L2)
- Develop Decentralized applications.(L6)

### UNIT-V

**Mining:** Consensus on Blockchain network, mining, Block validation, state storage in Ethereum.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Define Consensus on Blockchain network(L1)
- Demonstrate State Storage in Ethereum(L2)

### **Course outcomes:**

Upon completion of the course, the students should be able to:

- Create customized blockchain solutions (L6)
- Make use of the specific mechanics of Ethereum(L3)
- Experiment with Smart contracts (L3)
- Develop Enterprise applications using Blockchain(L6)

### **Text book:**

1. Arshadeepbahga, Vijay madiseti, “Blockchain Applications A hands-on approach”, VPT 2017.
2. Chandramouli Subramanian, Asha A George, Abhilash K A and MeenaKarthikeyan, “Blockchain Technology”, Universty Press, 2021

**References:**

1. Imran Bashir, "Mastering Blockchain" Packt Publishing Ltd, March 2017.
2. Melanie swan, "Blokchain blueprint for a new economy", O'REILLY

**(19A05802b) MEAN STACK TECHNOLOGIES**

**Course Objectives:**

This course is designed to:

- Translate user requirements into the overall architecture
- Implement new systems and manage the projects
- Write optimized front end code using HTML and JavaScript
- Monitor the performance of web applications & its infrastructure
- Design and implement Robust and Scalable Front End Applications

**UNIT I**

Introduction to Web: Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. Html5 concepts, CSS3, Anatomy of a web page. XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Summarize the protocols related to Internet & WWW(L2)
- Compare and contrast XML and HTML(L5)

**UNIT II**

JavaScript: The Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. Angular Java Script Angular JS Expressions: ARRAY, Objects, \$eval, Strings, Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS.

**Learning Outcomes:**

After completing this Unit, students will be able to

- Illustrate the importance of JavaScript(L2)
- Develop applications using Angular JS(L6)

**UNIT III**

Node.js: Introduction, Advantages, Node.js Process Model, Node JS Modules. Express.js: Introduction to Express Framework, Introduction to Nodejs , What is



Nodejs, Getting Started with Express, Your firstExpress App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling , API Handling , Debugging, Developing Template Engines, Using Process Managers, Security & Deployment.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Explain the Node JS modules(L2)
- Make use of MVC in Express(L3)

### **UNIT IV**

RESTful Web Services: Using the Uniform Interface, Designing URIs, Web Linking, Conditional Requests. React Js: Welcome to React, Obstacles and Roadblocks, React's Future, Keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Outline the RESTful Web Services(L2)
- Assess the future of React Js(L5)

### **UNIT V**

Mongo DB: Introduction, Architecture, Features, Examples, Database Creation & Collection in Mongo DB. Deploying Applications: Web hosting & Domains, Deployment Using Cloud Platforms.

### **Learning Outcomes:**

After completing this Unit, students will be able to

- Explain the features and architecture of Mongo DB (L2)
- Create and collect Database in MongDB(L6)

### **Course Outcomes**

After the completion of the course, student will be able to

- List the Basic Concepts of Web & MarkupLanguages(L1)
- Develop web Applications using Scripting Languages & Frameworks(L6)
- Make use of Express JS and Node JS frameworks(L3)
- Illustrate the uses of web services concepts like restful, reactjs (L2)
- Deploying applications using Cloud Platforms (L6)

#### Text Books:

- 1) Programming the World Wide Web, Robert W. Stiebitz, 7th ed, Pearson.
- 2) Web Technologies, Uttam K Roy, Oxford
- 3) Pro Mean Stack Development, Eyal Gal, Apress
- 4) Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
- 5) JavaScript & jQuery the missing manual, David Sawyer McFarland, O'Reilly
- 6) Web Hosting for Dummies, Peter Pollock, John Wiley & Sons

#### Reference Books:

- 1) Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, O'Reilly (2006).
- 2) Programming Perl, 4th ed, Tom Christiansen, Jonathan Orwant, O'Reilly (2012).
- 3) Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, DreamTech.
- 4) An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning.
- 5) Express.JS Guide, The Comprehensive Book on Express.js, Azat Mardan, Lean Publishing.

#### e-Resources:

- 1) <http://www.upriss.org.uk/perl/PerlCourse.html>

**(19A27802a) FOOD PLANT UTILITIES & SERVICES**  
**OPEN ELECTIVE - IV**

**PREAMBLE**

This subject focuses on different utilities like water, steam, electricity and its properties, production of consumption of these sources in the food plant.

**OBJECTIVES**

- To give brief idea about the utilities that are required/used in food industry and their sources and importance.

**UNIT – I**

Introduction Classification of various utilities and services in food industry. Water use in Food Processing Industry Water supply system: Pumps of different types, operational aspects, piping system for fresh water, chilled water etc., fittings and control, water requirement for cleaning and processing, water quality, water purification and softening Unit

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Water use in Food Processing Industry
- Water supply system: Pumps of different types, operational aspects, piping system for fresh water, chilled water etc.,
- fittings and control, water requirement for cleaning and processing,
- water quality, water purification and softening Unit

**UNIT – II**

Water use in food processing: Different types of water requirements in food processing plants, types of water use, waste water sources, water wastage minimization, water loadings per unit mass of raw material. Water conservation: Water and waste water management, economic use of water, water filtration and recirculation.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Different types of water requirements in food processing plants,
- types of water use, waste water sources, water wastage minimization,
- water loadings per unit mass of raw material
- Water and waste water management, economic use of water,

- water filtration and recirculation

### **UNIT – III**

Steam uses in Food Industry Steam uses in food industry: Food processing operations in which steam is used, temperature, pressure and quantity of steam required in various food processing operations Steam generation system: Components of a boiler system, fuels used in boilers, energy analysis for a steam generation system, heat loss from boiler system, boiler design consideration.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Food processing operations in which steam is used
- Temperature, pressure and quantity of steam required in various food processing operations
- Components of a boiler system, fuels used in boilers, energy analysis for a steam generation system
- Heat loss from boiler system, boiler design consideration.

### **UNIT – IV**

Waste-Heat Recovery in Food Processing Facilities Quantity and quality of waste heat in food processing facilities, waste heat utilization, heat exchangers for waste heat recovery, heat pumps for waste heat recovery. Waste Disposal and its Utilization Industrial waste, sewage, influent, effluent, sludge, dissolved oxygen, biological oxygen demand, chemical oxygen demand.

#### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Waste-heat recovery in food processing facilities
- Quantity and quality of waste heat in food processing facilities,
- Waste heat utilization, heat exchangers for waste heat recovery, heat pumps for waste heat recovery.
- Waste disposal and its utilization industrial waste, sewage, influent, effluent, sludge,
- Dissolved oxygen, biological oxygen demand, chemical oxygen demand

### **UNIT – V**

Planning and Design of Service Facilities in Food Industry Estimation of utilities requirements: Lighting, ventilation, drainage, CIP system, dust removal, fire protection etc.

Maintenance of facilities: Design and installation of piping system, codes for building, electricity, boiler room, plumbing and pipe colouring, maintenance of the service facilities. Services required in offices, laboratories, locker and toilet facilities, canteen, parking lots and roads, loading docks, garage, repair and maintenance shop, ware houses etc.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Planning and Design of Service Facilities in Food Industry Estimation of utilities requirements: Lighting, ventilation, drainage, etc.
- Maintenance of facilities: Design and installation of piping system, codes for building, electricity, plumbing, maintenance of the service facilities.
- Services required in offices, laboratories, locker and toilet facilities, canteen, parking lots and roads, repair and maintenance shop, ware houses etc

### **Course Outcomes**

By end of the course, students will understand the following

- Various utilities and services used in food industry and its applications in food industry namely water, steam, electricity and etc.

### **TEXT BOOKS**

1. Lijun Wang. “Energy Efficiency and Management in Food Processing Facilities”. CRC Press. 2008,
2. M. E. Casper. “Energy-saving Techniques for the Food Industry”. Noyes Data Corporation. 1977,

### **REFERENCES**

1. P.L. Ballaney, “Thermal Engineering in SI Units”, 23<sup>rd</sup> Edition, Khanna Publishers, Delhi, 2003.
2. C.P. Arora. “Refrigeration and Air Conditioning”. 3<sup>rd</sup> Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi. 2008,
3. W. E. Whitman, “A Survey of Water Use in the Food Industry”, S. D. Holdsworth. Published by British Food Manufacturing Industries Research Association.
4. Chilton's Food Engineering. 1979, Chilton Co Publishers.

**(19A27802b) NUTRACEUTICALS AND FUNCTIONAL FOODS**

**OPEN ELECTIVE – IV**

**PREAMBLE**

This course will cover the classification, brief history and the impact of nutraceuticals and functional foods on health and disease prevention. Nutraceuticals to be covered in the course include isoprenoids, isoflavones, flavanoids, carotenoids, lycopene, garlic, omega 3 fatty acids, sphingolipids, vitamin E and antioxidants, herbal products in foods. Also marketing issues related to functional foods and nutraceuticals as well as stability testing will be reviewed.

**Course Objectives:**

- To understand the interrelationship between nutraceuticals and health maintenance.
- Cite the evidence supporting the efficacy and safety of nutraceutical and functional food products
- To explain the metabolic consequences of nutraceuticals and functional foods.
- Describe the physiologic and biochemical changes associated with consumption of nutraceuticals

**UNIT – I**

Introduction, definition, Modification in the definition of nutraceuticals. Classification of nutraceuticals, Nutraceuticals market scenario, formulation considerations. Challenges for Nutraceuticals.

**Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Classification of nutraceuticals,
- Nutraceuticals market scenario and formulation considerations.
- Challenges for Nutraceuticals.

**UNIT – II**

Nutraceuticals value of spices and seasoning – Turmeric, Mustard, Chilli, Cumin, Fenugreek, Black Cumin, Fennel, Asafoetida, Garlic, Ginger, Onion, Clove, Cardamom etc., Nutraceuticals from Fruits And Vegetables – Mango, Apple, Grapes, Bel, Banana, Broccoli, Tomato, Bitter Melon, Bitter Orange etc.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Nutraceuticals value of spices and seasoning – Turmeric, Mustard, Chilli, Etc.
- Nutraceuticals from Fruits and Vegetables – Mango, Apple, Grapes, Tomato etc.

### **UNIT – III**

Omega -3 fatty acids from fish- Typical properties, structural formula, functional category. CLA- typical properties, structural formula, functional category. Application in Nutraceuticals. Calcium, chromium, copper, iodine, iron, magnesium, Zn- mechanism of action, bioavailability, uses and deficiency, dietary sources.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Properties of Omega -3 fatty acids from fish and structures
- Application in Nutraceuticals. Calcium, iodine, iron, Zn- mechanism of action, bioavailability, uses and deficiency, dietary sources.

### **UNIT – IV**

Definition, classification – Type of classification (Probiotics, probiotics and synbiotics: Taxonomy and important features of probiotic microorganisms. Health effects of probiotics including mechanism of action. Probiotics in various foods: fermented milk products, non-milk products etc. Prebiotics. Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: Non-digestible carbohydrates/oligosaccharides: Dietary fibre, Resistant starch, Gums.

### **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Probiotics, probiotics and synbiotics: important features of probiotic microorganisms.
- Non-digestible carbohydrates/oligosaccharides: Dietary fibre and etc.

### **UNIT – V**

Phytosterol, Fatty Acids, Carotenoids, Anthocyanins, Carotenoids, Amino Acids, Water Soluble Vitamins, Free radical biology and antioxidant activity of nutraceuticals. Regulations of Nutraceuticals and Functional Foods in India and rest of the world.

## **Learning Outcomes:**

At the end of unit, students will be able to understand the following

- Phytosterol, Fatty Acids, Carotenoids, Anthocyanins, Free radical biology and antioxidant activity of nutraceuticals.
- Regulations of Nutraceuticals and Functional Foods in India and rest of the world.

## **Course Outcomes**

- Students will get know the nutraceuticals and its active components in different foods, regulations on nutraceuticals in India.

## **TEXT BOOKS**

1. "Handbook of Nutraceuticals and Functional Foods. Yashwant Pathak, Vol. 1. (Ingredients, formulations, and applications)" CRC Press 2005.
2. "Handbook of Nutraceuticals and Functional Foods". Robert Wildman, 2<sup>nd</sup> Edition. CRC Press 2001.

## **REFERENCES**

1. B. Shrilakshmi, "Dietetics", 5<sup>th</sup> Edition, New Age International (P) Ltd., New Delhi, 2005.
2. A. E. Bender, "Nutrition and Dietetic Foods", Chem. Pub. Co. New York, 2<sup>nd</sup> Edition, 2004.
3. P. S. Howe, "Basic Nutrition in Health and Disease", 2<sup>nd</sup> Edition, W. B. Saunders Company, London, 2003.
4. Kramer, "Nutraceuticals in Health and Disease Prevention", Hoppe and Packer, Marcel Dekker, Inc., NY 2001.
5. Bao and Fenwick, "Phytochemicals in Health and Disease", Marcel Decker, Inc. NY 2004.



(19A54802a) MATHEMATICAL MODELING & SIMULATION  
OPEN ELECTIVE-IV

**Course Objective:**

This course focuses on what is needed to build simulation software environments, and not just building simulations using preexisting packages.

**UNIT-I:**

Simulation Basics-Handling Stepped and Event-based Time in Simulations-Discrete versus Continuous Modeling-Numerical Techniques-Sources and Propagation of Error

**Learning Outcomes:**

Students will be able to

- Understand computer simulation technologies and techniques.

**UNIT-II**

Dynamical, Finite State, and Complex Model Simulations-Graph or Network Transitions Based Simulations-Actor Based Simulations-Mesh Based Simulations-Hybrid Simulations

**Learning Outcomes:**

Students will be able to

- implement and test a variety of simulation and data analysis.

**UNIT-III**

Converting to Parallel and Distributed Simulations-Partitioning the Data-Partitioning the Algorithms-Handling Inter-partition Dependencies

**Learning Outcomes:**

Students will be able to

- Understand concepts of modeling layers of society's critical infrastructure networks.
- Understand partitioning the data.

**UNIT-IV**

Probability and Statistics for Simulations and Analysis-Introduction to Queues and Random Noise-Random Variates Generation-Sensitivity Analysis

**Learning Outcomes:**

Students will be able to

- Understand Queues and Random noise.
- Understand sensitivity analysis.

**UNIT-V**

Simulations Results Analysis and Viewing Tools-Display Forms: Tables, Graphs, and Multidimensional Visualization-Terminals, X and MS Windows, and Web Interfaces-Validation of Model Results

**Learning Outcomes:**

Students will be able to

- Build tools to view and control simulations and their results.

**Course Outcomes:**

After the completion of course, student will be able to

- Understand basic Model Forms.
- Understand basic Simulation Approaches.
- Evaluate handling Stepped and Event-based Time in Simulations.
- Distinguish Discrete versus Continuous Modeling.
- Apply Numerical Techniques.
- Calculate Sources and Propagation of Error.

**TEXT BOOKS:**

1. JN Kapur, "Mathematical modelling", Newage publishers
2. Kai Velten, "Mathematical Modeling and Simulation: Introduction for Scientists and Engineers" Wiley Publishers.

**(19A51802a) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT**

**Course Objectives:**

- Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

**UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Apply the Green chemistry Principles for day to day life as well as synthesis (L3)
- Describe the sustainable development and green chemistry (L2)
- Explain economic and un-economic reactions (L2)
- Demonstrate Polymer recycling (L2)

**UNIT 2: CATALYSIS AND GREEN CHEMISTRY**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries (L2)
- Differentiate Homogeneous and Heterogeneous catalysis (L2)
- Identify the importance of Bio and Photo Catalysis (L3)
- Discuss Transition metal and Phase transfer Catalysis (L3)

### **UNIT 3: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent

#### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Demonstrate Organic solvents and importance of solvent free systems (L3)
- Discuss Super critical carbondioxide (L2)
- Explain Super critical water and water as a reaction solvent (L2)
- Interpret Ionic Liquids as Catalyst and Solvent (L2)

### **UNIT 4: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES**

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

#### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Describe importance of Biomass and Solar Power (L2)
- Illustrate Sonochemistry and Green Chemistry ((L2)
- Apply Green Chemistry for Sustainable Development (L3)
- Discuss the importance of Renewable resources (L3)

## **UNIT 5: GREEN PROCESSES FOR GREEN NANOSCIENCE**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Discuss green Chemistry Principles for practicing Green nano synthesis (L3)
- Illustrate Microwave Assisted Synthesis (L2)
- Differentiate Hydrothermal and Reflux synthesis (L2)
- Demonstrate Green Chemistry applications of Inorganic nanomaterials (L2)

### **Course Outcomes:**

Upon completion of this course the students should recognize and acquire green chemistry concepts and apply these ideas to develop respect for the inter connectedness of our world and an ethic of environmental care and sustainability.

### **Text Books :**

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4<sup>th</sup> Edition,  
Oxford University Press, USA

### **References :**

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and Ackmez Mudhoo, CRC Press, 2010.
2. Edited by Alvis Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

# HONOURS

**(19A02H01) ADAPTIVE CONTROL SYSTEMS**

**Honors**

**Course Objectives:**

- To understand the basic concepts of Adaptive control and types
- To understand the concept of Self Tuning Regulator
- To design various STR based Adaptive control strategies
- To understand the concept of MRAS
- To understand the concept of Gain scheduling and applications of Adaptive control

**Unit – I**

Introduction, Block Diagram of an Adaptive System, Effects of Process Variations on System Performance, Types of Adaptive Schemes, Formulation of the Adaptive Control Problem, Abuses of Adaptive Control, Least Squares Method and Regression Models for Parameter Estimation – Theorems, Estimating Parameters in Models of Dynamic Systems, The Finite Impulse Response Model, The Transfer Function Model, and The Stochastic Model

**Unit – II**

Block Diagram of Deterministic Self Tuning Regulator (STR), Pole Placement Design – Process Model, Model Following, Causality Conditions. Indirect STRs – Estimation, Continuous - Time STRs, Direct STRs – Minimum Phase Systems, Adaptive Control Algorithm, Feed Forward Control, Non Minimum Phase Systems – Adaptive Control Algorithm, Algorithm For Hybrid STR.

**Unit – III**

Design of Minimum Variance and Moving - Average Controllers, Stochastic STR – Indirect STR, Algorithm for Basic STR, Theorems on Asymptotic Properties. Unification of Direct STRs, Generalized Direct Self Tuning Algorithm, Self Tuning Feed Forward Control. Linear Quadratic STR – Theorems on LQG Control, Algorithms for Indirect LQG – STRs Based on Spectral Factorization and Riccati Equation.

**Unit –IV**

Model Reference Adaptive System (MRAS), The MIT Rule, Block Diagram of an MRAS for adjustment of Feed Forward Gain based on MIT Rule. Adaptation Gain – Methods for determination. Design of MRAS using Lyapunov Theory – Block Diagram of an MRAS based on Lyapunov Theory for a First Order System. Proof of The Kalman – Yakubovich Lemma, Adjustment Rules for Adaptive Systems, Relation between MRAS and STR.

**Unit – V**

Gain Scheduling – Principle, Block Diagram, Design of Gain Scheduling Controllers, Nonlinear Transformations, Block Schematic of a Controller based on Nonlinear Transformations. Application of Gain Scheduling for Ship Steering, Flight Control. Self Oscillating Adaptive System (SOAS) – Principle, Block Diagram, Properties of The Basic SOAS, Procedure for Design of SOAS. Industrial Adaptive Controllers and applications.

**Course Outcomes:**

- Understand the basic concepts of Adaptive control system, types, formulation of control problem and various dynamic models.
- Analyse the Adaptive models like STR and MRAS
- Design of STR based control algorithms and MRAS based control algorithms
- Apply the Adaptive control concepts for various applications
- Evaluate the given dynamical system performance using Adaptive control laws

Text books

1. K.J.Astrom and Bjorn Wittenmark, Adaptive control, Pearson Edu., 2nd Edn.
2. Sankar Sastry, Adaptive control

References

1. V.V.Chalam, Adaptive Control System - Techniques & Applications, Marcel Dekker Inc.
2. Miskhin and Braun, Adaptive control systems, MC Graw Hill
3. Karl Johan Åström, Graham Clifford Goodwin, P. R. Kumar, Adaptive Control, Filtering and Signal Processing
4. G.C. Goodwin, Adaptive control.



(19A02H02) AC DRIVES

Honors

**Course Objectives:**

- To understand the basic concepts of phase Controlled Induction Motor Drive
- To understand the concept of Voltage Source Inverter Fed Induction Motor Drive
- To design various Rotor Side Control of Slip-Ring Induction Motor
- To understand the concept of Control of Synchronous Motor Drives
- To understand the concept of PMSM and BLDC Drives.

**UNIT-I Phase Controlled Induction Motor Drive**

Stator Voltage Control of Induction Motor, Phase-Controlled Converter Fed Induction Motor, Power Circuit and Gating, Reversible Phase-Controlled Induction Motor Drive, Torque-Speed Characteristics.

**Learning Outcomes:**

- Understand the concept of Selection of control of AC motor drive
- To know about various characteristics of phase controlled drives
- To know about power circuit and gating configurations of converter
- To understand about reversible drive

**UNIT-II: Voltage Source Inverter Fed Induction Motor Drive**

Stator Voltage and Frequency Control of Induction Motor, Torque-Speed Characteristic Static Frequency Changers, PWM Inverter Fed Induction Motor Drive, Variable-Voltage Variable-Frequency Operation of Induction Motor, Constant E/f And V/f Control Schemes, Slip Regulation.

**Learning Outcomes:**

- Understand the concept of Variable-Frequency operation of Induction Motor
- To understand about variable-voltage, variable-frequency operation of Induction motor
- Understand the concept of Stator Voltage and Frequency Control of Induction Motor
- To understand about PWM fed IM drive

**UNIT-III: Rotor Side Control of Slip-Ring Induction Motor**

Slip-Power Recovery Schemes, Steady-State Analysis- Range of Slip, Equivalent Circuit, Performance Characteristics; Rating of Converters.

**Vector Control of Induction Motor:**

Principles of Vector Control, Direct Vector Control, Indirect Vector Control, Implementation – Block Diagram, Estimation of Flux, Flux Weakening Operation.

**Learning Outcomes:**

- Understand the concept of rotor side control Slip-Ring Induction Motor

- To know about performance characteristics
- To know about direct vector control of IM drive
- To know about indirect vector control of IM drive

#### **UNIT-IV: Control of Synchronous Motor Drives**

Synchronous Motor - Control Strategies-Constant Torque Angle Control-Power Factor Control, Constant Flux Control, Flux Weakening Operation, Load Commutated Inverter Fed Synchronous Motor Drive, Motoring and Regeneration, Phasor Diagrams.

##### **Learning Outcomes:**

- Understand Synchronous Motor Control Strategies
- Designing of Commutated Inverter Fed Synchronous Motor Drive
- To know about Motoring and Regeneration
- To understand phasor diagrams of Synchronous Motor Drive

#### **Unit-V: PMSM and BLDC Drives**

Characteristics of Permanent Magnet, Synchronous Machines With Permanent Magnet, Vector Control of PMSM- Motor Model and Control Scheme, Constant Torque Angle Control, Constant Mutual Flux Linkages, Unity PF Control. Modelling of PM Brushless DC Motor, Drive Scheme, Commutation Torque Ripple, Phase Advancing.

##### **Learning Outcomes:**

- Understand the concept of PMSM and BLDC Drives
- Design of motor model and control schemes of BLDC motors.
- To understand characteristics of PMSM
- To understand BLDC motor modelling aspects

##### **Course Outcomes:**

- Understand the basic concepts of AC Motor Drives.
- Modelling and analysis Stator Voltage and Frequency Control of Induction Motor, Torque-Speed Characteristic Static Frequency Changers, PWM Inverter Fed Induction Motor Drive.
- Design of speed control of induction motor from rotor end.
- Design and analysis of synchronous motor drives.
- Understand Design the concept of BLDC motor PMSM Motor

##### **TEXT BOOK:**

1. R. Krishnan, **Electric Motor Drives Modelling, Analysis & control**, Pearson Education, 2001.
2. B. K. Bose **Modern Power Electronics and AC Drives**, Pearson Publications, 2001.

**REFERENCE BOOKS:**

1. MD Murphy & FG Turn Bull, Power Electronics control of AC motors, 1<sup>st</sup> Edition, Pergamon press, 1998.
2. G.K. Dubey, **Fundamentals of Electrical Drives**, Narosa Publications, 1995.
3. S. K. Pillai, A First Course on Electrical Drives, New Age International, 1989.
4. Vedam Subrahmanyam, Electric Drives: Concepts and Applications, 2<sup>nd</sup> Edition, McGraw Hill Education, 2017

**(19A02H03) HYBRID AND ELECTRIC VEHICLES**

**Honors**

**UNIT-I:**

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

**UNIT-II:**

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

**UNIT-III:**

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

**UNIT-IV:**

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

**UNIT-V:**

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

References:

1. Iqbal Hussein, *Electric and Hybrid Vehicles: Design Fundamentals*, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, *Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*, CRC Press, 2004.
3. James Larminie, John Lowry, *Electric Vehicle Technology Explained*, Wiley, 2003.

**(19A02H04) POWER SYSTEM WIDE AREA MONITORING AND CONTROL**

**Honors**

**UNIT - I : COMPUTER CONTROL OF POWER SYSTEMS**

Need for real - time and computer control of power systems, operating states of a power system - 3 state & 5 states operation of power system - Supervisory Control and Data Acquisition system (SCADA), implementation considerations, energy control centers. WAMS (Wide Area Measurement system): Architecture, Components of WAMS, GUI (Graphical User Interface), Applications: Voltage Stability Assessment, Frequency stability Assessment, Power Oscillation Assessment, Communication needs of WAMS, WAMPAC (Wide Area Monitoring Protection & Control), RAS (Remedial Action Scheme). Standards: IEEE 1344, IEEE C37.118 (2005), IEEE Standard C37.111-1999 (COMTRADE), IEC61850 GOOSE.

**UNIT - II : STATE ESTIMATION IN POWER SYSTEMS**

Introduction, Power system state estimation, Maximum likelihood, Weighted least Square estimation, Weighted least square estimation. State Estimation of AC Networks: Types of measurements, Linear weighted least square (WLS) estimation theory, DC Load flow based WLS state estimation, Linearised model of WLS state estimation of Non - Linear AC power systems, sequential and non - Sequential methods to process measurements, Typical results of state estimation on an Ac network.

**UNIT - III : TYPES OF STATE ESTIMATION AND NETWORK OBSERVABILITY**

State estimation by conventional WLS (normal equations), Orthogonal decomposition and its algorithm, hybrid method. Tracking of state estimation, Dynamic state estimation, Detection and identification of bad measurements, estimation of quantities not being measured. Network observability and pseudo-measurements, observability by graphical technique and triangularisation approach, Optimal meter placement, Application of power system state estimation.

**UNIT - IV : POWER SYSTEM SECURITY ANALYSIS**

Concept of security, Security analysis and monitoring, factors affecting power system security, detection of network problems, an overview of security analysis. Contingency analysis for generator and line outages by Interactive Linear Power Flow (ILPF) method, Fast decoupled inverse Lemma based approach, network sensitivity factors, Contingency selection, concentric relaxation and bounding.

**UNIT – V: VOLTAGE STABILITY**

Basic concepts, Voltage collapse – general characterization, classification, Voltage stability analysis – modeling, dynamic analysis, static analysis, shortest distance to instability, continuation power flow analysis, prevention of voltage collapse – design measures, operating measures.

#### TEXT BOOKS:

1. Allen J. Wood and Bruce Woolenberg, Power System Generation, Operation and Control, John Wiley and Sons, 1996.
2. John J. Grainger and William D Stevenson Jr, Power System Analysis, McGraw Hill ISE, 1994.
3. P. Kundur, Power System Stability and Control, McGraw Hill.
4. Fahd Hashiesh, M. M. Mansour , Hossam E. Mostafa Fahd Hashiesh , M. M. Mansour , Hossam E. Mostafa, Wide Area Monitoring, Protection and Control: The Gateway to Smart Grids, Lambert Academic Publishing.

#### REFERENCE BOOKS:

1. E. Handschin, Real-time Control of Electrical Power Systems, Elsevier Publications & Co, 1988.
2. Special Issue on Computer Control of Power Systems, IEEE Proc, July 1974.

**(19A02H05) RESTRUCTURED POWER SYSTEMS**

**Honors**

**UNIT I: KEY ISSUES IN ELECTRIC UTILITIES**

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion.

**UNIT II: OPEN ACCESS SAME-TIME INFORMATION SYSTEM (OASIS) & MARKET POWER**

Structure of OASIS - Posting of Information – Transfer capability on OASIS. Market Power: Introduction - Different types of market Power – Mitigation of Market Power - Examples.

**UNIT III: AVAILABLE TRANSFER CAPABILITY (ATC) & ELECTRICITY PRICING**

Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow. Electricity Pricing: Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting.

**UNIT IV: POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT**

Introduction – Operational Planning Activities of ISO- The ISO in Pool Markets – The ISO in Bilateral Markets – Operational Planning Activities of a GENCO.

**UNIT V: TRANSMISSION COST ALLOCATION METHODS & ANCILLARY SERVICES MANAGEMENT**

Introduction - Transmission Cost Allocation Methods : Postage Stamp Rate Method - Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods. Ancillary Services Management: Introduction – Reactive Power as an Ancillary Service – a Review – Synchronous Generators as Ancillary Service Providers.

**TEXT BOOKS :**

1. Kankar Bhattacharya, Math H.J. Boller and Jaap E.Daalder, Operation of Restructured Power System, Kulwer Academic Publishers, 2001.
2. Mohammad Shahidehpour and Muwaffaq Alomoush, Restructured Electrical Power Systems, Marcel Dekker, Inc., 2001.

**REFERENCE BOOKS:**

1. Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd., England.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
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**ANANTHAPURAMU – 515 002 (A.P) INDIA**



**ELECTRICAL AND ELECTRONICS ENGINEERING**

**II B.TECH.**

**Semester– III**

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54302	Complex Variables & Transforms	BS	3	0	0	3
2.	20A02301T	Electrical Circuit Analysis	PC	3	0	0	3
3.	20A02302T	DC Machines & Transformers	PC	3	0	0	3
4.	20A04303T	Digital Logic Design	PC	3	0	0	3
5.	20A52301	<b>Humanities Elective – I</b> Managerial Economics & Financial Analysis	HS	3	0	0	3
	20A52302	Organizational Behavior					
	20A52303	Business Environment					
6.	20A02301P	Electrical Circuit Analysis Lab	PC	0	0	3	1.5
7.	20A02302P	DC Machines & Transformers Lab	PC	0	0	3	1.5
8.	20A04303P	Digital Logic Design Lab	PC	0	0	3	1.5
9.	20A05305	<b>Skill oriented course – I</b> Application development with Python	SC	1	0	2	2
10	20A52201	<b>Mandatory noncredit course – II</b> Universal Human Values	MC	3	0	0	0
11	20A99301	NSS/NCC/NSO Activities	MC	-	-	-	0
<b>Total</b>							<b>21.5</b>

**Semester– IV**

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54402	Numerical Methods & Probability Theory	BS	3	0	0	3
2.	20A04404T	Analog Electronic Circuits	ES	3	0	0	3
3.	20A02401T	Power Electronics	PC	3	0	0	3
4.	20A02402T	AC Machines	PC	3	0	0	3
5.	20A02403T	Electromagnetic Field Theory	PC	3	0	0	3
6.	20A04404P	Analog Electronic Circuits Lab	PC	0	0	3	1.5
7.	20A02401P	Power Electronics Lab	PC	0	0	3	1.5
8.	20A02402P	AC Machines Lab	PC	0	0	3	1.5
9.	20A02404	<b>Skill oriented course – II</b> Circuits Simulation & Analysis using PSPICE	SC	1	0	2	2
10	20A99401	<b>Mandatory noncredit course – III</b> Design Thinking for Innovation	MC	2	1	0	0
<b>Total</b>							<b>21.5</b>
Community Service Internship (Mandatory) for 6 weeks duration during summer vacation							

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

**Note:**

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during third semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	Complex variables and Transforms (Common to ECE & EEE)		L	T	P	C
20A54302			3	0	0	3
Pre-requisite	Functions, Differentiations and Integration	Semester	III			
<b>Course Objectives:</b>						
This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.						
<b>Course Outcomes (CO):</b> Student will be able to						
<ul style="list-style-type: none"> <li>• Understand the analyticity of complex functions and conformal mappings.</li> <li>• Apply cauchy's integral formula and cauchy's integral theorem to evaluate improper integrals along contours.</li> <li>• Understand the usage of laplace transforms, fourier transforms and z transforms.</li> <li>• Evaluate the fourier series expansion of periodic functions.</li> <li>• Understand the use of fourier transforms and apply z transforms to solve difference equations.</li> </ul>						
UNIT - I	<b>Complex Variable – Differentiation:</b>		8 Hrs			
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations ( $\sin z$ , $e^z$ , $\cos z$ , $z^2$ ) Mobius transformations (bilinear) and their properties.						
UNIT - II	<b>Complex Variable – Integration:</b>		9 Hrs			
Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with $f(z)$ not having poles on real axis).						
UNIT - III	<b>Laplace Transforms</b>		9 Hrs			
Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.						
UNIT - IV	<b>Fourier series</b>		8 Hrs			
Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.						
UNIT - V	<b>Fourier transforms &amp; Z Transforms:</b>		9 Hrs			
Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem . Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.						

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**Textbooks:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

**Reference Books:**

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

**Online Learning Resources:**

1. [nptel.ac.in/courses/111107056](http://nptel.ac.in/courses/111107056)
2. [onlinelibrary.wiley.com](http://onlinelibrary.wiley.com)
3. <https://onlinecourses.nptel.ac.in/noc18ma12>.

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	ELECTRICAL CIRCUIT ANALYSIS		L	T	P	C
20A02301T			3	0	0	3
Pre-requisite	Fundamentals of Electrical Circuits	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.</li> <li>Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.</li> <li>To know the applications of Fourier transforms to electrical circuits excited by non sinusoidal sources.</li> <li>Study of Different types of filters, equalizers.</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.</li> <li>To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.</li> <li>Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources are known.</li> <li>To design filters and equalizers.</li> </ul>						
UNIT - I	<b>Locus Diagrams &amp; Resonance</b>		8 Hrs			
Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.						
UNIT - II	<b>Two Port Networks</b>		9 Hrs			
Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.						
UNIT - III	<b>Transient Analysis</b>		12 Hrs			
<b>D.C Transient Analysis:</b> Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation. <b>A.C Transient Analysis:</b> Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.						
UNIT - IV	<b>Fourier Transforms</b>		10 Hrs			
Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.						
UNIT - V	<b>Filters</b>		9 Hrs			
Filters – Low Pass – High Pass, Band Pass and Band Stop– RC, RL filters– derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers.						
<b>Textbooks:</b>						

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1. William Hayt, Jack E. Kemmerly and Jamie Phillips, “Engineering Circuit Analysis”, Mc Graw Hill, 9th Edition, 2019.
2. A. Chakrabarti, “Circuit Theory: Analysis & Synthesis”, Dhanpat Rai & Sons, 2008.

**Reference Books:**

1. M.E. Van Valkenberg, “Network Analysis”, 3rd Edition, Prentice Hall (India), 1980.
2. V. Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall International, 2009.
3. Charles K. Alexander and Matthew. N. O. Sadiku, “Fundamentals of Electric Circuits” Mc Graw Hill, 5th Edition, 2013.
4. MahamoodNahvi and Joseph Edminister, “Electric Circuits” Schaum’s Series, 6th Edition, 2013.
5. John Bird, Routledge, “Electrical Circuit Theory and Technology”, Taylor & Francis, 5th Edition, 2014.

**Online Learning Resources:**

- [https://onlinecourses.nptel.ac.in/noc21\\_ee99/preview](https://onlinecourses.nptel.ac.in/noc21_ee99/preview)
- [https://onlinecourses.nptel.ac.in/noc21\\_ee14/preview](https://onlinecourses.nptel.ac.in/noc21_ee14/preview)

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	DC MACHINES & TRANSFORMERS		L	T	P	C
20A02302T			3	0	0	3
Pre-requisite	Fundamentals of Electrical circuits and Magnetic circuits	Semester	III			
<b>Course Objectives:</b>						
Student will be able to						
<ul style="list-style-type: none"> <li>• Study magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.</li> <li>• understand the constructional details of DC machines and Transformers</li> <li>• Analyze the performance characteristics of DC machines and transformer</li> <li>• Evaluate efficiency, regulation and load sharing of DC machines and transformers Design Equivalent circuit of transformer</li> </ul>						
<b>Course Outcomes (CO):</b>						
At the end of this course, students will demonstrate the ability to						
<ul style="list-style-type: none"> <li>• Understand the concepts of magnetic circuits, principle and operations of DC machines, starters and single and three phase transformers</li> <li>• Analyze armature reaction, parallel operation, speed control and characteristics of DC machines. Also analyze the performance characteristics with the help of OC and SC tests of transformer</li> <li>• Evaluate generated emf, back emf, speed, efficiency and regulations of DC machines and efficiency and regulation of transformer also load sharing of parallel connected transformers</li> <li>• Design winding diagrams of DC machines and equivalent circuit of transformer.</li> </ul>						
UNIT - I	<b>Magnetic Material Properties and Applications:</b>	10 Hrs				
Introduction, Magnetic materials and their properties, magnetically induced emf and force, AC operation of magnetic circuits, hysteresis and eddy current losses, permanent magnets, and applications of permanent magnet materials.						
<b>Principles of electromechanical energy conversion:</b>						
Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems, forces/torques in systems with permanent magnets, energy conversion via electric field, dynamical equations of electro mechanical systems						
UNIT - II	<b>DC Generators</b>	9Hrs				
Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation, armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, emf induced in a coil undergoing commutation, methods of improving commutation, OCC and load characteristics of different types of generators. Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections						
UNIT - III	<b>DC Motors</b>	10 Hrs				
Force on conductor carrying current, back emf, Torque and power developed by armature, speed control of DC motors (Armature control and Flux control methods), Necessity of starters, constructional details of 3-point and 4-point starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency						
<b>Testing of DC machines:</b>						
Brake test, Swinburne's test, Hopkinson's test, Fields test, Retardation test.						
UNIT - IV	<b>Single Phase Transformers</b>	10 Hrs				
Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagrams (no load and on load), Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, losses and efficiency Testing - open circuit and short						

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circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

UNIT - V

**Three Phase Transformers**

9 Hrs

Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection, Tap-changing transformers - No-load and on-load tap changing of transformers, Three-winding transformers- Cooling of transformers.

**Textbooks:**

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

**Reference Books:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

**Online Learning Resources:**

- [https://onlinecourses.nptel.ac.in/noc21\\_ee71/preview](https://onlinecourses.nptel.ac.in/noc21_ee71/preview)
- [https://onlinecourses.nptel.ac.in/noc21\\_ee24/preview](https://onlinecourses.nptel.ac.in/noc21_ee24/preview)



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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	DIGITAL LOGIC DESIGN (Common to ECE and EEE)		L	T	P	C
20A04303T			3	0	0	3
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To familiarize with the concepts of different number systems and Boolean algebra.</li> <li>• To introduce the design techniques of combinational, sequential logic circuits.</li> <li>• To model combinational and sequential circuits using HDLs.</li> </ul>						
<b>Course Outcomes (CO):</b>						
CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map. CO2: Make use of the concepts to solve the problems related to the logic circuits. CO3: Analyze the combinational and sequential logic circuits. CO4: Develop digital circuits using HDL, and Compare various Programmable logic devices CO5: Design various logic circuits using Boolean algebra, combinational and sequential logic circuits.						
UNIT - I	<b>Number Systems, Boolean algebra and Logic Gates</b>					
Number systems - binary numbers, octal, hexadecimal, other binary codes; complements, signed binary numbers, digital logic operations and gates, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, complements of Boolean functions, two-level NAND and NOR Implementation of Boolean functions.						
UNIT - II	<b>Minimization of Boolean functions and Combinational Logic Circuits</b>					
The Karnaugh map method (up to five variables), product of sums simplifications, don't care conditions, Tabular method, Introduction, Combinational circuits, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, decoders and encoders, multiplexers, demultiplexers,						
UNIT - III	<b>Sequential Logic Circuits</b>					
Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register						
UNIT - IV	<b>Finite State Machines and Programmable Logic Devices</b>					
Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector.						
UNIT - V	<b>Hardware Description Language</b>					
Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs, Introduction to Verilog - structural Specification of logic circuits, behavioural specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop; using storage elements with CAD tools-using Verilog constructs for storage elements, flip-flop with clear capability, using Verilog constructs for registers and counters.						
<b>Textbooks:</b>						

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| <ol style="list-style-type: none"><li>1. M. Morris Mano, “Digital Design”, 3rd Edition, PHI. (Unit I to IV)</li><li>2. Stephen Brown and Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design”, 3rd Edition, McGraw-Hill (Unit V)</li></ol> |
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**Reference Books:**

- |   |
|---|
| <ol style="list-style-type: none"><li>1. Charles H. Roth, Jr, “Fundamentals of Logic Design”, 4th Edition, Jaico Publishers.</li><li>2. Zvi Kohavi and Niraj K. Jha, “Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.</li><li>3. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, 2<sup>nd</sup> Edition, Prentice Hall PTR.</li><li>4. D.P. Leach, A.P. Malvino, “Digital Principles and Applications”, TMH, 7th Edition.</li></ol> |
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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS		L	T	P	C
20A52301	(Common to All branches of Engineering)		3	0	0	3
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To inculcate the basic knowledge of micro economics and financial accounting</li> <li>• To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost</li> <li>• To Know the Various types of market structure and pricing methods and strategy</li> <li>• To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.</li> <li>• To provide fundamental skills on accounting and to explain the process of preparing financial statements</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Define the concepts related to Managerial Economics, financial accounting and management.</li> <li>• Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets</li> <li>• Apply the Concept of Production cost and revenues for effective Business decision</li> <li>• Analyze how to invest their capital and maximize returns</li> <li>• Evaluate the capital budgeting techniques</li> <li>• Develop the accounting statements and evaluate the financial performance of business entity.</li> </ul>						
UNIT - I	<b>Managerial Economics</b>					
Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.						
UNIT - II	<b>Production and Cost Analysis</b>					
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale.Cost&Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.						
UNIT - III	<b>Business Organizations and Markets</b>					
Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies						
UNIT - IV	<b>Capital Budgeting</b>					
Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)						

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<b>UNIT - V</b>	<b>Financial Accounting and Analysis</b>
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). <i>Financial Analysis</i> - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.	
<b>Textbooks:</b>	
<ol style="list-style-type: none"> <li>1. Varshney&amp;Maheswari: Managerial Economics, Sultan Chand, 2013.</li> <li>2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. Ahuja HI Managerial economics Schand,3/e,2013</li> <li>2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.</li> <li>3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.</li> <li>4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.</li> </ol>	
<b>Online Learning Resources:</b>	
<a href="https://www.slideshare.net/123ps/managerial-economics-ppt">https://www.slideshare.net/123ps/managerial-economics-ppt</a> <a href="https://www.slideshare.net/rossanz/production-and-cost-45827016">https://www.slideshare.net/rossanz/production-and-cost-45827016</a> <a href="https://www.slideshare.net/darkyla/business-organizations-19917607">https://www.slideshare.net/darkyla/business-organizations-19917607</a> <a href="https://www.slideshare.net/balarajbl/market-and-classification-of-market">https://www.slideshare.net/balarajbl/market-and-classification-of-market</a> <a href="https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396">https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396</a> <a href="https://www.slideshare.net/ashu1983/financial-accounting">https://www.slideshare.net/ashu1983/financial-accounting</a>	

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	ORGANISATIONAL BEHAVIOUR (Common to All branches of Engineering)		L	T	P	C
20A52302			3	0	0	3
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To enable student's comprehension of organizational behavior</li> <li>• To offer knowledge to students on self-motivation, leadership and management</li> <li>• To facilitate them to become powerful leaders</li> <li>• To Impart knowledge about group dynamics</li> <li>• To make them understand the importance of change and development</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Define the Organizational Behaviour, its nature and scope.</li> <li>• Understand the nature and concept of Organizational behaviour</li> <li>• Apply theories of motivation to analyse the performance problems</li> <li>• Analyse the different theories of leadership</li> <li>• Evaluate group dynamics</li> <li>• Develop as powerful leader</li> </ul>						
UNIT - I	<b>Introduction to Organizational Behavior</b>					
Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.						
UNIT - II	<b>Motivation and Leading</b>					
Theories of Motivation- Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Clelland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory .						
UNIT - III	<b>Organizational Culture</b>					
Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader- Women and Corporate leadership.						
UNIT - IV	<b>Group Dynamics</b>					
Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution						
UNIT - V	<b>Organizational Change and Development</b>					
Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development						
<b>Textbooks:</b>						
1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011 2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017						
<b>Reference Books:</b>						
<ul style="list-style-type: none"> <li>▪ McShane, Organizational Behaviour, TMH 2009</li> <li>▪ Nelson, Organisational Behaviour, Thomson, 2009.</li> <li>▪ Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009.</li> <li>▪ Aswathappa, Organisational Behaviour, Himalaya, 2009</li> </ul>						
<b>Online Learning Resources:</b>						

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

<https://www.slideshare.net/Knight1040/organizational-culture-9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714>  
<https://www.slideshare.net/harshrastogi1/group-dynamics-159412405>  
<https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951>

Course Code	Business Environment (Common to All branches of Engineering)		L	T	P	C
20A52303			3	0	0	3
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To make the student to understand about the business environment</li> <li>• To enable them in knowing the importance of fiscal and monetary policy</li> <li>• To facilitate them in understanding the export policy of the country</li> <li>• To Impart knowledge about the functioning and role of WTO</li> <li>• To Encourage the student in knowing the structure of stock markets</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Define Business Environment and its Importance.</li> <li>• Understand various types of business environment.</li> <li>• Apply the knowledge of Money markets in future investment</li> <li>• Analyse India's Trade Policy</li> <li>• Evaluate fiscal and monetary policy</li> <li>• Develop a personal synthesis and approach for identifying business opportunities</li> </ul>						
UNIT - I	<b>Overview of Business Environment</b>					
Introduction – meaning Nature, Scope, significance, functions and advantages. Types-Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis-advantages & limitations of environmental analysis& Characteristics of business.						
UNIT - II	<b>Fiscal &amp; Monetary Policy</b>					
Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.						
UNIT - III	<b>India's Trade Policy</b>					
Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.						
UNIT - IV	<b>World Trade Organization</b>					
Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.						
UNIT - V	<b>Money Markets and Capital Markets</b>					
Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.						

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**Textbooks:**

1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.
2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition. HPH 2016

**Reference Books:**

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

**Online Learning Resources:**

- <https://www.slideshare.net/ShompaDhali/business-environment-53111245>
- <https://www.slideshare.net/rbalsells/fiscal-policy-ppt>
- <https://www.slideshare.net/aguness/monetary-policy-presentationppt>
- <https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982>
- <https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt>
- <https://www.slideshare.net/viking2690/wto-ppt-60260883>
- <https://www.slideshare.net/prateeknepal3/ppt-mo>

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	ELECTRICAL CIRCUIT ANALYSIS LAB		L	T	P	C
20A02301P			0	0	3	1.5
Pre-requisite	Electrical circuits	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• Understand and experimentally verify various resonance phenomenon.</li> <li>• Understand and analyze various current locus diagrams.</li> <li>• Apply and experimentally analyze two port network parameters</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Understand and experimentally verify various resonance phenomenon.</li> <li>• Understand and analyze various current locus diagrams.</li> <li>• Apply and experimentally analyze two port network parameters</li> </ul>						
<b>List of Experiments:</b>						
<ol style="list-style-type: none"> <li>1. Locus Diagram of RL Series Circuits: a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'</li> <li>2. Locus Diagram of RC Series Circuits: a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'</li> <li>3. Series Resonance</li> <li>4. Parallel Resonance</li> <li>5. Determination of Z Parameters</li> <li>6. Determination of Y Parameters</li> <li>7. Transmission Parameters</li> <li>8. Hybrid Parameters</li> <li>9. Determination of Coefficient of coupling</li> <li>10. Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations.</li> </ol>						
<b>References:</b>						
David A. Bell, Fundamentals of Electric Circuits: Lab Manual OUP Canada, 7th Edition, 2009.						
<b>Online Learning Resources/Virtual Labs:</b>						
<ul style="list-style-type: none"> <li>• <a href="http://vlabs.iitkgp.ernet.in/asnm/index.html">http://vlabs.iitkgp.ernet.in/asnm/index.html</a></li> <li>• <a href="https://vlab.amrita.edu/?sub=1&amp;brch=75">https://vlab.amrita.edu/?sub=1&amp;brch=75</a></li> <li>• <a href="http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php">http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php</a></li> </ul>						



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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	DC MACHINES & TRANSFORMERS LAB		L	T	P	C
20A02302P			0	0	3	1.5
Pre-requisite	DC Machines and Transformer	Semester	III			
<b>Course Objectives:</b>						
To conduct various experiments on <ul style="list-style-type: none"> <li>• DC motors and DC Generators</li> <li>• The speed control techniques of DC motors.</li> <li>• To conduct various experiments for testing on 1-phase transformers</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Able to conduct and analyze load test on DC shunt generator</li> <li>• Able to understand and analyze magnetization characteristics of DC shunt generator</li> <li>• Able to understand and analyze speed control techniques and efficiency of DC machines</li> <li>• Able to understand to predetermine efficiency and regulation of single-phase Transformers</li> </ul>						
<b>List of Experiments:</b>						
<p><b>Minimum ten experiments from the following list are required to be conducted</b></p> <ol style="list-style-type: none"> <li>1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.</li> <li>2. Load test on DC shunt generator. Determination of characteristics.</li> <li>3. Brake test on DC shunt motor. Determination of performance curves.</li> <li>4. Swinburne's test on DC shunt motor, Predetermination of efficiency.</li> <li>5. Speed control of DC shunt motor (Armature control and Field control method).</li> <li>6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.</li> <li>7. OC and SC test on single phase transformer</li> <li>8. Parallel operation of single phase transformers.</li> <li>9. Sumpner's test on single phase transformers.</li> <li>10. Load test on DC long shunt compound generator. Determination of characteristics.</li> <li>11. Load test on DC short shunt compound generator. Determination of characteristics.</li> <li>12. Separation of losses in DC shunt motor.</li> <li>13. Separation of losses of single phase transformer</li> </ol>						
<b>References:</b>						
D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017						
<b>Online Learning Resources/Virtual Labs:</b>						
<ul style="list-style-type: none"> <li>• <a href="http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering">http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering</a></li> <li>• <a href="http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html">http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html</a></li> </ul>						

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code		DIGITAL LOGIC DESIGN LAB (Common to ECE and EEE)	L	T	P	C
20A04303P				0	0	3
Pre-requisite	NIL		Semester	IV		
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To understand various pin configurations of the Digital ICs used in the laboratory</li> <li>• To conduct the experiments and verify the truth tables of various logic circuits.</li> <li>• To analyze the logic circuits</li> <li>• To design sequential and combinational logic circuits and verify their properties.</li> <li>• To design of any sequential/combinational circuit using Hardware Description Language.</li> </ul>						
<b>Course Outcomes (CO):</b>						
CO1: Understand the pin configuration of various digital ICs used in the lab CO2: Conduct the experiment and verify the properties of various logic circuits. CO3: Analyze the sequential and combinational circuits. CO4: Design of any sequential/combinational circuit using Hardware/ HDL.						
<b>List of Experiments:</b>						
<ol style="list-style-type: none"> <li>1. Verification of truth tables of the following Logic gates Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR</li> <li>2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.</li> <li>3. Verification of functional table of 3 to 8-line Decoder /De-multiplexer</li> <li>4. 4variable logic function verification using 8 to1 multiplexer.</li> <li>5. Design full adder circuit and verify its functional table.</li> <li>6. Verification of functional tables of (i) JK Edge triggered Flip–Flop (ii) JK Master Slav Flip–Flop (iii) D Flip-Flop</li> <li>7. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output</li> <li>8. Design a four bit Johnson’s counter using D Flip-Flops/JK Flip Flops and verify output</li> <li>9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.</li> <li>10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.</li> <li>11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.</li> <li>12. (a) Draw the circuit diagram of a single bit comparator and test the output (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.</li> </ol>						
<b>ADD on Experiments:</b>						
<ol style="list-style-type: none"> <li>1. Design BCD Adder Circuit and Test the Same using Relevant IC</li> <li>2. Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit.</li> <li>3. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs.</li> <li>4. Design of any combinational circuit using Hardware Description Language</li> <li>5. Design of any sequential circuit using Hardware Description Language</li> </ol>						
<b>References:</b>						
M. Morris Mano, “Digital Design”, 3rd Edition, PHI						
Online learning resources/virtual labs: <a href="https://www.vlab.co.in/">https://www.vlab.co.in/</a>						

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Course Code	Application Development with Python		L	T	P	C
20A05305			1	0	2	2
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To learn the basic concepts of software engineering and life cycle models</li> <li>• To explore the importance of Databases in application Development</li> <li>• Acquire programming skills in core Python</li> <li>• To understand the importance of Object-oriented Programming</li> </ul>						
<b>Course Outcomes (CO):</b>						
Students should be able to <ul style="list-style-type: none"> <li>• Identify the issues in software requirements specification and enable to write SRS documents for software development problems</li> <li>• Explore the use of Object oriented concepts to solve Real-life problems</li> <li>• Design database for any real-world problem</li> <li>• Solve mathematical problems using Python programming language</li> </ul>						
<b>Module 1. Basic concepts in software engineering and software project management</b>						
Basic concepts: abstraction versus decomposition, the evolution of software engineering techniques, Software development life cycle Software project management: project planning and project scheduling  Task: 1. <a href="#">Identifying the Requirements from Problem Statements</a>						
<b>Module 2. Basic Concepts of Databases</b>						
Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, <u>Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table), Data Manipulation Language(DML) Statements</u> Task: 1. Implement <a href="#">Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)</a> 2. Implement <a href="#">Data Manipulation Language(DML) Statements</a>						
<b>Module 3. Python Programming:</b>						
<b>Introduction to Python:</b> Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements						
<b>Python Data Structures:</b> Lists, Dictionaries, Tuples.						
<b>Strings:</b> Creating strings and basic operations on strings, string testing methods.						
<b>Functions:</b> Defining a function- Calling a function- Types of functions-Function Arguments- Anonymous functions- Global and local variables						
<b>OOPS Concepts;</b> Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding						
<b>Modules and Packages:</b> Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages						
<b>Working with Data in Python:</b> Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy						

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Tasks:

**1. OPERATORS**

- a. Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
- b. Read your name and age and write a program to display the year in which you will turn 100 years old.
- c. Read radius and height of a cone and write a program to find the volume of a cone.
- d. Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

**2. CONTROL STRUCTURES**

- a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if...elif...else statement.
- b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.
- c. Write a Program to find the sum of a Series  $1/1! + 2/2! + 3/3! + 4/4! + \dots + n/n!$ . (Input :n = 5, Output : 2.70833)
- d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

**3: LIST**

- a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
- b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
- c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
- d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

**4: TUPLE**

- a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test\_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
- b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test\_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”, ), (“Gfg”, “CS”)], Output : [(,“GFG”, „IS“, „BEST“)]).
- c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

**5: SET**

- a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x\*x).
- b. Write a program to perform union, intersection and difference using Set A and Set B.
- c. Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3)
- d. Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

**6: DICTIONARY**

- a. Write a program to do the following operations:
  - i. Create a empty dictionary with dict() method
  - ii. Add elements one at a time

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- iii. Update existing key's value
- iv. Access an element using a key and also get() method
- v. Deleting a key value using del() method
- b. Write a program to create a dictionary and apply the following methods:
  - i. pop() method
  - ii. popitem() method
  - iii. clear() method
- c. Given a dictionary, write a program to find the sum of all items in the dictionary.
- d. Write a program to merge two dictionaries using update() method.

**7: STRINGS**

- a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
- b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
- c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
- d. Write a program to read a string and count how many times each letter appears. (Histogram).

**8: USER DEFINED FUNCTIONS**

- a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
- b. Write a function merge\_dict(dict1, dict2) to merge two Python dictionaries.
- c. Write a fact() function to compute the factorial of a given positive number.
- d. Given a list of n elements, write a linear\_search() function to search a given element x in a list.

**9: BUILT-IN FUNCTIONS**

- a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
- b. Write a program to demonstrate the working of built-in trigonometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
- c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
- d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

**10. CLASS AND OBJECTS**

- a. Write a program to create a BankAccount class. Your class should support the following methods for
  - i) Deposit
  - ii) Withdraw
  - iii) GetBalance
  - iv) PinChange
- b. Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).
- c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee\_info() method and also using dictionary (\_\_dict\_\_).
- d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

**11. FILE HANDLING**

- a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform

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the following operations:

- i. Count the sentences in the file.
  - ii. Count the words in the file.
  - iii. Count the characters in the file.
- b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
- c. Write a Python program to store N student"s records containing name, roll number and branch. Print the given branch student"s details only.

**References:**

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
3. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
4. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, 2018

**Online Learning Resources/Virtual Labs:**

1. <http://vlabs.iitkgp.ernet.in/se/>
2. <http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php>
3. <https://python-iitk.vlabs.ac.in>

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Course Code	UNIVERSAL HUMAN VALUES (Common to all branches of Engineering)		L	T	P	C
20A52201			3	0	0	0
Pre-requisite	NIL	Semester	III			
<b>Course Objectives:</b>						
<p>The objective of the course is fourfold:</p> <ul style="list-style-type: none"> <li>• Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.</li> <li>• Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence</li> <li>• Strengthening of self-reflection.</li> <li>• Development of commitment and courage to act.</li> </ul>						
<b>Course Outcomes (CO):</b>						
<p>By the end of the course,</p> <ul style="list-style-type: none"> <li>• Students are expected to become more aware of themselves, and their surroundings (family, society, nature)</li> <li>• They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.</li> <li>• They would have better critical ability.</li> <li>• They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).</li> <li>• It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.</li> </ul>						
UNIT - I	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education					8 Hrs
<p>Purpose and motivation for the course, recapitulation from Universal Human Values-I  Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration  Continuous Happiness and Prosperity- A look at basic Human Aspirations  Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority  Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario  Method to fulfil the above human aspirations: understanding and living in harmony at various levels.  Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking</p>						
UNIT - II	Understanding Harmony in the Human Being - Harmony in Myself!					12 Hrs
<p>Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’  Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility  Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)  Understanding the characteristics and activities of ‘I’ and harmony in ‘I’  Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail  Programs to ensure Sanyam and Health.  Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease</p>						
UNIT - III	Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship					8 Hrs
<p>Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship  Understanding the meaning of Trust; Difference between intention and competence  Understanding the meaning of Respect, Difference between respect and differentiation; the other salient</p>						

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<p>values in relationship          Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals          Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.</p> <p>Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives</p>		
UNIT – IV	Understanding Harmony in the Nature and Existence - Whole existence as Coexistence	10 Hrs
<p>Understanding the harmony in the Nature          Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature          Understanding Existence as Co-existence of mutually interacting units in all- pervasive space          Holistic perception of harmony at all levels of existence.          Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.</p>		
UNIT – V	Implications of the above Holistic Understanding of Harmony on Professional Ethics	8 Hrs
<p>Natural acceptance of human values          Definitiveness of Ethical Human Conduct          Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order          Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.          Case studies of typical holistic technologies, management models and production systems          Strategy for transition from the present state to Universal Human Order:          a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers          b. At the level of society: as mutually enriching institutions and organizations          Sum up.          Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.</p>		
<b>Textbooks:</b>		
<p>R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1          R R Gaur, R Asthana, G P Bagaria, “Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics”, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2</p>		
<b>Reference Books:</b>		
<p>Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.          A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004.          The Story of Stuff (Book).          4. Mohandas Karamchand Gandhi “The Story of My Experiments with Truth”          5. E. F.Schumacher. “Small is Beautiful”          Slow is Beautiful –Cecile Andrews          J C Kumarappa “Economy of Permanence”          Pandit Sunderlal “Bharat Mein Angreji Raj”          Dharampal, “Rediscovering India”          Mohandas K. Gandhi, “Hind Swaraj or Indian Home Rule”          India Wins Freedom - Maulana Abdul Kalam Azad          Vivekananda - Romain Rolland(English)          Gandhi - Romain Rolland (English)</p>		



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**MODE OF CONDUCT**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	Numerical Methods & Probability Theory (Common to EEE, MECH)		L	T	P	C
20A54402			3	0	0	3
<b>Pre-requisite</b>	Basic Equations and Basic Probability	<b>Semester</b>	<b>IV</b>			
<b>Course Objectives:</b>						
This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations, the theory of Probability and random variables.						
<b>Course Outcomes (CO): Student will be able to</b>						
<ul style="list-style-type: none"> <li>• Apply numerical methods to solve algebraic and transcendental equations</li> <li>• Derive interpolating polynomials using interpolation formulae</li> <li>• Solve differential and integral equations numerically</li> <li>• Apply Probability theory to find the chances of happening of events.</li> <li>• Understand various probability distributions and calculate their statistical constants.</li> <li>•</li> </ul>						
UNIT - I	<b>Solution of Algebraic &amp; Transcendental Equations:</b>		8 Hrs			
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.						
UNIT - II	<b>Interpolation</b>		8 Hrs			
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.						
UNIT - III	<b>Numerical Integration &amp; Solution of Initial value problems to Ordinary differential equations</b>		9 Hrs			
Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.						
UNIT - IV	<b>Probability theory:</b>		9 Hrs			
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.						
UNIT - V	<b>Random variables &amp; Distributions</b>		9 Hrs			
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution						
<b>Textbooks:</b>						
<ol style="list-style-type: none"> <li>1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.</li> <li>2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, PNIE.</li> <li>3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.</li> </ol>						
<b>Reference Books:</b>						
<ol style="list-style-type: none"> <li>1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.</li> <li>2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.</li> </ol>						
<b>Online Learning Resources:</b>						
<ol style="list-style-type: none"> <li>1. <a href="https://onlinecourses.nptel.ac.in/noc17_ma14/preview">https://onlinecourses.nptel.ac.in/noc17_ma14/preview</a></li> <li>2. <a href="https://nptel.ac.in/courses/117101056/17">nptel.ac.in/courses/117101056/17</a></li> <li>3. <a href="http://nptel.ac.in/courses/111105090">http://nptel.ac.in/courses/111105090</a></li> </ol>						

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	ANALOG ELECTRONIC CIRCUITS		L	T	P	C
20A04404T			3	0	0	3
Pre-requisite	Network Analysis, Electronic Devices and Circuits	Semester	IV			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• List various types of feedback amplifiers, oscillators and large signal Amplifiers.</li> <li>• Explain the operation of various electronic circuits and linear ICs.</li> <li>• Apply various types of electronic circuits to solve engineering problems</li> <li>• Analyse various electronic circuits and regulated power supplies for proper understanding</li> <li>• Justify choice of transistor configuration in a cascade amplifier.</li> <li>• Design electronic circuits for a given specification.</li> </ul>						
Course Outcomes (CO):						
CO1. List various types of feedback amplifiers, oscillators and large signal amplifiers CO2. Explain the operation of various electronic circuits and linear ICs CO3. Apply various types of electronic circuits to solve engineering problems CO4. Analyze various electronic circuits and regulated power supplies for proper understanding CO5. Justify choice of transistor configuration in a cascade amplifier CO6. Design electronic circuits for a given specification						
UNIT - I	Multistage Amplifiers					
Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.						
UNIT - II	Feedback Amplifiers and Oscillators					
Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage–shunt. Oscillators: Sinusoidal Oscillators, Conditions for oscillations, Phase-shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).						
UNIT - III	Large Signal Amplifiers (Power Amplifiers)					
Introduction, Classification, Class A large signal amplifiers, Second - Harmonic Distortion, Higher - Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.						
UNIT - IV	Operational Amplifier					
Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal op-amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations. The Practical op-amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain–bandwidth product, frequency limitations and compensations, transient response.						
UNIT - V	Applications of OP-AMPS and Special ICs					
Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, Oscillators: RC phase shift oscillator, Wien bridge oscillator, Square wave generator. Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of						

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Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO566, PLL565, Fixed and variable Voltage regulators.

**Textbooks:**

- Millman, Halkias and Jit , “Electronic Devices and Circuits” , 4<sup>th</sup> Edition , McGraw Hill Education (India) Private Ltd.,2015.
- Salivahanan and N. Suresh Kumar, “ Electronic Devices and Circuits”,4<sup>th</sup>Edition,McGrawHill Education(India)Private Ltd.,2017.
- Ramakanth A. Gayakwad, “Op-Amps& LinearICs”,4<sup>th</sup>Edition, Pearson, 2017.

**Reference Books:**

- Millman and Taub, Pulse, Digital and Switching Waveforms, 3<sup>rd</sup>Edition, TataMcGraw-Hill Education, 2011.
- J. Milliman, C.C. Halkias and Chetan Parikh, “Integrated Electronics”, 2<sup>nd</sup>Edition, McGraw Hill, 2010.
- David A. Bell, “ Electronic Devices and Circuits”, 5<sup>th</sup>edition,OxfordPress,2008.
- D. Roy Choudhury, “LinearIntegratedCircuits”,2<sup>nd</sup>Edition, New Age International (p)Ltd,2003.

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	POWER ELECTRONICS		L	T	P	C
20A02401T			3	0	0	3
Pre-requisite	Electrical circuits and semiconductor devices	Semester	IV			
<b>Course Objectives:</b>						
The student will be able to: <ul style="list-style-type: none"> <li>Understand the differences between signal level and power level devices.</li> <li>Analyze controlled rectifier circuits.</li> <li>Analyze the operation of DC-DC choppers.</li> <li>Analyze the operation of voltage source inverters.</li> </ul>						
<b>Course Outcomes (CO):</b>						
At the end of this course students will be able to: <ul style="list-style-type: none"> <li>Understand the operation, characteristics and usage of basic Power Semiconductor Devices.</li> <li>Understand different types of Rectifier circuits with different operating conditions.</li> <li>Understand DC-DC converters operation and analysis of their characteristics.</li> <li>Understand the construction and operation of voltage source inverters, Voltage Controllers and Cyclo Converters.</li> <li>Apply all the above concepts to solve various numerical problem solving</li> </ul>						
UNIT - I	<b>Power Switching Devices</b>	9 Hrs				
Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction to Gallium Nitride and Silicon Carbide Devices.						
UNIT - II	<b>Rectifiers</b>	10 Hrs				
Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems.						
UNIT - III	<b>DC-DC CONVERTERS</b>	9 Hrs				
Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.						
UNIT - IV	<b>INVERTERS</b>	10 Hrs				
Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.						
UNIT - V	<b>AC VOLTAGE CONTROLLERS &amp; CYCLO CONVERTERS:</b>	10 Hrs				
AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output						

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voltage equation.

**Textbooks:**

1. M. H. Rashid, “Power Electronics: Circuits, Devices and Applications”, 2nd edition, Prentice Hall of India, 1998
2. P.S.Bimbhra, ”Power Electronics”, 4th Edition, Khanna Publishers, 2010.
3. M. D. Singh & K. B. Kanchandhani, “Power Electronics”, Tata Mc Graw Hill Publishing Company, 1998.

**Reference Books:**

1. Ned Mohan, “Power Electronics”, Wiley, 2011.
2. Robert W. Erickson and Dragan Maksimovic, “Fundamentals of Power Electronics” 2nd Edition, Kluwer Academic Publishers, 2004.
3. Vedam Subramanyam, “Power Electronics”, New Age International (P) Limited, 1996.
4. V.R.Murthy, “Power Electronics”, 1st Edition, Oxford University Press, 2005. 5. P.C.Sen, “Power Electronics”, Tata Mc Graw-Hill Education, 1987.
5. “Power Electronic Control of Alternating Current Motors” by J.M.D.Murphy

**Online Learning Resources:**

<https://www.classcentral.com/course/youtube-electrical-power-electronics-47667/classroom>  
[https://onlinecourses.nptel.ac.in/noc21\\_ee01/preview](https://onlinecourses.nptel.ac.in/noc21_ee01/preview)

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	AC MACHINES		L	T	P	C
20A02402T			3	0	0	3
Pre-requisite	Electrical circuits, Magnetic circuits, DC machines and transformers	Semester	IV			
<b>Course Objectives:</b>						
The students will be able to: <ul style="list-style-type: none"> <li>Understand the fundamentals of AC machines, know equivalent circuit performance characteristics.</li> <li>Understand the methods of starting of Induction motors.</li> <li>Understand the methods of starting of Synchronous motors.</li> <li>Understand the parallel operation of Alternators.</li> </ul>						
<b>Course Outcomes (CO):</b>						
At the end of this course, students will be able to: <ul style="list-style-type: none"> <li>Understand the basics of ac machine windings, construction, principle of working, equivalent circuit of induction and synchronous machines.</li> <li>Analyze the phasor diagrams of induction and synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators.</li> <li>Apply the concepts to determine V and inverted V curves and power circles of synchronous motor.</li> <li>Analyze the various methods of starting in both induction and synchronous machines.</li> </ul>						
UNIT - I	<b>Fundamentals of AC machine windings</b>	9Hrs				
Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factors.						
UNIT - II	<b>Induction Machines</b>	10 Hrs				
Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram, performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging. Analysis of 3 phase induction motors with single phasing operation.						
UNIT - III	<b>Synchronous generators</b>	10 Hrs				
Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation, EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.						
UNIT - IV	<b>Synchronous motors</b>	10 Hrs				
Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.						
UNIT - V	<b>Single-phase induction motors</b>	9 Hrs				
Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase						

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motors, reluctance single phase motors, stepper motors, BLDC motors.

**Textbooks:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

**Reference Books:**

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

**Online Learning Resources:**

- [https://onlinecourses.nptel.ac.in/noc21\\_ee13/preview](https://onlinecourses.nptel.ac.in/noc21_ee13/preview)



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Course Code	ELECTROMAGNETIC FIELD THEORY		L	T	P	C
20A02403T			3	0	0	3
Pre-requisite	Magnetic circuits	Semester	IV			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To understand the basic principles of electrostatics</li> <li>• To understand the basic principles of magneto statics for time invariant and time varying fields</li> <li>• To understand the principles of dielectrics, conductors and magnetic potentials</li> </ul>						
<b>Course Outcomes (CO):</b>						
After completion of the course, the student will be able to:						
<ul style="list-style-type: none"> <li>• Understand the concept of electrostatics</li> <li>• Understand the concepts of Conductors and Dielectrics</li> <li>• Understand the fundamental laws related to Magneto Statics</li> <li>• Understand the concepts of Magnetic Potential and Time varying Fields</li> </ul>						
UNIT - I	<b>ELECTROSTATICS</b>		9 Hrs			
Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss Law Application of Gauss Law-Maxwell's First Law – Numerical Problems. Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.						
UNIT - II	<b>CONDUCTORS AND DIELECTRICS</b>		9 Hrs			
Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.						
UNIT - III	<b>MAGNETO STATICS</b>		11 Hrs			
Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular & Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems. Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.						
UNIT - IV	<b>MAGNETIC POTENTIAL</b>		9 Hrs			
Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations. Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.						
UNIT - V	<b>TIMEVARYING FIELDS</b>		10 Hrs			

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Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current. Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.'

**Textbooks:**

1. Sadiku, Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2015
2. William.H.Hayt, "Engineering Electromagnetics", Mc Graw Hill, 2010.

**Reference Books:**

- 1.J.D.Kraus, "Electromagnetics", 5th Edition, Mc Graw Hill Inc, 1999.
2. David K. Cheng, "Field & Electromagnetic Waves", 2nd Edition, 1989.
3. Joseph A. Edminister, "Electromagnetics", 2nd Edition, Schaum's Outline, Mc Graw Hill, 2017.
4. K.A. Gangadhar and P.M. Ramanathan, "Electromagnetic Field Theory", 8th Reprint, Khanna Publications, 2015.

**Online Learning Resources:**

- <https://www.classcentral.com/course/youtube-electrical-electro-magnetic-fields-47689/classroom>
- [https://onlinecourses.nptel.ac.in/noc21\\_ee83/preview](https://onlinecourses.nptel.ac.in/noc21_ee83/preview)

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	ANALOG ELECTRONIC CIRCUITS LAB		L	T	P	C
20A04404P			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To learn basic techniques for the design of analog circuits, digital circuits and fundamental concepts used in the design of systems.</li> <li>• To design and analyze multistage amplifiers, feedback amplifiers and OPAMP based circuits.</li> <li>• To implement simple logical operations using combinational logic circuits</li> <li>• To design combinational logic circuits, sequential logic circuits.</li> </ul>						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>• Analyze various amplifier circuits.</li> <li>• Design multistage amplifiers.</li> <li>• Design OPAMP based analog circuits.</li> <li>• Understand working of logic gates.</li> <li>• Design and implement Combinational and Sequential logic circuits.</li> </ul>						
<b>List of Experiments:</b>						
<b>PARTA</b>						
<b>List of Experiments:</b>						
<ol style="list-style-type: none"> <li>1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.</li> <li>2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.</li> <li>3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.</li> <li>4. Design RC Phase shift oscillator/Wien bridge oscillator and square wave generator for the given specifications. Determine the frequency of oscillation.</li> <li>5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without cross-over distortion. Determine maximum output power and efficiency.</li> <li>6. Design inverting and non-inverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.</li> <li>7. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.</li> <li>8. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.</li> <li>9. Design an astable multi-vibrator circuit for the given specifications using 555timer. Observe ON &amp; OFF states of transistor in an astable multi-vibrator. Plot output waveforms.</li> <li>10. Design an Monostable Multi-Vibrator circuit for the given specifications using 555 Timer. Plot output waveforms.</li> </ol>						
<p><b>Note:</b> Design &amp; simulate any 6 experiments with Multisim/PSPICE or equivalent software and verify the results in hardware lab with discrete components.</p>						

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**PART B**

**List of Experiments:**

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Realization of Boolean Expressions using Gates
3. Design a 3-bit Adder/Subtractor
4. Design and realization a 4-bit Gray to Binary and Binary to Gray Converter
5. Design and construct basic flip-flops R-S, J-K, J-K Masterslave flip-flops using gates and verify their truth tables
6. Design and implementation of Mod-N synchronous counter using J-K flip-flops.
7. Design and implementation of i) Ring counter and ii) Johnson counter using 4 3 bit shift register
8. Design and realization of 8x1 MUX using 2x1 MUX

**Note:** Student has to perform minimum of 4 experiments using digital ICs

**Online learning resources/Virtual Labs:**

<https://www.vlab.co.in/>

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	POWER ELECTRONICS LAB		L	T	P	C
20A02401P			0	0	3	1.5
Pre-requisite	Power Electronics	Semester	IV			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.</li> <li>• Analyze the operation of single-phase half &amp; fully-controlled converters and inverters with different types of loads.</li> <li>• Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.</li> <li>• Create and analyze various power electronic converters using PSPICE software.</li> </ul>						
<b>Course Outcomes (CO):</b>						
<p>By the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.</li> <li>• Analyze the operation of single-phase half &amp; fully-controlled converters and inverters with different types of loads.</li> <li>• Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.</li> <li>• Create and analyze various power electronic converters using PSPICE software.</li> </ul>						
<b>List of Experiments:</b>						
<b>Minimum eight experiments from the following list are required to be conducted</b>						
<ol style="list-style-type: none"> <li>1. Study of Characteristics of SCR, MOSFET &amp; IGBT</li> <li>2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering</li> <li>3. Single Phase AC Voltage Controller with R and RL Loads</li> <li>4. Single Phase fully controlled bridge converter with R and RL loads</li> <li>5. Forced Commutation circuits (Class A, Class B, Class C, Class D &amp; Class E)</li> <li>6. DC Jones chopper with R and RL Loads</li> <li>7. Single Phase Parallel, inverter with R and RL loads</li> <li>8. Single Phase Cycloconverter with R and RL loads</li> <li>9. Single Phase Half controlled converter with R and RL load</li> <li>10. Single Phase Fully controlled converter with R and RL load</li> <li>10. Three Phase half controlled bridge converter with R, RL-load</li> <li>11. Three Phase fully controlled bridge converter with R, RL-load</li> <li>11. Single Phase series inverter with R and RL loads</li> <li>12. Single Phase Bridge converter with R and RL loads</li> <li>13. Single Phase dual converter with RL loads</li> </ol>						
<b>References:</b>						
<ol style="list-style-type: none"> <li>1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007.</li> <li>2. M.H.Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications.</li> <li>3. PSPICE A/D user's manual – Microsim, USA.</li> <li>4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user's manual and – Math works, USA.</li> </ol>						
<b>Online Learning Resources/Virtual Labs:</b>						
<ul style="list-style-type: none"> <li>• <a href="http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php">http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php</a></li> </ul>						

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	AC MACHINES LAB		L	T	P	C
20A02402P			0	0	3	1.5
Pre-requisite	AC Machines	Semester	IV			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.</li> <li>• Predetermine regulation of a three-phase alternator by synchronous impedance &amp; m.m.f methods.</li> <li>• Predetermine the regulation of Alternator by Zero Power Factor method <math>X_d</math> and <math>X_q</math> determination of salient pole synchronous machine.</li> <li>• Evaluate and analyze V and inverted V curves of 3 phase synchronous motor</li> </ul>						
<b>Course Outcomes (CO):</b>						
<p>By the end of the course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.</li> <li>• Predetermine regulation of a three-phase alternator by synchronous impedance &amp; m.m.f methods.</li> <li>• Predetermine the regulation of Alternator by Zero Power Factor method <math>X_d</math> and <math>X_q</math> determination of salient pole synchronous machine.</li> <li>• Evaluate and analyze V and inverted V curves of 3 phase synchronous motor</li> </ul>						
<b>List of Experiments:</b>						
<p><b>All the following ten experiments are required to be conducted</b></p> <ol style="list-style-type: none"> <li>1. No-load &amp; Blocked-rotor tests on Squirrel cage Induction motor.</li> <li>2. Load test on three phase slip ring Induction motor.</li> <li>3. Speed control of three phase induction motor</li> <li>4. Rotor resistance starter for slip ring induction motor</li> <li>5. Load test on single phase induction motor.</li> <li>6. Determination of Equivalent circuit of a single phase induction motor.</li> <li>7. Predetermination of Regulation of a three phase alternator by synchronous impedance &amp; m.m.f methods.</li> <li>8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.</li> <li>9. Determination of <math>X_d</math> and <math>X_q</math> of a salient pole synchronous machine by slip test.</li> <li>10. V and inverted V curves of a 3-phase synchronous motor.</li> </ol>						
<b>References:</b>						
<ol style="list-style-type: none"> <li>1. D. P.Kothari and B. S. Umre, "Laboratory Manual for Electrical Machines" I.K International Publishing House Pvt. Ltd, 2017.</li> <li>2. D.R. Kohli and S.K. Jain, "A Laboratory Course in Electrical Machines" NEM Chand &amp; Bros.</li> </ol>						
<b>Online Learning Resources/Virtual Labs:</b>						
<ul style="list-style-type: none"> <li>• <a href="http://vem-iitg.vlabs.ac.in/">http://vem-iitg.vlabs.ac.in/</a></li> <li>• <a href="http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering">http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering</a></li> <li>• <a href="http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html">http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html</a></li> </ul>						

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	CIRCUITS SIMULATION AND ANALYSIS USING PSPICE		L	T	P	C
20A02404			1	0	2	2
Pre-requisite	Electrical Circuits, Power Electronics	Semester	IV			
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• Simulation of various circuits using PSPICE software.</li> <li>• Simulation of single-phase half &amp; fully-controlled converters, and inverters</li> <li>• Simulation of single-phase AC Voltage controllers with different loads.</li> </ul>						
<b>Course Outcomes (CO)</b>						
By the end of the course, the student will be able to:						
<ul style="list-style-type: none"> <li>• Simulation of various circuits using PSPICE software.</li> <li>• Simulation of single-phase half &amp; fully-controlled converters, and inverters</li> <li>• Simulation of single-phase AC Voltage controllers with different loads.</li> </ul>						
<b>List of Experiments:</b>						
<p>I Simulation of Electrical Circuits</p> <ol style="list-style-type: none"> <li>a) DC &amp; AC Circuits</li> <li>b) Mesh Analysis</li> <li>c) Nodal Analysis</li> <li>d) Transient Response</li> </ol> <p>II Simulation of Power Electronic Circuits</p> <ol style="list-style-type: none"> <li>a) Single-phase half wave, Semi and full converters with RLE loads.</li> <li>b) Three-phase half wave, Semi and full converters with RLE loads.</li> <li>c) Buck, Boost and Buck-Boost Converters</li> <li>d) Single-phase AC voltage controller</li> <li>e) Single and Three phase Quasi Square wave and PWM Inverters.</li> </ol>						
<b>References:</b>						
<ol style="list-style-type: none"> <li>1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.</li> <li>2. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.</li> <li>3. PSPICE A/D user's manual – Microsim, USA.</li> <li>4. PSPICE reference guide – Microsim, USA.</li> <li>5. MATLAB and its Tool Books user's manual and – Mathworks, USA</li> </ol>						
<b>Online Learning Resources/Virtual Labs:</b>						
<ul style="list-style-type: none"> <li>• <a href="http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php">http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php</a></li> </ul>						

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Code	Design Thinking for Innovation (Common to All branches of Engineering)		L	T	P	C
20A99401			2	1	0	0
Pre-requisite	NIL	Semester	IV			
<b>Course Objectives:</b>						
The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.						
<b>Course Outcomes (CO):</b>						
<ul style="list-style-type: none"> <li>● Define the concepts related to design thinking.</li> <li>● Explain the fundamentals of Design Thinking and innovation</li> <li>● Apply the design thinking techniques for solving problems in various sectors.</li> <li>● Analyse to work in a multidisciplinary environment</li> <li>● Evaluate the value of creativity</li> <li>● Formulate specific problem statements of real time issues</li> </ul>						
<b>UNIT - I</b>	<b>Introduction to Design Thinking</b>					<b>10 Hrs</b>
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.						
<b>UNIT - II</b>	<b>Design Thinking Process</b>					<b>10 Hrs</b>
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development						
<b>Activity:</b> Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.						
<b>UNIT - III</b>	<b>Innovation</b>					<b>8 Hrs</b>
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.						
<b>Activity:</b> Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.						
<b>UNIT - IV</b>	<b>Product Design</b>					<b>8 Hrs</b>
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.						
<b>Activity:</b> Importance of modelling, how to set specifications, Explaining their own product design.						
<b>UNIT - V</b>	<b>Design Thinking in Business Processes</b>					<b>10 Hrs</b>
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.						
<b>Activity:</b> How to market our own product, About maintenance, Reliability and plan for startup.						
<b>Textbooks:</b>						



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1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

**Reference Books:**

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

**Online Learning Resources:**

<https://nptel.ac.in/courses/110/106/110106124/>  
<https://nptel.ac.in/courses/109/104/109104109/>  
[https://swayam.gov.in/nd1\\_noc19\\_mg60/preview](https://swayam.gov.in/nd1_noc19_mg60/preview)

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

**COMMUNITY SERVICE PROJECT**

.....Experiential learning through community engagement

**Introduction**

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

**Objective**

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

**Implementation of Community Service Project**

- Every student should put in a 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty incharge.

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- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

**Procedure**

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

**EXPECTED OUTCOMES**

**BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**

**Learning Outcomes**

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- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

**Personal Outcomes**

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

**Social Outcomes**

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

**Career Development**

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

**Relationship with the Institution**

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

**BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS**

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES**

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY**

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

**SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT**

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The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

**For Engineering Students**

- 1. Water facilities and drinking water availability**
- 2. Health and hygiene**
- 3. Stress levels and coping mechanisms**
- 4. Health intervention programmes**
- 5. Horticulture**
- 6. Herbal plants**
- 7. Botanical survey**
- 8. Zoological survey**
- 9. Marine products**
- 10. Aqua culture**
- 11. Inland fisheries**
- 12. Animals and species**
- 13. Nutrition**
- 14. Traditional health care methods**
- 15. Food habits**
- 16. Air pollution**
- 17. Water pollution**
- 18. Plantation**
- 19. Soil protection**
- 20. Renewable energy**
- 21. Plant diseases**
- 22. Yoga awareness and practice**
- 23. Health care awareness programmes and their impact**
- 24. Use of chemicals on fruits and vegetables**
- 25. Organic farming**
- 26. Crop rotation**
- 27. Floury culture**
- 28. Access to safe drinking water**
- 29. Geographical survey**
- 30. Geological survey**
- 31. Sericulture**
- 32. Study of species**
- 33. Food adulteration**
- 34. Incidence of Diabetes and other chronic diseases**
- 35. Human genetics**

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36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

**Programmes for School Children**

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

**Programmes for Women Empowerment**

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

**General Camps**

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

**Programmes for Youth Empowerment**

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

**Common Programmes**

1. Awareness on RTI
2. Health intervention programmes

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**ELECTRICAL AND ELECTRONICS ENGINEERING**

3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
  - i. Agriculture
  - ii. Health
  - iii. Marketing and Cooperation
  - iv. Animal Husbandry
  - v. Horticulture
  - vi. Fisheries
  - vii. Sericulture
  - viii. Revenue and Survey
  - ix. Natural Disaster Management
  - x. Irrigation
  - xi. Law & Order
  - xii. Excise and Prohibition
  - xiii. Mines and Geology
  - xiv. Energy

**Role of Students:**

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

**Timeline for the Community Service Project Activity**

**Duration: 8 weeks**

**1. Preliminary Survey (One Week)**

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

**2. Community Awareness Campaigns (One Week)**

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- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

**3. Community Immersion Programme (Three Weeks)**

**Along with the Community Awareness Programmes**, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

**4. Community Exit Report (One Week)**

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.





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**B.TECH. – ELECTRICAL & ELECTRONICS ENGINEERING**  
**Course Structure (R20) – III & IV Year**

<b>Semester-V</b>						
<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1.	20A02501	Power System Architecture	3	0	0	3
2.	20A02502T	Control Systems	3	0	0	3
3.	20A02503T	Measurements & Sensors	3	0	0	3
4.		<b>Professional Elective Course – I</b>	3	0	0	3
	20A02504a	Switchgear and Protection				
	20A02504b	Power Electronics Drives				
	20A02504c	Power Quality				
5.		<b>Open Elective Course – I</b>	3	0	0	3
6.	20A02502P	Control Systems Lab	0	0	3	1.5
7.	20A02503P	Measurements & Sensors Lab	0	0	3	1.5
8.		<b>Skill oriented course - III</b>	1	0	2	2
	20A52401	Soft Skills				
9.	20A02505	Evaluation of Community Service Project				1.5
<b>Total</b>						<b>21.5</b>

**Open Elective Course – I**

<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1	20A01505	Building Technology	CE
2	20A03505	3D Printing Technology	ME
3	20A04506	Principles of Communication Systems	ECE
4	20A05505a	Java Programming	CSE & Allied/IT
5	20A05602T	Artificial Intelligence	
6	20A12502	Mobile Application Development using Android	
7	20A27505	Computer Applications in Food Processing	FT
8	20A54501	Optimization Techniques	Mathematics
9	20A56501	Materials Characterization Techniques	Physics
10	20A51501	Chemistry of Energy Materials	Chemistry

**Note:**

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline



<b>Semester–VI</b>						
<b>S.No.</b>	<b>CourseCode</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1.	20A02601T	Power System Analysis	3	0	0	3
2.	20A02602T	Digital Computing Platforms	3	0	0	3
3.	20A04502T	Digital Signal Processing	3	0	0	3
4.		<b>Professional Elective Course– II</b>	3	0	0	3
	20A02604a	HVDC and FACTS				
	20A02604b	Nonlinear System Analysis				
	20A02604c	Design of Photovoltaic Systems				
5.		<b>Open Elective Course – II</b>	3	0	0	3
6.	20A02601P	Power Systems AnalysisLab	0	0	3	1.5
7.	20A02602P	Digital Computing Platforms Lab	0	0	3	1.5
8.	20A04502P	Digital Signal Processing Lab	0	0	3	1.5
9.		<b>Skill oriented course - IV</b>	1	0	2	2
	20A02606	Applications of Soft Computing Tools in Electrical Engineering				
10.		<b>Mandatory Non-credit Course</b>	2	0	0	0
	20A99601	Intellectual Property Rights & Patents				
<b>Total</b>						<b>21.5</b>
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

### Open Elective Course – II

<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1	20A01605	Environmental Economics	CE
2	20A03605	Introduction to Robotics	ME
3	20A04606	Basic VLSI Design	ECE
4	20A04701b	Introduction to Internet of Things	ECE/CSE
5	20A05605a	Principles of Operating Systems	CSE & Allied/IT
6	20A05605b	Foundations of Machine Learning	
7	20A05605c	Data Analytics Using R	
8	20A27605	Food Refrigeration and Cold Chain Management	FT
9	20A54701	Wavelet Transforms & its applications	Mathematics
10	20A56701	Physics Of Electronic Materials and Devices	Physics
11	20A51701	Chemistry of Polymers and its Applications	Chemistry



<b>Semester-VII</b>						
<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>1.</b>	20A02701a 20A02701b 20A02701c	<b>Professional Elective Course– III</b> Power System Operation & Control Switched Mode Power Converters Electrical & Electronics Instrumentation	3	0	0	3
<b>2.</b>	20A02702a 20A02702b 20A02702c	<b>Professional Elective Course– IV</b> Electrical Distribution System & Automation FPGA based Controller Design Intelligent Control Techniques	3	0	0	3
<b>3.</b>	20A02703a 20A04403T 20A02703c	<b>Professional Elective Course– V</b> Programmable Logic Controllers Linear & Digital IC Applications Electric Vehicle Technologies	3	0	0	3
<b>4.</b>	20A52701a 20A52701b 20A52701c	<b>Humanities Elective – II</b> Entrepreneurship and Incubation Management Science Enterprise Resource Planning	3	0	0	3
<b>5.</b>		<b>Open Elective Course – III</b>	3	0	0	3
<b>6.</b>		<b>Open Elective Course – IV</b>	3	0	0	3
<b>7.</b>	20A02706	<b>Skill oriented course – V</b> Energy Conservation and Audit	1	0	2	2
<b>8.</b>	20A02707	Evaluation of Industry Internship				3
<b>Total</b>						<b>23</b>

**Open Elective Course – III**

<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offered by the Dept.</b>
1	20A01704	Cost Effective Housing Techniques	CE
2	20A03704	Product Design & Development	ME
3	20A04704	Electronic Sensors	ECE
4	20A05704a	Web Technologies	CSE & Allied/IT
5	20A05704b	VR & AR for Engineers	
6	20A05704c	Software Engineering	
7	20A27704	Human Nutrition	FT
8	20A54702	Numerical Methods for Engineers	Mathematics
9	20A56702	Sensors And Actuators for Engineering Applications	Physics
10	20A51702	Chemistry of Nanomaterials and Applications	Chemistry

**Open Elective Course – IV**

<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offering by the Dept.</b>
1	20A01705	Health, Safety & Environmental management	CE
2	20A03705	Introduction to Composite Materials	ME
3	20A04706	Principles of Cellular & Mobile Communications	ECE
4	20A05705a	Cyber Security	CSE & Allied/IT
5	20A05705b	Introduction to Full Stack Development	
6	20A05705c	Industrial IoT	
7	20A27705	Waste and Effluent Management	FT
8	20A54703	Number theory & its applications	Mathematics
9	20A56703	Smart Materials and Devices	Physics
10	20A51703	Green Chemistry and Catalysis for Sustainable Environment	Chemistry



<b>Semester-VIII</b>							
<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1.	20A02801	Full Internship & Project work	PR				12
<b>Total</b>							<b>12</b>

**COURSES OFFERED FOR HONOURS DEGREE IN EEE**

<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Contact Hours per week</b>		<b>Credits</b>
			<b>L</b>	<b>T</b>	
1	20A02H01	Electric Vehicle Technology & Mobility	3	1	4
2	20A02H02	Battery Management Systems	3	1	4
3	20A02H03	Special Machines for Electric Vehicles	3	1	4
4	20A02H04	Grid Interface of Electric Vehicles	3	1	4
<b>SUGGESTED MOOCs</b>					
5	20A02H05	Introduction to Hybrid and Electric Vehicles (MOOC-NPTEL)	--	--	2
6	20A02H06	Electric Vehicles and RenewableEnergy(MOOC-NPTEL)	--	--	2

**LIST OF MINORS OFFERED TO EEE**

<b>S.No.</b>	<b>Minor Title</b>	<b>Department offering the Minor</b>
1.	Construction Technology	Civil Engineering
2.	Environmental Geotechnology	Civil Engineering
3.	3D Printing	ME
4.	Industrial Engineering	ME
5.	Internet of Things	ECE
6.	Food Science	Food Technology
8.	Artificial Intelligence & Data Science	CSE& Allied/ IT
9.	Virtual & Augmented Reality	
10.	Cyber Security &Blockchain Technologies	



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**B.Tech (EEE)– III-I Sem**

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**(20A02501) POWER SYSTEM ARCHITECTURE**

**Course Objectives:**

- Operation of Conventional Power generating systems and their components.
- The role of non-conventional power generating systems and their operation and economic aspects.
- Calculation of different transmission line parameters and their use.
- Modeling of transmission line and evaluation of constants.

**Course Outcomes:**

- Remember and understand the concepts of conventional and nonconventional power generating systems.
- Apply the economic aspects to the power generating systems.
- Analyse the transmission lines and obtain the transmission line parameters and constants.
- Design and develop the schemes to improve the generation and capability of transmission line to meet the day-to-day power requirements.

**UNIT I POWER GENERATING SYSTEMS**

**Thermal Power:** Block Diagram of Thermal Power Station (TPS), Brief Description of TPS Components

**Hydro Power:** Selection of Site, Classification, Layout, Description of Main Components.

**Nuclear Power:** Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor.- Reactor Components: Moderators, Control Rods, Reflectors and Coolants- Radiation Hazards: Shielding and Safety Precautions- Types of Nuclear Reactors.

**Solar Power Generation:** Role and Potential of Solar Energy Options, Principles of Solar Radiation, Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

**Wind Power Generation:** Role and potential of Wind Energy Options, Horizontal and Vertical Axis Windmills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.

**UNIT II TRANSMISSION LINE PARAMETERS**

Types of conductors - calculation of resistance for solid conductors, Bundle conductors, Skin effect, Proximity effect, concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, single and double circuit lines, symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

**UNIT III MODELING OF TRANSMISSION LINES**

Classification of Transmission Lines - Short, medium and long lines and their models - representations - Nominal-T, Nominal- $\pi$  and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent  $\pi$ , Numerical Problems – Surge Impedance and surge Impedance loading - Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients- Termination of lines with different types of conditions-wavelengths and Velocity of propagation – Ferranti effect, Charging current, Need of Shunt Compensation.

**UNIT IV INSULATORS, CORONA AND MECHANICAL DESIGN OF LINES AND CABLES**

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of string efficiency, Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems.

**UNIT V GENERAL ASPECTS OF DISTRIBUTION SYSTEMS**

Classification of Distribution Systems - Comparison of DC & AC and Under-Ground & Over - Head



Distribution Systems. Voltage Drop and power loss in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor, LVDC Distribution Network. Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, feeder loading; basic design of secondary distribution. Voltage Drop and power loss in A.C. Distributors.

**SUBSTATIONS:**

**Location of Substations:** Rating of distribution substations, service area within primary feeders. Benefits derived through optimal location of substations.

**Classification of substations:** Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment – Gas Insulated Substation (GIS).

**Textbooks:**

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, DhanpatRai& Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.
3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.

**Reference Books:**

1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems by V.K. Mehta and Rohit Mehta, S.CHAND& COMPANY LTD., New Delhi 2004.
4. Wind Electrical Systems by S. N. Bhadra, D. Kasta& S. Banerjee – Oxford University Press, 2013.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee17/preview](https://onlinecourses.nptel.ac.in/noc22_ee17/preview)



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**B.Tech (EEE)– III-I Sem**

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**(20A02502T) CONTROL SYSTEMS**

**Course Objectives:**

- Merits and demerits of open loop and closed loop systems; the effect of feedback
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function
- Transient and steady state response, time domain specifications and the concept of Root loci
- Frequency domain specifications, Bode diagrams and Nyquist plots
- State space modelling of Control system

**Course Outcomes:**

- Understand the concepts of control systems classification, feedback effect, mathematical modelling, time response and frequency response characteristics, state space analysis
- Apply the concepts of Block diagram reduction, Signal flow graph method and state space formulation for obtaining mathematical and Root locus, Bode, Nyquist, Polar plots for stability calculations, controllability and observability and demonstrate the use of these techniques.
- Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.
- Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them in solving various engineering applications.

**UNIT I CONTROL SYSTEMS CONCEPTS**

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchronos.

**UNIT II TIME RESPONSE ANALYSIS**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

**UNIT III STABILITY ANALYSIS IN TIME DOMAIN**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to  $G(s)H(s)$  on the root loci.

**UNIT IV FREQUENCY RESPONSE ANALYSIS**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

**UNIT V STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

**Textbooks:**



1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5<sup>th</sup> edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5<sup>th</sup> edition, 2007.

**Reference Books:**

1. Control Systems Principles & Design by M.Gopal, 4<sup>th</sup> Edition, Mc Graw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud& Ivan J Williams, 2<sup>nd</sup> Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6<sup>th</sup> Edition, Pearson, 2010.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee31/preview](https://onlinecourses.nptel.ac.in/noc22_ee31/preview)





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**(20A02503T) MEASUREMENTS & SENSORS**

**Course Objectives:**

- The student has to acquire knowledge about:
- The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
- The measurements of RLC parameters using bridge principles.
- The principles of magnetic measurements
- The principle of working of CRO and its applications

**Course Outcomes:**

- Able to Understand the working of various instruments and equipments used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors
- Able to analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements.
- Analyse the different operation of extension range ammeters and voltmeters, DC and AC bridge for measurement of parameters and different characteristics of periodic and aperiodic signals using CRO.
- Design and development of various voltage and current measuring meters and the varieties of issues coming up in the field of electrical measurements.

**UNIT I MEASURING INSTRUMENTS & DIGITAL METERS**

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range – Numerical examples.

Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer.

**UNIT II MEASUREMENT OF POWER, POWER FACTOR AND ENERGY**

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter – Numerical examples

**UNIT III INSTRUMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS**

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations. DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples – Numerical Examples

**UNIT IV D.C & A.C BRIDGES**

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge – Numerical Examples

**UNIT V CRO AND SENSORS**

Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns.

Capacitive and Inductive displacement sensors, Electromagnetism in sensing, Flow, Level sensors, Position and Motion sensors, Pressure sensors and Temperature sensors

**Textbooks:**



## JNTUA B.Tech. R20 Regulations

1. Electrical & Electronic Measurement & Instruments by A.K.SawhneyDhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5<sup>th</sup> Edition, Reem Publications, 2011.

### Reference Books:

1. Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3<sup>rd</sup> Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2<sup>nd</sup> Edition, S. Chand & Co., 2<sup>nd</sup> Edition, 2013.
4. Sensor Technology: Handbook by Jon S. Wilson, ELSEVIER publications, 2005

### Online Learning Resources:

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee112/preview](https://onlinecourses.nptel.ac.in/noc22_ee112/preview)





## JNTUA B.Tech. R20 Regulations

1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press.
2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.

### **Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee101/preview](https://onlinecourses.nptel.ac.in/noc22_ee101/preview)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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**(20A02504b) POWER ELECTRONICS DRIVES**  
**(Professional Elective Course-I)**

**Course Objectives:**

- To understand the various drive mechanisms and methods for energy conservation.
- To apply power electronic converters to control the speed of DC motors and induction motors.
- To evaluate the motor and power converter for a specific application.
- To develop closed loop control strategies of drives

**Course Outcomes:**

- Understand the various drive mechanisms and methods for energy conservation.
- Apply power electronic converters to control the speed of DC motors and induction motors.
- Evaluate the motor and power converter for a specific application.
- Develop closed loop control strategies of drives

**UNIT I INTRODUCTION TO ELECTRIC DRIVES**

Introduction, Advantages of Electric drives, Parts of Electrical Drives, Electric Motors, Power Modulators, Sources, Choice of Electric Drives and selection of drives for various applications.

**UNIT IIDYNAMICS OF ELECTRICAL DRIVES**

Fundamental torque equation, components of load torque, speed-torque characteristics of loads, Nature and classification of load torques, speed-torque convention & multi- quadrant operation. Equivalent values of drive parameters, loads with rotational motion, loads with translational motion, measurement of moment of inertia, components of load torques. Steady state stability, dynamic stability, load equalization. Basic principles of closed-loop control.

**UNIT IIIDC MOTOR DRIVES**

Speed control of DC motors using single-phase and three-phase fully controlled and half controlled rectifiers in continuous and discontinuous mode of operation. Single quadrant, two quadrant and four quadrant chopper controlled drives in continuous and discontinuous mode of operation.

**UNIT IVINDUCTION MOTOR DRIVES**

Speed control of cage induction motor with v/f control; slip power recovery scheme, static Scherbius and Kramer methods. Variable frequency and variable voltage control using VSI and CSI. AC and DC dynamic braking methods.

**UNIT VSYNCHRONOUS MOTOR DRIVES**

Wound field cylindrical rotor motor, Equivalent circuits, performance equations of operation Power factor control and V curves, starting and braking of Synchronous motor drives, speed control of synchronous motors, adjustable frequency operation of synchronous motors, voltage source inverter drive with open loop control, self controlled and separate controlled synchronous motor, self controlled synchronous motor drive using load commutated thyristor inverter, Cycloconverter fed drive

**Textbooks:**

1. G.K. Dubey: Fundamentals of Electric Drives –Narosa Publishers, Second edition, 2007.
2. S.B. Dewan, G.R. Slemom, A. Straughen: Power semiconductor drives, John Wiley & Sons.
3. Vedam Subramanyam: Electric Drives Concepts & Applications –Tata McGraw Hill Edn. Pvt.Ltd, Second Edition, 2011.

**Reference Books:**

1. Werner Leonhard: Control of Electric Drives, Springer international edition 2001.
2. Nisit K. De and Swapan K. Dutta: Electric Machines and Electric Drives, PHI learning Pvt. Ltd, 2011.
3. V. Subrahmanyam: Thyristor Control of Electric Drives, Tata McGraw Hill Edn. Pvt.Ltd, 2010.

**Online Learning Resources:**<https://nptel.ac.in/courses/108/104/108104140/>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

**L T P C**  
**3 0 0 3**

**(20A02504c) POWER QUALITY**  
**(Professional Elective Course-I)**

**Course Objectives:**

- To learn about voltage disturbances and power transients that is occurring in power systems.
- To know about voltage sag and transient over voltages for quality of power supply
- To understand about harmonics and their mitigation
- To study about different power quality measuring and monitoring concepts.
- To know about long duration voltage variations

**Course Outcomes:**

- Understand the basic concepts of different power quality issues and to mitigate them, principles of regulation of long duration voltage variations
- Analyze voltage disturbances and power transients that are occurring in power systems.
- Understand the concept of harmonics in the system and their effect on different power system equipment.
- Apply the knowledge about different power quality measuring and monitoring concepts.

**UNIT I POWER QUALITY ISSUES**

Power quality, voltage quality, The power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-duration voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

**UNIT II VOLTAGE SAGS AND TRANSIENT OVER VOLTAGES**

Sources of sags and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-use level, Motor-starting sags and utility system fault-clearing issues, sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

**UNIT III FUNDAMENTALS OF HARMONICS**

Harmonic sources from commercial and industrial loads, locating harmonic sources, Power system response characteristics, Harmonics Vs transients, Effect of harmonics, harmonic distortion, voltage and current distortion, harmonic indices, inter harmonics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive and active filters, IEEE and IEC Standards.

**UNIT IV LONG-DURATION VOLTAGE VARIATIONS**

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation, End user capacitor applications, flicker.

**UNIT V POWER QUALITY BENCH MARKING AND MONITORING**

Benchmarking process, RMS Voltage variation Indices, Harmonic indices Power Quality Contracts, Monitoring considerations, power quality measurement equipment, Power quality Monitoring standards.

**Textbooks:**

1. Electrical Power Systems Quality by Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, 2<sup>nd</sup> Edition, TMH Education Pvt. Ltd, 2012
2. Power quality by C. Sankaran, CRC Press, 2017

**Reference Books:**

1. Electrical systems quality Assessment by J. Arrillaga, N.R. Watson, S. Chen, John Wiley & Sons, 2000.
2. Understanding Power quality problems by Math H. J. Bollen, Wiley-IEEE Press, 2000



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– III-I Sem** **L T P C**  
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**(20A02502P) CONTROL SYSTEMS LAB**

**Course Objectives:**

- Determination of transfer functions of various systems and control of it by different methodologies.
- To provide knowledge in the analysis and design of controllers and compensators.
- The characteristics of servo mechanisms which are helpful in automatic control systems.
- To know the stability analysis using MATLAB.

**Course Outcomes:**

- Get the knowledge of feedback control and transfer function of DC servo motor.
- Model the systems and able to design the controllers and compensators.
- Get the knowledge about the effect of poles and zeros location on transient and steady state behavior of second order systems and can implement them to practical systems and MATLAB
- Determine the performance and time domain specifications of first and second order systems.

**List of Experiments:**

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order system
7. Lag and lead compensation – Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Simulation of Op-Amp based Integrator and Differentiator circuits.
12. Linear system analysis (Time domain analysis, Error analysis) using Soft Tools.
13. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using Soft Tools
14. State space model for classical transfer function using Soft Tools – Verification.
15. P, PI and PID Controller design for Temperature Control using Soft Tools.

**References:**

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

**Online Learning Resources/Virtual Labs:**

1. <http://iitb.vlab.co.in/?sub=8&brch=117>



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**B.Tech (EEE)– III-I Sem**

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**(20A02503P) MEASUREMENTS AND SENSORS LAB**

**Course Objectives:**

This laboratory deals with the practical exercises for:

- Calibration of various electrical measuring instruments
- Accurate determination of inductance and capacitance using AC Bridges
- Measurement of coefficient of coupling between two coupled coils
- Measurement of resistance for different range of resistors using bridges

**Course Outcomes:**

At the end of the course, the student will be able to:

- Calibrate various electrical measuring instruments
- Accurately determine the values of inductance and capacitance using AC bridges
- Compute the coefficient of coupling between two coupled coils
- Accurately determine the values of very low resistances

**List of Experiments:**

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance
5. Determination of Coefficient of coupling between two mutually coupled coils
6. Determination of Capacitance using Schering Bridge
7. Determination of Inductance using Anderson bridge
8. Measurement of 3-phase reactive power with single-phase wattmeter
9. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods
10. Determination of Inductance using Maxwell's bridge
11. Determination of Capacitance using DeSauty bridge
12. Calibration of LPF wattmeter – by Phantom loading
13. Wheatstone bridge – measurement of medium resistances
14. LVDT and capacitance pickup – characteristics and Calibration
15. Resistance strain gauge – strain measurement and Calibration
16. Transformer turns ratio measurement using AC Bridge
17. AC Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil

**References:**

NA

**Online Learning Resources/Virtual Labs:**

1. <http://vlabs.iitkgp.ernet.in/asnm/#>





**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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**(20A52401) SOFT SKILLS**  
**(Skill Oriented Course-III)**

**Course Objectives:**

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

**Course Outcomes (CO):**

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

**UNIT – I**

**Soft Skills & Communication Skills**

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

**Activities:**

**Intrapersonal Skills-** Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

**Interpersonal Skills-** Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

**Verbal Communication-** Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

**Non-verbal communication** – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

**UNIT – II**

**Critical Thinking**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

**Activities:**

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

**UNIT – III**

**Problem Solving & Decision Making**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

**Activities:**

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

**UNIT – IV Emotional Intelligence & Stress Management**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

**Activities:**

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates



## UNIT – V

### Leadership Skills

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

#### Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

#### NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

#### Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

#### Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

#### Online Learning Resources:

1. [https://youtu.be/DUlsNJtg2L8?list=PLLy\\_2iUCG87CQhELCYtvXh0E\\_y-bOO1\\_q](https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCYtvXh0E_y-bOO1_q)
2. [https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel\\_j2PUy0pwjVUgj7KIJ](https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KIJ)
3. <https://youtu.be/-Y-R9hDI7IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

**L T P C**  
**3 0 0 3**

**(20A02601T) POWER SYSTEM ANALYSIS**

**Course Objectives:**

- The use of per unit values and graph theory concepts, solving a problem using computer.
- Formation of  $Y_{bus}$  and  $Z_{bus}$  of a Power System network, power flow studies by various methods.
- Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
- Analysis of power system for steady state and transient stability and also methods to improve stability

**Course Outcomes:**

- Remember and understand the concepts of per unit values, Y Bus and Z bus formation, load flow studies, symmetrical and unsymmetrical fault calculations.
- Apply the concepts of good algorithm for the given power system network and obtain the converged load flow solution and experiment some of these methods using modern tools and examine the results.
- Analyse the symmetrical faults and unsymmetrical faults and done the fault calculations, analyse the stability of the system and improve the stability. Demonstrate the use of these techniques through good communication skills.
- Develop accurate algorithms for different networks and determine load flow studies and zero, positive and negative sequence impedances to find fault calculations.

**UNIT Ip. u. SYSTEM AND  $Y_{bus}$  FORMATION**

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix,  $Y_{Bus}$  formation by Direct and Singular Transformation Methods, Numerical Problems.

**UNIT II FORMATION OF  $Z_{bus}$**

Formation of  $Z_{Bus}$ : Partial network, Algorithm for the Modification of  $Z_{Bus}$  Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of  $Z_{Bus}$  for the changes in network ( Problems )

**UNIT III POWER FLOW ANALYSIS**

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

**UNIT IV SHORT CIRCUIT ANALYSIS**

Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components, Positive, Negative and Zero sequence Networks. Symmetrical Fault Analysis: LLLG faults with and without fault impedance, Unsymmetrical Fault Analysis: LG, LL and LLG faults with and without fault impedance, Numerical Problems.

**UNIT V STABILITY ANALYSIS**

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.



**Textbooks:**

1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.
2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4<sup>th</sup> Edition, 2011.

**Reference Books:**

1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994.
2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998.
3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee120/preview](https://onlinecourses.nptel.ac.in/noc22_ee120/preview)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

**L T P C**  
**3 0 0 3**

**(20A02602T) DIGITAL COMPUTING PLATFORMS**

**Course Objectives:**

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understand the Interfacing of 8086 with various advanced communication devices
- Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
- To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
- To understand Xilinx programming and understanding of Spartan FPGA board

**Course Outcomes:**

- Understand the basic architecture & pin diagram of 8086 microprocessor, 8051 Microcontroller, DSP Processor and FPGA Processors
- Apply the concepts to design Assembly language programming to perform a given task, Interrupt service routines for all interrupt types
- Design Real time applications by writing Assembly Language Programs for the Digital Signal Processors, Xilinx programming for Spartan FPGA boards and use Interrupts for real-time control applications
- Analyse various real time systems by using various controllers

**UNIT I INTRODUCTION TO MICROPROCESSORS**

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams - CISC and ARM Processors.

**UNIT II ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE**

Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

**UNIT III 8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS**

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

**UNIT IV INTRODUCTION TO TMS320LF2407 DSP CONTROLLER**

Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

**UNIT V FIELD PROGRAMMABLE GATE ARRAYS (FPGA)**

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming – overview of Spartan 3E and Virtex II pro FPGA boards- case study.

**Textbooks:**

1. Ramesh S. Gaonkar, DI Architecture Programming and Applications with 8085, Penram Intl. Publishing, 6<sup>th</sup> Edition, 2013
2. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3<sup>rd</sup> Edition, 2013.

**Reference Books:**



1. Microprocessor and Interfacing by Douglas V Hall, 2<sup>nd</sup> Edition, Tata McGraw hill, 1992
2. Microprocessor, Nilesh B Bahadure, PHI, 2010.
3. The 8051 Micro Controller Architecture, Programming and Applications by Kenneth J Ayala, Pearson International publishing (India).
4. Hamid A. Tolyat, DSP Based Electro Mechanical Motion Control, CRC press, 2004.
5. Application Notes from the webpage of Texas Instruments.
6. XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998
7. XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999
8. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/106108100>
2. <https://nptel.ac.in/courses/108105102>
3. <https://nptel.ac.in/courses/117108040>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

**L T P C**  
**3 0 0 3**

**(20A04502T) DIGITAL SIGNAL PROCESSING**

**Course Objectives:**

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing.

**Course Outcomes:**

- Formulate difference equations for the given discrete time systems
- Apply FFT algorithms for determining the DFT of a given signal
- Compare FIR and IIR filter structures
- Design digital filter (FIR & IIR) from the given specifications
- Outline the concept of multirate DSP and applications of DSP.

**UNIT I**

Introduction to discrete time signals and systems

Introduction to digital signal processing, review of discrete-time signals and systems, analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

**UNIT II**

Discrete Fourier Transform - Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform - Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

**UNIT III**

IIR Filters - Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

**UNIT IV**

FIR Filters - Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanning, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

**UNIT V**

Quantization Errors in Digital Signal Processing: Representation of numbers, Quantization of filter coefficients, Round-off Effects in digital filters.

Multirate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Polyphase decomposition.

**Textbooks:**

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI.

**References:**

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.

**Online Learning Resources:**

[https://onlinecourses.nptel.ac.in/noc22\\_ee99/preview,2](https://onlinecourses.nptel.ac.in/noc22_ee99/preview,2). <https://nptel.ac.in/courses/108105055>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– III-II Sem**

**L T P C**  
**3 0 0 3**

**(20A02604a) HVDC AND FACTS**  
**(Professional Elective Course-II)**

**Course Objectives:** To get the student exposed to:

- High voltage DC transmission systems
- Flexible AC transmission systems
- Various configurations of the above, Principle of operation, Characteristics of various FACTS devices

**Course Outcomes:**

- Understand the necessity of HVDC systems as emerging transmission networks
- Understand the necessity of reactive power compensation devices
- Design equivalent circuits of various HVDC system configurations
- Design and analysis of various FACTS devices

**UNIT I INTRODUCTION**

Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS.

**UNIT II HIGH VOLTAGE DC TRANSMISSION – I**

Types of HVDC links - Monopolar, Homopolar, Bipolar and Back-to-Back, Advantages and disadvantages of HVDC Transmission, Analysis of Greinert circuit, Analysis of bridge circuit without overlap, Analysis of bridge with overlap less than  $60^\circ$ , Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link.

**UNIT III HIGH VOLTAGE DC TRANSMISSION – II**

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

**UNIT IV FLEXIBLE AC TRANSMISSION SYSTEMS-I**

Types of FACTS Controllers, brief description about various types of FACTS controllers, Operation of 6-pulse converter, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation, principle of operation of various types of Controllable shunt Var Generation, Principle of switching converter type shunt compensator, principles of operation of various types of Controllable Series Var Generation, Principle of Switching Converter type series compensator.

**UNIT V FLEXIBLE AC TRANSMISSION SYSTEMS-II**

Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, UPFC and IPFC control structures (only block diagram description), objectives and approaches of voltage and phase angle regulators

**Textbooks:**

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.

**Reference Books:**

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.
2. AnriqueAcha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.
3. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

**Online Learning Resources :** <https://nptel.ac.in/courses/108104013>, <https://nptel.ac.in/courses/108107114>





**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– III-II Sem**

**L T P C**  
**3 0 0 3**

**(20A02604b) NONLINEAR SYSTEM ANALYSIS**  
**(Professional Elective Course-II)**

**Course Objectives:**

To get the student exposed to:

- Basics of Nonlinear systems
- Mathematical preliminaries
- Stability concepts and various case studies

**Course Outcomes:**

The student will be able to:

- Understand the basic concepts of Nonlinear systems
- Understand the mathematical analysis of nonlinear systems
- Analyze various nonlinear case studies
- Evaluation of stability conditions for given nonlinear systems

**UNIT I MATHEMATICAL PRELIMINARIES-I**

Why nonlinear systems? - Non-linear Models of Physical Systems, Mathematical Preliminaries: Finite dimensional normed spaces, Euclidean space and its topology, Infinite dimensional Banach spaces - Contraction mapping theorem.

**UNIT II MATHEMATICAL PRELIMINARIES-II**

Existence and Uniqueness results for solutions to non linear ODEs, ODEs as vector fields - One dimensional systems - Phase portrait of second order linear systems -Equilibrium points, linearization and their classification

**UNIT III CASE STUDIES**

Examples: Simple pendulum, Bead on a hoop, Lotka-Volterra models for predation and competition, biological transcriptional system, van der Pol oscillator and conservative systems, non linear circuits - Limit cycles

**UNIT IV STABILITY CRITERION-I**

Bifurcations of two-dimensional flows: Saddle-node, pitchfork, transcritical and Hopf - their normal forms, Notions of stability - Lyapunov and LaSalle's theorems, Finding Lyapunov functions: Linear systems, variable gradient method - Center Manifold Theorem

**UNIT V STABILITY CRITERION-II**

Physical Non-linearities - Interconnections and feedback - Aizermann's conjecture – Passivity, PR systems - Dissipation equality - Passive filters, KYP Lemma - Popov and circle criterion

**Textbooks:**

- 1.Nonlinear Systems - Hassan Khalil
- 2.Nonlinear dynamics and chaos: with applications to physics, biology, chemistry, and engineering - Steven Strogatz

**Reference Books:**

- 1.Nonlinear systems: analysis, stability, and control - S.S.Sastry
- 2.Nonlinear Systems Analysis – Vidyasagar

**Online Learning Resources:**

[https://onlinecourses.nptel.ac.in/noc22\\_ee01/preview](https://onlinecourses.nptel.ac.in/noc22_ee01/preview)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

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**(20A02604c) DESIGN OF PHOTOVOLTAIC SYSTEMS**  
**(Professional Elective Course-II)**

**Course Objectives:**

To get the student exposed to:

- Basics of PV Cell
- Energy Estimation and costing
- Maximum Power Point Tracking
- PV Interfacing

**Course Outcomes:**

- Understand the basic concepts of PV Cells
- Understand the concepts of Energy estimation and Sizing
- Design MPPT
- Analyze PV system along with its interfacing

**UNIT I PV CELL**

A historical perspective, PV cell characteristics and equivalent circuit, Model of PV cell, Short Circuit, Open Circuit and peak power parameters, Datasheet study, Cell efficiency, Effect of temperature, Temperature effect calculation example, Fill factor, PV cell simulation, Series and Parallel Interconnection

**UNIT II ENERGY ESTIMATION AND SIZING PV**

Energy from Sun, insolation and irradiance, insolation variation with time delay, Solar geometry, Insolation on a horizontal flat plate, Sunrise and sunset hour angles, Energy plots in octave, atmospheric effects, air mass, Clearness index

Sizing PV for applications without batteries, Examples, Batteries: Introduction, Capacity, C-rate, efficiency, energy and power densities, Battery selection, other energy storage methods, PV system design

**UNIT III MAXIMUM POWER POINT TRACKING**

MPPT concept, Input impedance of DC-DC converters - Boost converter, Buck converter, Buck-Boost converter, PV module in SPICE, Simulation - PV and DC-DC interface, Impedance control methods-voltage scaling, current scaling, Sampling method, Power slope method 1, Power slope method 2, Hill climbing method, Practical points - Housekeeping power supply, Gate driver, MPPT for non-resistive loads, Simulation

**UNIT IV PV-BATTERY INTERFACE**

Direct PV-battery connection, Charge controller, Battery charger - Understanding current control, slope compensation, simulation of current control, Batteries in series - charge equalisation, Batteries in parallel

Peltier device – principle, Peltier element – datasheet, Peltier cooling, Thermal aspects- Conduction, Convection, A peltier refrigeration example, Radiation and mass transport, Demo of Peltier cooling, PV and Water pumping

**UNIT V PV AND GRID INTERFACE**

Grid connection principle, PV to grid topologies, 3ph d-q controlled grid connection- introduction, dq-axis theory, AC to DC transformation, DC to AC transformation, Complete 3ph grid connection, 1ph d-q controlled grid connection, 3ph PV-Grid interface example, SVPWM - discrete implementation, analog implementation, Application of integrated magnetics, LIFE CYCLE COSTING Growth models, examples, Annual payment and present worth factor, Examples

**Textbooks:**

1. Design of Photovoltaic Systems by L. Umanand

Online Learning Resources: <https://nptel.ac.in/courses/117108141>



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**(20A02601P) POWER SYSTEMS ANALYSIS LAB**

**Course Objectives:**

The objectives of this course include

- To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransient reactance's.
- To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
- To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
- To develop the SIMULINK model for single area load frequency problem.

**Course Outcomes:**

After completion of the course the student will able to

- Get the practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactance's.
- Get the practical knowledge on how to draw the equivalent circuit of three winding transformer.
- Get the knowledge on development of MATLAB program for formation of Y and Z buses.
- Get the knowledge on development of MATLAB programs for Gauss-Seidel and Fast Decouple Load Flow studies.
- Get the knowledge on development of SIMULINK model for single area load frequency problem.

**List of Experiments:**

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. Determination of Sequence Impedances of salient pole Synchronous Machine
3. LG Fault Analysis on an un loaded alternator
4. LL Fault Analysis on conventional phases
5. LLG Fault Analysis
6. LLLG Fault Analysis
7. Determination of Sub transient reactance of salient pole synchronous machine
8. Equivalent circuit of three winding transformer.
9.  $Y_{Bus}$  formation using Soft Tools
10.  $Z_{Bus}$  formation using Soft Tools
11. Gauss-Seidel load flow analysis using Soft Tools
12. Newton-Raphson load flow analysis using Soft Tools
13. Fast decoupled load flow analysis using Soft Tools
14. Solve the Swing equation and Plot the swing curve
15. Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.
16. Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
17. Develop a model for a uncontrolled two area load frequency control problem and simulate the same using Soft Tools.
18. Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools.

**Online Learning Resources/Virtual Labs:**

1. <https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#>



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**(20A02602T) DIGITAL COMPUTING PLATFORMS LAB**

**Course Objectives:**

- Write Assembly language programming on 8086 Microprocessors
- To Interface various devices with 8086
- To develop MASAM Programming
- For Interfacing of 8051 Microcontroller with its peripheral devices.

**Course Outcomes:**

- Understand the basic concepts to write assembly language programming on 8086 Microprocessors.
- Design various device configurations and Interfacing of various devices with 8086.
- Understand the basic concepts to write programming on 8051 Microcontroller.
- Design various Interfacing circuitry with 8051 Microcontroller with its peripheral devices

**List of Experiments:**

1. Programs for 16 bit arithmetic operations for 8086 (using various addressing modes) .
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086
5. Interfacing ADC and DAC to 8086.
6. Parallel communication between two microprocessors using 8255.
7. Serial communication between two microprocessor kits using 8251.
8. Interfacing to 8086 and programming to control stepper motor.
9. Programming using arithmetic, logical and bit manipulation instructions of 8051
10. Program and verify Timer/Counter in 8051.
11. Program and verify interrupt handling in 8051.
12. UART operation in 8051.
13. Communication between 8051 kit and PC.
14. Interfacing LCD to 8051.
15. Interfacing matrix or keyboard to 8051.

**References:**

1. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3<sup>rd</sup> Edition, 2013.
2. Microprocessor and Interfacing by Douglas V Hall, 2<sup>nd</sup> Edition, Tata McGraw hill, 1992
3. Microprocessors and Microcontrollers Lab Manual: 8086 & 8051 by Srinivasa Murthy, Kindle Edition.

Online Learning Resources/Virtual Labs:



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**B.Tech (EEE)– III-II Sem**

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**(20A04502P) DIGITAL SIGNAL PROCESSING LAB**

**Course Outcomes:**

- Implement various DSP Algorithms using software packages.
- Implement DSP algorithms with Digital Signal Processor.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.
- Analyze digital filters using Software Tools.

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

**List of Experiments:**

1. Generate the following standard discrete time signals.
  - i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.
  - i. Using rectangular window
  - ii. Using hamming window
  - iii. Using Kaiser window
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.
14. Compute the correlation coefficient for the two given audio signals of same length using a digital signal processor.

**Note: Any TWELVE of the experiments are to be conducted.**

**References:**

1. Digital Signal Processing: Alon V. Oppenheim, PHI
2. Digital Signal processing(II-Edition): S.K. Mitra, TMH

**Online Learning Resources/Virtual Labs:**

1. <http://vlabs.iitkgp.ac.in/dsp/#>



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**(20A02606) APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL ENGINEERING (Skill Oriented Course – IV)**

**Course Objectives:**

The objectives of this course include:

- Understand the basic concepts of Electrical Engineering.
- Apply the concepts to design MATLAB models.
- Analyse various Electrical engineering applications through MATLAB.
- Develop real time models using MATLAB.

**Course Outcomes:**

At the end of the course the student will be able to:

- Understand the basic concepts of Electrical Engineering.
- Apply the concepts to design MATLAB models.
- Analyse various Electrical engineering applications through MATLAB.
- Develop real time models using MATLAB.

**List of Experiments:**

Theory:

MATLAB-Introduction, different tool boxes, creation of program files, creation of simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

**List of Experiments:**

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second order system
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using  $Z_{bus}$  matrix
11. Design of virtual PMU
12. Wide area control of Two area Kundur system

**Online Learning Resources/Virtual Labs:**

1. <http://vem-iitg.vlabs.ac.in/>
2. <https://vp-dei.vlabs.ac.in/Dreamweaver/>



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**(20A99601) INTELLECTUAL PROPERTY RIGHTS AND PATENTS**  
**(Mandatory Non-Credit Course)**

**Course Objectives:**

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations

**Course Outcomes:**

- Understand IPR law & Cyber law
- Discuss registration process, maintenance and litigations associated with trademarks
- Illustrate the copy right law
- Enumerate the trade secret law.

**UNIT I**

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

**UNIT II**

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law-Semiconductor Chip Protection Act.

**UNIT III**

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

**UNIT IV**

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

**UNIT V**

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

**Textbooks:**

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
2. Kompal Bansal & Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections

**References:**

1. Prabhuddha Ganguli: ‘ Intellectual Property Rights’ Tata Mc-Graw – Hill, New Delhi
2. Richard Stim: “Intellectual Property”, Cengage Learning, New Delhi.
3. R. Radha Krishnan, S. Balasubramanian: “Intellectual Property Rights”, Excel Books. New Delhi.
4. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.



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**B.Tech (EEE)– IV-I Sem**

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**(20A02701a) POWER SYSTEM OPERATION AND CONTROL**  
**(Professional Elective Course – III)**

**Course Objectives:**

- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

**Course Outcomes:**

- Understand to deal with problems in Power System as Power System Engineer
- Understand to deal with AGC problems in Power System
- Analyze the problems in hydro electric and hydro thermal problems
- Evaluate the complexity of reactive power control problems and to deal with them
- Understand the necessity of deregulation aspects and demand side management problems in the modern power system era.

**UNIT IECONOMIC OPERATION OF POWER SYSTEMS**

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

**UNIT I HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW**

**Hydro-thermal Coordination:** Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydro-thermal coordination, Short-term hydro-thermal scheduling. **Optimal Power Flow:** Optimal power flow problem formulation for loss and cost minimisation, Solution of optimal power flow problem using Newton's method and Linear Programming technique – Numerical problems

**UNIT III AUTOMATIC GENERATION CONTROL**

Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples

**UNIT IV REACTIVE POWER CONTROL**

Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problems

**UNIT V POWER SYSTEMS DEREGULATION**

Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems

**Textbooks:**

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2<sup>nd</sup> edition, 1996.
2. Power System Engineering, D P Kothari and I J Nagrath, McGraw Hill Education India Pvt.





Limited, Chennai, 3e, 2019..

**Reference Books:**

1. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2<sup>nd</sup> edition, 1983.
2. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108104052>
2. <https://nptel.ac.in/courses/108101004>



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**(20A02701b) SWITCHED MODE POWER CONVERTERS**  
**(Professional Elective Course – III)**

**Course Objectives:** By the end of the course, the student will be able to

- Understand basic concepts of DC-DC converters
- Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
- Apply various modulation and harmonic elimination techniques over the converters.
- Analyze the state space modelling of various types of converters.
- Design inductor and transformer for various power electronic applications.

**Course Outcomes:**

- Understand the problems and to design of various DC-DC converters, advanced converters of SMPCs
- Evaluate the performance of resonant converters
- Analyze the performance characteristics of 1- $\phi$  and 3- $\phi$  inverters with single/multi levels, power conditioners, UPS and filters
- Design various applications of the above in Power Systems, EVE, Renewable Energy Systems, etc.

**UNIT I DC-DC CONVERTERS**

Principles of step-down and step-up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

**UNIT II SWITCHING MODE POWER CONVERTERS**

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

**UNIT III RESONANT CONVERTERS**

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

**UNIT IV DC-AC CONVERTERS**

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

**UNIT V POWER CONDITIONERS, UPS & FILTERS**

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

**Textbooks:**

1. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009
2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
3. Course material on Switched Mode Power Conversion by V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.

**Reference Books:**

1. Philip T. Krein, “Elements of Power Electronics”, Oxford University Press, 2012
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3<sup>rd</sup> Edition, John Wiley and Sons, 2006
3. M.H. Rashid, Power Electronics circuits, devices and applications, 3<sup>rd</sup> Edition Prentice Hall of India New Delhi, 2007.

**Online Learning Resources:** 1. <https://nptel.ac.in/courses/108108036>

2. <https://nptel.ac.in/courses/108105180>



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**(20A02701c) ELECTRICAL & ELECTRONICS INSTRUMENTATION**  
**(Professional Elective Course – III)**

**Course Objectives:** The student has to acquire knowledge about:

- Measuring system, Common errors, Objectives of Measuring systems
- Test signals and modulation phenomenon, Data acquisition system, various telemetry systems and various modulation systems
- Measuring various meters and analyzers
- Basic transducers and their usage in various measurements

**Course Outcomes:**

- Understand Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques
- Analyze various telemetry systems, basic operation of Data acquisition systems, measuring meters and signal analyzers
- Understand Transducers and their measurement of electrical and non-electrical quantities
- Apply the concepts to design various applications of the above

**UNIT I INSTRUMENT ERRORS**

Measuring Systems, Objectives of Measuring Instruments, definition of terms-Span & Range, Sensitivity, Threshold & Resolution, Accuracy, Precision & Reliability, Performance Characteristics - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical evaluation of measuring data – Numerical Problems

**UNIT II DATA TRANSMISSION AND TELEMETRY**

Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation. Methods of Data Transmission – General Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram)

**UNIT III SIGNAL ANALYZERS**

Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

**UNIT IV TRANSDUCERS**

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes.

**UNIT V MEASUREMENT OF NON-ELECTRICAL QUANTITIES**

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow, Liquid level

**Textbooks:**

1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India,2004.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai & Co.,2012.



**Reference Books:**

1. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 3/e.,2010.
2. Modern Electronic Instrumentation and Measurement techniques – by A.DHelfrick and W.D.Cooper, Pearson/Prentice Hall of India.,1990.
3. Industrial Instrumentation – Principles and Design by T. R. Padmanabhan, Springer, 3<sup>rd</sup> re print, 2009.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee112/preview](https://onlinecourses.nptel.ac.in/noc22_ee112/preview)



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**(20A02702a) ELECTRICAL DISTRIBUTION SYSTEM & AUTOMATION**

**(Professional Elective Course – IV)**

**Course Objectives:**

- To know about fundamental aspects of distribution system, principle of distribution substations
- To know about classification of various loads
- To understand difference between conventional load flow studies of power system and distribution system load flow
- To know about evaluation of voltage droop and power loss calculations, distribution automation and management system, SCADA

**Course Outcomes:**

- Understand basics of distribution systems and substations, modelling of various loads
- Evaluation of load flow solutions in distribution system
- Evaluation of power loss and feeder cost
- Analyze the concepts of SCADA, Automation distribution system and management

**UNIT I DISTRIBUTION SYSTEM FUNDAMENTALS**

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

**UNIT II DISTRIBUTION SYSTEM SUBSTATIONS AND LOADS**

**Substations:** Rating of a distribution substation for square and hexagonal shaped distribution substation service area, K constant, Radial feeder with uniformly and non-uniformly distributed loading. **Loads:** Various types of loads, Definitions of various terms related to system loading, detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors.

**UNIT III DISTRIBUTION SYSTEM LOAD FLOW**

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems

**UNIT IV VOLTAGE DROP AND POWER LOSS CALCULATION**

Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, types of three-phase capacitor-bank connections, Economic justification for capacitors – Numerical problems

**UNIT V DISTRIBUTION AUTOMATION**

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management, decision support applications, substation automation, control feeder automation, database structures and interfaces.

**Textbooks:**

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.

**Reference Books:**

1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007.

**Online Learning Resources:** [https://onlinecourses.nptel.ac.in/noc22\\_ee126/preview](https://onlinecourses.nptel.ac.in/noc22_ee126/preview)



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**B.Tech (EEE)– IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A02702b) FPGA BASED CONTROLLER DESIGN**  
**(Professional Elective Course – IV)**

**Course Objectives:**

- To know about FPGA architecture features and fabrics and basics of VLSI technology
- To learn about logic implementation and design aspects of FPGA
- To understand about performance analysis of sequential machines
- To learn about architectures and multi-FPGA large scale systems

**Course Outcomes:**

- Understand about features of FPGA and its fabrics
- Design of FPGA based systems and develop single and multi FPGA systems
- Apply the basic concepts to design various combinational logic gates using FPGAs
- Develop sequential logic machines and analyze the performance

**UNIT I FPGA ARCHITECTURE AND FABRICS**

Programmable Logic Devices-Types-PLA, PAL, FPGA-architectures, SRAM-based FPGAs, Permanently Programmed FPGAs, Chip I/O. Circuit Design of FPGA Fabrics. Architecture of FPGA Fabrics.

**UNIT II FPGA-BASED SYSTEMS AND VLSI TECHNOLOGY**

Introduction, Basic Concepts, Digital Design and FPGAs. FPGA-based system design. Manufacturing Processes, Deriving Transistor Characteristics, CMOS Logic Gates, Wires, Registers and RAM, Packages and Pads.

**UNIT III COMBINATIONAL LOGIC**

The Logic Design Process. Hardware Description Languages, combinational network delay. Power and energy optimization, arithmetic logic, logic implementation for FPGAs. Physical Design for FPGAs. The Logic Design Process.

**UNIT IV SEQUENTIAL MACHINES**

The sequential machine design process. Sequential design styles. Rules for Clocking. Performance Analysis. Power Optimization.

**UNIT V LARGE SCALE SYSTEMS**

Architectures and Large-Scale Systems, Behavioral Design, Design Methodologies. Design Example. Buses, Platform FPGAs, Multi-FPGA Systems, Novel Architectures.

**Textbooks:**

1. FPGA Based System Design, Wayne Wolf, Prentice Hall, 2004.
2. Modern VLSI Design, Wayne Wolf, Pearson Education 2002.

**Reference Books:**

1. Advanced Digital Design with verilog HDL, Michael D Ciletti, Pearson Education 2005
2. Verilog HDL, Samir Palnitkar, Pearson Education 2005.
3. A Verilog HDL Primer, J Bhaskar, 2nd edition, B S Publications, 2007.
4. VHDL for Programmable Logic, Kevin Skahill Pearson Education, 2004

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/117108040>



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**B.Tech (EEE)– IV-I Sem**

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**(20A02702c) INTELLIGENT CONTROL TECHNIQUES**  
**(Professional Elective Course – IV)**

**Course Objectives:**

- To get exposed to a few Intelligent Control Techniques
- To learn about Artificial Neural Network based Estimators
- To learn about Fuzzy Logic Control System as one of the ICT
- To learn about a few evolutionary algorithms, implement the various ICTs for linear and non-linear systems as case studies

**Course Outcomes:**

- Understand various Intelligent Control Techniques
- Design the controllers and estimators using ANN and Fuzzy Logic
- Apply Evolutionary algorithms suitable to optimize and design a given system specifications
- Designing of various ICTs for system modeling, control schemes and to design estimators using MATLAB tool boxes

**UNIT I FUNDAMENTALS OF AI**

AI trend in Engineering applications, Need for AI, Approaches to intelligent control; Architectures for intelligent control; Symbolic reasoning system; rule-based systems; Knowledge representation; Expert systems.

**UNIT II ANN BASED CONTROLLERS AND ESTIMATORS**

Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; Learning and Training the neural network-Supervised and unsupervised learning concepts, simple perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron – Back Propagation algorithm; BAM networks, Self-organizing network and Recurrent network; Neural Network based controllers and estimators design.

**UNIT III FUZZY LOGIC CONTROL SYSTEM**

Motivation and basic definitions; Crisp sets, Fuzzy sets, difference between crisp and fuzzy sets, Fuzzy properties, operations and relations; Fuzzy logic system and its components; Membership functions and methods for assignment of membership function values, Fuzzy knowledge and rule bases; Fuzzy modelling and control schemes for linear and nonlinear systems; Fuzzy estimators.

**UNIT IV EVOLUTIONARY ALGORITHMS**

Genetic Algorithm: Introduction - basic concepts, application, Adaptive Neuro-fuzzy Inference System (ANFIS), Neuro-Genetic, Fuzzy-Genetic systems. Ant colony optimization, Particle swarm optimization (PSO) – basic concepts and design procedures.

**UNIT V CASE STUDIES**

Identification and control of linear and nonlinear dynamic systems using Neural Networks, Power System Load Flow using Back Propagation algorithm; Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Single area Load Frequency Control using Fuzzy Logic; optimization for controller design in case of constrained and unconstrained optimization issues, Economic Load Dispatch using Genetic Algorithm/PSO.

**Textbooks:**

1. Jacek. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1<sup>st</sup> Edition, 1994
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3<sup>rd</sup> Edition, WILEY Publications, 2011
3. S.N. Sivanandam and S.N. Deepa, Introduction to Genetic Algorithms, Springer Publications, 2008

**Reference Books:**



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1. J.S.R. Jang, C.T.Sun and E. Mizutami, “Neuro-Fuzzy & Soft Computing”, Pearson India Education Services Pvt. Ltd.
2. LaurereFauselt, “Fundamentals of Neural Networks”, Pearson India Education Services Pvt. Ltd.
3. Padhy.N.P.; “Artificial Intelligence and Intelligent Systems”; Oxford University Press, 2005

### **Online Learning Resources:**

1. <https://nptel.ac.in/courses/108104049>
2. <https://nptel.ac.in/courses/112103301>





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**B.Tech (EEE)– IV-I Sem**

**L T P C**  
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**(20A02703a) PROGRAMMABLE LOGIC CONTROLLERS**  
**(Professional Elective Course – V)**

**Course Objectives:**

- The student will be able to:
- Understand the basic functions and types of PLCs, Easy Veep software, its applications
- Understand Classification of PLCs and applications
- Design PLC Programming for various applications
- Analyze PLC Troubleshooting aspects

**Course Outcomes:**

At the end of the course, the student will be able to:

- Understand different types of PLCs, Its classification and the usage of Easy Veep software
- Analyze the hardware details of Allen Bradley PLC
- Design PLC Programming for various applications
- Apply PLC programming concepts in different fields of Science and Technology

**UNIT I INTRODUCTION TO PLCs**

Introduction:

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

**UNIT II PLC COMPUTATIONAL TOOL**

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

**UNIT III PLC DEVELOPMENT**

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.

Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

**UNIT IV PLC PROGRAMMING**

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring.

**UNIT V APPLICATIONS**

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO<sub>2</sub>), plastic wrapping machines etc.

**Textbooks:**



## JNTUA B.Tech. R20 Regulations

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automationdirect Siemens)

### **Reference Books:**

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4<sup>th</sup> Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2<sup>nd</sup> Edition, Carolina Academic Press, 2006.

### **Online Learning Resources:**

1. <https://nptel.ac.in/courses/108105088>



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**B.Tech (EEE)– IV-I Sem**

**L T P C**  
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**(20A04403T) LINEAR& DIGITAL IC APPLICATIONS**  
**(Professional Elective Course – V)**

**Course Objectives:**

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of PLL.
- To introduce the concepts of waveform generation and introduce some special function ICs.
- Exposure to digital IC's

**Course Outcomes (CO):**

- List out the characteristics of Linear and Digital ICs.
- Discuss the various applications of linear & Digital ICs.
- Solve the application-based problems related to linear and digital ICs.
- Analyze various applications based circuits of linear and digital ICs.
- Design the circuits using either linear ICs or Digital ICs from the given specifications.

**UNIT – I ICs and OP- AMPS**

**INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER:** Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

**UNIT – II Applications of OP- AMP**

**LINEAR APPLICATIONS OF OP-AMP:** Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.  
**NON-LINEAR APPLICATIONS OF OP-AMP:** Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators, Oscillators

**UNIT - III Active Filters and other ICs**

**ACTIVE FILTERS:** Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

**TIMER AND PHASE LOCKED LOOPS:** Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL.

**UNIT – IV Voltage Regulators and Converters**

**VOLTAGE REGULATOR:** Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

**D to A AND A to D CONVERTERS:** Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

**UNIT - V Digital ICs**

**CMOS LOGIC:** CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.

**COMBINATIONAL CIRCUITS USING TTL 74XX ICS:** Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7-segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

**SEQUENTIAL CIRCUITS USING TTL 74XX ICS:** Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).



**Textbooks:**

1. D. Roy Choudhury, Shail B. Jain, “Linear Integrated Circuit”, 4th edition (2012), New Age International Pvt.Ltd., New Delhi, India
2. Ramakant A. Gayakwad, “OP-AMP and Linear Integrated Circuits”, 4th edition (2012), Prentice Hall / Pearson Education, New Delhi.
3. Floyd, Jain, “Digital Fundamentals”, 8th edition (2009), Pearson Education, New Delhi.

**References:**

1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108108111>
2. <https://nptel.ac.in/courses/108106069>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– IV-I Sem**

**L T P C  
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**(20A02703c) ELECTRIC VEHICLE TECHNOLOGIES  
(Professional Elective Course – V)**

**Course Objectives:**

- Understand the concepts of electric vehicles, hybrid electric vehicles and their impact on environment
- Analyze the drive-train topologies and advanced propulsion techniques
- Analyze hybrid energy storage methodologies
- Design suitable power converter topologies for motor control and hybrid energy storage

**Course Outcomes:**

- Understand the concepts of electric vehicles, hybrid electric vehicles and their impact on environment
- Analyze the drive-train topologies and advanced propulsion techniques
- Analyze hybrid energy storage methodologies
- Design suitable power converter topologies for motor control and hybrid energy storage

**UNIT I INTRODUCTION**

Conventional vehicle, basics of vehicle performance, History of electric vehicles, social and environmental importance of electric vehicles, impact of modern drive-trains on energy supplies.

**UNIT II HYBRID ELECTRIC VEHICLES**

Micro hybrid vehicles, mild hybrid vehicles, full hybrid vehicles, Parallel hybrid vehicles, series Hybrid Vehicles, Series-Parallel Hybrid vehicles, plug-in hybrid vehicles, power flow diagrams for various operating modes. Plug-in Hybrid Vehicles: Operating principle, architectures: series-parallel-series-parallel, challenges related to grid connection. Range-extended Electric Vehicles: Classification and configurations, Fuel Cell Electric Vehicles, Solar electric Vehicles, Electric Bicycles and their propulsion systems, Vehicle-to-grid, vehicle to-home concepts, Concept of Hybrid Electric Vehicles.

**UNIT III ELECTRIC DRIVE-TRAINS & PROPULSION UNIT**

Electric drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis  
Electric propulsion unit: Electric components used in electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives, Drive system efficiency.

**UNIT IV ENERGY STORAGE**

Storage requirements for Electric Vehicles, Battery based energy storage, Fuel Cell based energy storage, Super Capacitor based energy storage and their analysis. Power pack management systems, Cell balancing techniques, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices, compressed air storage systems, super conducting magnetic storage systems and Energy management systems.

**UNIT V CONVERTERS FOR HYBRID ENERGY STORAGE SYSTEMS**

Converter configurations for hybrid energy systems based on Battery and Ultra Capacitors-cascaded converter, multiple parallel-connected converter, dual-active-bridge converter, multiple-input converter,- multiple modes single converter, interleaved converter, switched capacitor converter, converters for coupled inductor based hybridization. Fundamentals of Chargers: Charger classifications and standards, selection of AC charging systems, DC charging systems, Converter topologies for charging, wireless chargers.

**Textbooks:**



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1. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, Taylor & Francis Group 2015.
2. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Hussein, CRC Press, 2003, 2nd Edition.

### **Reference Books:**

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, CRC Press, 2005.
2. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley, 2003.

### **Online Learning Resources:**

1. <https://nptel.ac.in/courses/108/106/108106170/>
2. <https://nptel.ac.in/courses/108/102/108102121/>



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**B.Tech (EEE)– IV-I Sem**

**L T P C**  
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**20A52701a) ENTREPRENEURSHIP & INCUBATION**  
**(HUMANITIES ELECTIVE II)**

**Course Objectives:**

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

**Course Outcomes:**

- Understand the concept of Entrepreneurship and challenges in the world of competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
- Evaluate the role of central government and state government in promoting Entrepreneurship.
- Create and design business plan structure through incubations.

**UNIT I**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**UNIT II**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

**UNIT III**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

**UNIT IV**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

**UNIT V**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

**Textbooks:**

1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : [login.cengage.com](http://login.cengage.com))
2. Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013

**References:**

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.



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2. Rajeev Roy “Entrepreneurship”, 2<sup>nd</sup> Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwanal “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

### **E-Resources**

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. <http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship>
3. [http://nptel.ac.in/courses/122106032/Pdf/7\\_4.pdf](http://nptel.ac.in/courses/122106032/Pdf/7_4.pdf)
4. <http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurship/50>





**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (CE)– III-II Sem** **L T P C**  
**3 0 0 3**

**(20A52701b) MANAGEMENT SCIENCE**  
**(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

**Course Outcomes:**

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

**UNIT I INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

**UNIT II OPERATIONS MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

**UNIT III HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

**UNIT IV STRATEGIC & PROJECT MANAGEMENT**

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

**UNIT V CONTEMPORARY ISSUES IN MANAGEMENT**



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The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

### **Textbooks:**

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

### **References:**

1. Koontz & Wehrich, "Essentials of Management", 6<sup>th</sup> edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.
4. Samuel C.Certo, "Modern Management", 9<sup>th</sup> edition, PHI, 2005



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (CE)– III-II Sem**

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**3 0 0 3**

**(20A52701c) ENTERPRISE RESOURCE PLANNING  
(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

- To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning
- To enable the students in knowing the Advantages of ERP
- To train the students to develop the basic understanding of how ERP enriches the Business organizations in achieving a multidimensional growth.
- Impart knowledge about the historical background of BPR
- To aim at preparing the students, technologically competitive and make them ready to self-upgrade with the higher technical skills.

**Course Outcomes:**

- Understand the basic use of ERP Package and its role in integrating business functions.
- Explain the challenges of ERP system in the organization
- Apply the knowledge in implementing ERP system for business
- Evaluate the role of IT in taking decisions with MIS
- Create reengineered business processes with process redesign

**UNIT I**

Introduction to ERP: Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM),

**UNIT II**

Benefits of ERP: Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design-making Capability

**UNIT III**

ERP Implementation Lifecycle: Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

**UNIT IV**

BPR: Historical background: Nature, significance and rationale of business process reengineering (BPR), Fundamentals of BPR. Major issues in process redesign: Business vision and process objectives, Processes to be redesigned, Measuring existing processes,

**UNIT V**

IT in ERP: Role of information technology (IT) and identifying IT levers. Designing and building a prototype of the new process: BPR phases, Relationship between BPR phases. MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System.

**Textbooks:**

1. Pankaj Sharma. “Enterprise Resource Planning”. Aph Publishing Corporation, New Delhi, 2004.
2. Alexis Leon, “Enterprise Resource Planning”, IV Edition, Mc.Graw Hill, 2019

**References:**

1. Marianne Bradford “Modern ERP”, 3rd edition.
2. “ERP making it happen Thomas f. Wallace and Michael
3. Directing the ERP Implementation Michael w pelphrey



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– IV-I Sem**

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**(20A02706) ENERGY CONSERVATION AND AUDIT**  
**(Skill Oriented Course – V)**

**Course Objectives:**

The following industry relevant skills of the competency ‘Undertake energy conservation and energy audit’ are expected to be developed in the students by undertaking

- Identification of energy losses and opportunities of energy conservation.
- Implementation of energy conservation technique.
- Apply energy conservation techniques in electrical installations.
- Use Co-generation and relevant tariff for reducing losses in facilities.
- Carryout energy audit for electrical system.

**Course Outcomes:**

At the end of the course the student will be able to:

- Understand energy conservation policies in India.
- Design energy conservation techniques in electrical machines.
- Apply energy conservation techniques in electrical installations, Co-generation and relevant tariff for reducing losses in facilities.
- Design and analyze energy audit for electrical system.

**List of Experiments:**

Theory:

Different types of Electrical apparatus, ratings, units, Loads, efficiency calculations, power consumption calculations, improvement of p.f., lightening, fans, electricity tariff, need for energy saving, energy audit questionnaire

**List of Experiments:**

1. Analyze star labeled electrical apparatus and compare the data sheet (Pamphlet) of various star ratings.
2. Determine the ‘% loading’ and the related efficiency of given Induction motor at different loading
3. Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode at no load/ light loads.
4. Use APFC / PFC unit for improvement of p. f. of electrical load.
5. Compare power consumption of (Fluorescent and LED) lighting
6. Determine Net Energy Saving by Lamp replacements.
7. Determine Energy conservation in Fan by using Electronic Regulator
8. Analysis of electric bill based on tariff of Industrial consumer to reduce energy usage and electric bill
9. To analyze the energy bill of a commercial consumer and to suggest (if needed) suitable tariff to achieve energy conservation and reduction in energy bill
10. To interpret the energy bill of a residential consumer, suggest suitable tariff to achieve energy conservation and reduction in energy bill.
11. Estimate energy saving by improving power factor and load factor for given cases.
12. Prepare a sample energy audit questionnaire for the given industrial facility.
13. Prepare an energy audit report
14. Determination of rating of Inverter capacity for household applications

**References:**

1. Guide Books no. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors
2. Energy Management and Conservation By Sharma, K. V., Venkatasessaiah P

**Online Learning Resources/Virtual Labs:**

1. <https://nptel.ac.in/courses/108106022>



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# OPEN ELECTIVES



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**

**(20A01505) BUILDING TECHNOLOGY**  
**(Open Elective-I)**

**Course Objectives:**

- To know different types of buildings, principles and planning of the buildings.
- To identify the termite control measure in buildings, and importance of grouping circulation, lighting and ventilation aspects in buildings.
- To know the different modes of vertical transportation in buildings.
- To know the utilization of prefabricated structural elements in buildings.
- To know the importance of acoustics in planning and designing of buildings.

**Course Outcomes (CO):**

- Understand the principles in planning and design the buildings
- To get different types of buildings, principles and planning of the buildings
- To know the different methods of termite proofing in buildings.
- Know the different methods of vertical transportation in buildings.
- Know the implementation of prefabricated units in buildings and effect of earthquake on buildings.
- Know the importance of acoustics in planning and designing of buildings.

**UNIT I**

Overview of the course, basic definitions, buildings-types-components-economy and design-principles of planning of buildings and their importance. Definitions and importance of grouping and circulation-lighting and ventilation-consideration of the above aspects during planning of building.

**UNIT II**

Termite proofing: Inspection-control measures and precautions-lighting protection of buildings-general principles of design of openings-various types of fire protection measures to be considered while planning a building.

**UNIT III**

Vertical transportation in a building: Types of vertical transportation-stairs-different forms of stairs-planning of stairs-other modes of vertical transportation –lifts-ramps-escalators.

**UNIT IV**

Prefabrication systems in residential buildings-walls-openings-cupboards-shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, principles, seismic forces and their effect on buildings.

**UNIT V**

Acoustics –effect of noise –properties of noise and its measurements, principles of acoustics of building. Sound insulation-importance and measures.

**Textbooks:**

1. Building construction by Varghese, PHI Learning Private Limited 2<sup>nd</sup> Edition 2015
2. Building construction by Punmia.B.C, Jain.A.K and Jain.A.K Laxmi Publications 11<sup>th</sup> edition 2016

**Reference Books:**

1. National Building Code of India, Bureau of Indian Standards
  2. Building construction-Technical teachers training institute, Madras, Tata McGraw Hill.
  3. Building construction by S.P.Arora and S.P.BrndraDhanpat Rai and Sons Publications, New Delh 2014 edition
- <https://nptel.ac.in/courses/105102206>  
<https://nptel.ac.in/courses/105103206>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**

**(20A03505) 3D PRINTING TECHNOLOGY**  
**(Open Elective-I)**

**Course Objectives:**

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.
- Train Various Pre – Processing, Processing and Post Processing errors in RP Processes.

**Course Outcomes:**

- Use techniques for processing of CAD models for rapid prototyping.
- Understand and apply fundamentals of rapid prototyping techniques.
- Use appropriate tooling for rapid prototyping process.
- Use rapid prototyping techniques for reverse engineering.
- Identify Various Pre – Processing, Processing and Post Processing errors in RP processes.

**UNIT I Introduction to 3D Printing**

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

**UNIT II Solid and Liquid Based RP Systems**

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

**UNIT III Powder Based & Other RP Systems**

**Powder Based RP Systems:** Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).

**Other RP Systems:** Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

**UNIT IV Rapid Tooling & Reverse Engineering**

**Rapid Tooling:** Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

**Reverse Engineering (RE):** Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

**UNIT V Errors in 3D Printing and Applications:**

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc.

**Software:** Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

**Applications:** Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

**Textbooks:**

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer, 2/e, 2010.



**Reference Books:**

1. Frank W.Liou, “Rapid Prototyping & Engineering Applications”, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley&Sons, 2006.

**Online Learning Resources:**

- NPTEL Course on Rapid Manufacturing.
- <https://nptel.ac.in/courses/112/104/112104265/>
- <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
- <https://slideplayer.com/slide/6927137/>
- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- [https://www.cet.edu.in/noticfiles/258\\_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf](https://www.cet.edu.in/noticfiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf)
- [https://www.vssut.ac.in/lecture\\_notes/lecture1517967201.pdf](https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf)
- <https://www.youtube.com/watch?v=NkC8TNts4B4>





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**(20A04506) PRINCIPLES OF COMMUNICATION SYSTEMS**

**Course Objectives:**

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

**Course Outcomes:**

- Understand the concept of various modulation schemes and multiplexing
- Apply the concept of various modulation schemes to solve engineering problems
- Analyse various modulation schemes, and evaluate various modulation scheme in real time applications

**UNIT I Amplitude Modulation**

Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

**UNIT II Angle Modulation**

Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

**UNIT III Pulse Modulation**

Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

**UNIT IV Digital Modulation**

Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

**UNIT V Communication Systems**

Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

**Textbooks:**

1. Herbert Taub, Donald L Schilling and Goutam Saha, "Principles of Communication Systems", 3<sup>rd</sup> Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

**References:**

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, "Modern Digital and Analog Communication Systems", 4<sup>th</sup> Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam "Digital and Analog Communication Systems", Wiley India Edition, 2008.



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**(20A05505a) JAVA PROGRAMMING**  
**(Open Elective Course – I)**

**Course Objectives:**

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

**Course Outcomes:**

- Solve real-world problems using OOP techniques.
- Apply code reusability through inheritance, packages and interfaces
- Solve problems using java collection framework and I/O classes.
- Develop applications by using parallel streams for better performance and develop applets for web applications.
- Build GUIs and handle events generated by user interactions and Use the JDBC API to access the database.

**UNIT I Introduction**

Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods

**UNIT II Inheritance, Packages, Interfaces**

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,  
Packages: Basics, Finding packages and CLASSPATH, Access Protection, Importing packages.  
Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

**UNIT III Exception handling, Stream based I/O**

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

**UNIT IV Multithreading, The Collections Framework**

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes-Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

**UNIT V Applet, GUI Programming with Swings, Accessing Databases with JDBC**

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jLabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jTable, An overview of jmenubar, jmenu and jmenuitem,



creating a main menu, show message dialog, show confirmdialog, show input dialog, show option dialog, jdialog, create a modeless dialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

**Textbooks:**

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

**Reference Books:**

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java, P. Radha Krishna, University Press.
6. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
7. Java Programming and Object-oriented Application Development, R.A. Johnson, Cengage Learning.

**Online Learning Resources:**

[https://www.w3schools.com/java/java\\_oop.asp](https://www.w3schools.com/java/java_oop.asp)

<http://peterindia.net/JavaFiles.html>



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**3 0 0 3**

**(20A05602T) ARTIFICIAL INTELLIGENCE**  
**Open Elective Course - I**

**Course Objectives:**

This course is designed to:

- Introduce Artificial Intelligence
- Teach about the machine learning environment
- Present the searching Technique for Problem Solving
- Introduce Natural Language Processing and Robotics

**Course Outcomes:**

After completion of the course, students will be able to

- Apply searching techniques for solving a problem
- Design Intelligent Agents
- Develop Natural Language Interface for Machines
- Design mini robots
- Summarize past, present and future of Artificial Intelligence

**UNIT I Introduction** Lecture 9Hr

**Introduction:** What is AI, Foundations of AI, History of AI, The State of Art.

**Intelligent Agents:** Agents and Environments, Good Behaviour: The Concept of Rationality, The Na Environments, The Structure of Agents.

**UNIT II Solving Problems by searching** Lecture 9 Hr

Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Str: Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithm Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic A Searching with partial observations, online search agents and unknown environments.

**UNIT III Reinforcement Learning & Natural Language Processing** Lecture 8Hr

**Reinforcement Learning:** Introduction, Passive Reinforcement Learning, Active Reinforcement Le Generalization in Reinforcement Learning, Policy Search, applications of RL

**Natural Language Processing:** Language Models, Text Classification, Information Retrieval, Infor Extraction.

**UNIT IV Natural Language for Communication** Lecture 8 Hr

**Natural Language for Communication:** Phrase structure grammars, Syntactic Analysis, Aug Grammars and semantic Interpretation, Machine Translation, Speech Recognition

**Perception:** Image Formation, Early Image Processing Operations, Object Recognition by appe Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

**UNIT V Robotics** Lecture 10Hr

**Robotics:** Introduction, Robot Hardware, Robotic Perception, planning to move, planning ur movements, Moving, Robotic software architectures, application domains

**Philosophical foundations:** Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Architectures, Are we going in the right direction, What if AI does succeed.

**Textbooks:**

1. Stuart J.Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3<sup>rd</sup> Edition, I Education, 2019.



**Reference Books:**

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.

**Online Learning Resources:**

<http://peterindia.net/AILinks.html>

<http://nptel.ac.in/courses/106106139/>

<https://nptel.ac.in/courses/106/105/106105152/>



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**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**  
**(20A12502) MOBILE APPLICATION DEVELOPMENT USING ANDROID**  
**(Open Elective-I)**

**Course Objectives:**

- Facilitate students to understand android SDK.
- Help students to gain a basic understanding of Android application development.
- Inculcate working knowledge of Android Studio development tool.

**Course Outcomes:**

- Identify various concepts of mobile programming that make it unique from programming for other platforms.
- Evaluate mobile applications on their design pros and cons.
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- Develop mobile applications for the Android operating system that use basic and advanced phone features.
- Demonstrate the deployment of applications to the Android marketplace for distribution.

**UNIT I Introduction and Mobile User Interface Design**

Introduction to Android: The Android Platform, Android SDK, Android Studio Installation, Android Installation, building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

**UNIT II Activities, Intents and Android User Interface**

Android Application Design Essentials: Anatomy of an Android application, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions

**UNIT III Advanced User Interface and Data Persistence**

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

**UNIT IV Android Services, Publishing Android Applications**

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

**UNIT V Android Databases**

Using Common Android APIs: Using Android Data and Storage APIs, managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

**Textbooks:**

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011).
2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development," Wiley India, First Edition, 2012.

**Reference Books:**

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

**Online Learning Resources:**

1. <https://developer.android.com/>



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**B.Tech III-I Sem**

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**3 0 0 3**

**(20A27505) COMPUTER APPLICATIONS IN FOOD TECHNOLOGY**  
**(Open Elective-1)**

**Course Objectives:**

- To know different software and applications in food technology.
- To understand the Chemical kinetics in food processing, Microbial distraction in thermal processing of food.
- To acquire knowledge on computer aided manufacturing and control of food machinery, inventory control, process control.

**Course Outcomes:**

- Students will gain knowledge on software in food technology, data analysis, Chemical kinetics, microbial distortion in thermal process
- Use of linear regression in analyzing sensory data, application of computer in some common food industries like, milk plant, bakery units & fruits vegetable plants.

**UNIT I**

Introduction to various software and their applications in food technology. Application of MS Excel to solve the problems of Food Technology, SPSS and JMP for data analysis, Pro-Engineering for design, Lab VIEW and SCADA for process control .

**UNIT II**

Chemical kinetics in food processing: Determining rate constant of zero order reaction First order rate constant and half-life of reactions. Determining energy of activation of vitamin degradation during food storage Rates of Enzymes catalyzed reaction. Microbial distraction in thermal processing of food. Determining decimal reduction time from microbial survival data, Thermal resistance factor, Z-values in thermal processing of food. Sampling to ensure that a lot is not contaminated with more than a given percentage Statistical quality control. Probability of occurrence in normal distribution. Using binomial distribution to determine probability of occurrence. Probability of defective items in a sample obtained from large lot

**UNIT III**

Sensory evaluation of food Statistical descriptors of a population estimated from sensory data obtained from a sample Analysis of variance. One factor, completely randomized design For two factor design without replication. Use of linear regression in analyzing sensory data. Mechanical transport of liquid food. Measuring viscosity of liquid food using a capillary tube viscometer . Solving simultaneous equations in designing multiple effect evaporator while using matrix algebra available in excel.

**UNIT IV**

Familiarization with the application of computer in some common food industries like, milk plant, bakery units & fruits vegetable plants, stating from the receiving of raw material up to the storage & dispatch of finished product.

**UNIT V**

Basic Introduction to computer aided manufacturing. Application of computers, instrumentation and control of food machinery, inventory control, process control etc.

**Recommended books:**

1. Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis by R. Paul Singh, AP.
2. Manuals of MS Office.



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**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**

**(20A54501) OPTIMIZATION TECHNIQUES**  
**(Open Elective- I)**

**Course Objectives:**

This course enables the students to classify and formulate real-life problem for modeling as optimization problem, solving and applying for decision making.

**Course Outcomes:** Student will be able to

- formulate a linear programming problem and solve it by various methods.
- give an optimal solution in assignment jobs, give transportation of items from sources to destinations.
- identify strategies in a game for optimal profit.
- implement project planning.

**UNIT I**

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.

**UNIT II**

Transportation problems- assignment problems-Game theory.

**UNIT III**

CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations.

**UNIT IV**

Sequencing Problems-Replacement problems-Capital equipment- Discounting costs- Group replacement.

**UNIT V**

Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models- Single period inventory models with shortage cost.

**Textbooks:**

1. Operations Research , S.D. Sharma.
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
3. Operations Research, Nita H Shah, Ravi M Gor, Hardik Soni, PHI publishers

**Reference Books:**

1. Problems on Operations Research, Er. Prem kumargupta, Dr.D.S. Hira, Chand publishers
2. Operations Research, CB Gupta, PK Dwivedi, Sunil kumaryadav

**Online Learning Resources:**

[https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module\\_1/M1L2slides.pdf](https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L2slides.pdf)

<https://slideplayer.com/slide/7790901/>

<https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf>





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**L T P C**  
**3 0 0 3**

**(20A56501) MATERIALS CHARACTERIZATION TECHNIQUES**

**(Open Elective- I)**

**Course Objectives:**

- To provide an exposure to different characterization techniques.
- To enlighten the basic principles and analysis of different spectroscopic techniques.
- To explain the basic principle of Scanning electron microscope along with its limitations and applications.
- To identify the Resolving power and Magnification of Transmission electron microscope and its applications.
- To educate the uses of advanced electric and magnetic instruments for characterization.

**Course Outcomes:** At the end of the course the student will be able

- To explain the structural analysis by X-ray diffraction.
- To understand the morphology of different materials using SEM and TEM.
- To recognize basic principles of various spectroscopic techniques.
- To study the electric and magnetic properties of the materials.
- To make out which technique can be used to analyse a material

**UNIT I**

Structure analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

**UNIT II**

Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

**UNIT III**

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

**UNIT IV**

Spectroscopy techniques – Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

**UNIT V**

Electrical & Magnetic Characterization techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

**Textbooks:**

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Handbook of Materials Characterization -by Sharma S. K. - Springer

**References:**

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall, 2001
3. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods-[Yang Leng](#)- John Wiley & Sons
4. Characterization of Materials 2<sup>nd</sup> Edition, 3 Volumes-Kaufmann E N -John Wiley (Bp)



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**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**  
**(20A51501) CHEMISTRY OF ENERGY MATERIALS**  
**(Open Elective- I)**

**Course Objectives:**

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
- Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

**Course Outcomes:**

- Ability to perform simultaneous material and energy balances.
- Student learn about various electrochemical and energy systems
- Knowledge of solid, liquid and gaseous fuels
- To know the energy demand of world, nation and available resources to fulfill the demand
- To know about the conventional energy resources and their effective utilization
- To acquire the knowledge of modern energy conversion technologies
- To be able to understand and perform the various characterization techniques of fuels
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively

**UNIT I: Electrochemical Systems:** Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batteries.

**UNIT II: Fuel Cells:** Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell,.

**UNIT III: Hydrogen Storage:** Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogel storage by high pressure methods. Liquifaction method.

**UNIT IV:Solar Energy:** Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells.

**UNIT V:** Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

**References:**

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins
4. Fuel Cell Hand Book 7<sup>th</sup> Edition, by US Department of Energy (EG&G technical services and corporation)
5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff



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**(20A01605) ENVIRONMENTAL ECONOMICS**  
**(Open Elective Course - II)**

**Course Objectives:**

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

**Course Outcomes :**

After the completion of the course, the students will be able to know

- The information on sustainable development and economics of energy
- The information regarding environmental degradation and economic analysis of degradation
- The identification of economics of pollution and their management
- The cost benefit analysis of environmental resources
- The principles of economics of biodiversity

**UNIT I**

Sustainable Development: Introduction to sustainable development - Economy-Environment inter-linkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy – Nonrenewable energy, scarcity, optimal resources, backstop technology, property research, externalities, and the conversion of uncertainty.

**UNIT II**

Environmental Degradation: Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

**UNIT - III**

Economics of Pollution: Economics of Pollution - Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

**UNIT IV**

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

**UNIT V**

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

**Textbooks:**

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

**Reference Books:**

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaf, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),
3. Environmental and Resource Economics: An Introduction by Michael S. Common and Michael Stuart 2<sup>nd</sup>Edition, Harlow: Longman.(1996),
4. Natural Resource and Environmental Economics by Roger Perman, Michael Common, Yue Ma and James Mc Gilvray 3<sup>rd</sup>Edition, Pearson Education.(2003),

**Online Learning Resources:**

<https://nptel.ac.in/courses/109107171>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A03605c) INTRODCUTION TO ROBOTICS**  
**(Open Elective-II)**

**Course Objectives:**

- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system

**Course Outcomes:**

After completing the course, the student will be able to,

- Explain fundamentals of Robots
- Apply kinematics and differential motions and velocities
- Demonstrate control of manipulators
- Understand robot vision
- Develop robot cell design and programming

**UNIT I** Fundamentals of Robots

Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

**UNIT II** Kinematics, Differential motions and velocities of robot

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, the inverse kinematic of robots, degeneracy and dexterity, simple problems with D-H representation.

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

**UNIT III** Control of Manipulators

Open- and close-loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

**UNIT IV** Robot Vision

Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

**UNIT V** Robot Cell Design and Programming

Robot cell layouts-Robot centred cell, In-line robot cell, considerations in work cell design, work cell control, interlocks, error detection, work cell controller. methods of robot programming, WAIT, SIGNAL, and DELAY commands, Robotic languages, VAL system.

**Textbooks:**

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, Industrial Robotics — Mc Graw Hill, 1986.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.



**References:**

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley- Interscience, 1986.
3. Robert J. Schilling, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.

**Online Learning Resources:**

<https://nptel.ac.in/courses/108105088>

<https://nptel.ac.in/courses/108105063>

<https://nptel.ac.in/courses/108105062>

<https://nptel.ac.in/courses/112104288>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**

**(20A04606) BASIC VLSI DESIGN**

**Course Objectives:**

- Understand the fundamental aspects of circuits in silicon
- Relate to VLSI design processes and design rules

**Course Outcomes:**

- Identify the CMOS layout levels, and the design layers used in the process sequence.
- Describe the general steps required for processing of CMOS integrated circuits.
- Design static CMOS combinational and sequential logic at the transistor level.
- Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc.
- Interpret the need for testability and testing methods in VLSI.

**UNIT I**

Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, pwell processes, BiCMOS, Comparison of bipolar and CMOS. Basic Electrical Properties of MOS And BiCMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, trans conductance.

**UNIT II**

Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio: nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up. Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, BiCMOS drivers.

**UNIT III**

MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style Design rules and layout & Scaling of MOS Circuits:  $\lambda$  - based design rules, scaling factors for device parameters

**UNIT IV**

Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS Examples of structured design: Parity generator, Bus arbitration, multiplexers, logic function block, code converter.

**UNIT V**

Subsystem Design and Layout-2: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity Definition & Computation Practical aspects and testability: Some thoughts of performance, optimization and CAD tools for design and simulation.

**Textbooks:**

1. "Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3 rd Edition, Prentice Hall of India publication, 2005.

**References:**

1. "CMOS Digital Integrated Circuits, Analysis And Design", Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3 rd Edition, 2003.
2. VLSI Technology", S.M. Sze, 2nd edition, Tata McGraw Hill, 2003



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem** **L T P C**  
**3 0 0 3**

**(20A04701b) INTRODUCTION TO INTERNET OF THINGS**  
**(Open Elective Course-II)**

**Course Objectives:**

Students will understand the concepts of Internet of Things and can able to build IoT applications.

**Course Outcomes:**

- Understand the concepts of Internet of Things
- Identify hardware and software components of Internet of Things
- Analyze basic communication protocols
- Design IoT applications in different domain and be able to analyze their performance

**UNIT 1**

Introduction to IoT: Architectural overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals-Devices and gateways, Data management, Business processes in IoT, Role of cloud in IoT

**UNIT II**

Elements of IoT: Hardware components – computing (Arduino, Raspberry Pi), communication, Sensing, Actuation, I/O interfaces Software Components- Programming APIs (Using python/Arduino) for communication protocols-MQTT, Zigbee, Bluetooth, CoAP, UDP, TCP

**UNIT III**

Sensing and Actuation: Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT

**UNIT IV**

IoT Application Development: Solution frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices

**UNIT V**

IoT Case Studies: IoT Case studies and mini projects based on industrial Automation, Transportation, Agriculture, Healthcare, Home Automation.

**Textbooks:**

1. Vijay Madiseti, ArshdeepBahga, “Internet of Things a Hands-On- Approach”,2014.

**References:**

1. Dr SRN Reddy, RachitThukral and Manasi Mishra ,” Introduction to Internet of Things”: A practical Approach” ETI Labs
2. Raj Kamal , “ Internet of Things: Architecture and Design”, McGraw Hill
3. Adrian McEwen, “Designing the Internet of Things”, Wiley Publishers, 2013



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem**

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**3 0 0 3**

**(20A05605a) PRINCIPLES OF OPERATING SYSTEMS**

**(Open Elective Course – II)**

**Course Objectives:**

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Expose the students with different techniques of handling deadlocks
- Provide good insight on various memory management techniques
- Explore the concept of file-system and its implementation issues

**Course Outcomes:**

- Demonstrate and understand of computer systems and operating systems functions
- Distinguish between process and thread and classify scheduling algorithms
- Solve synchronization and deadlock problems
- Compare various memory management schemes
- Explain file systems concepts and i/o management

**UNIT I Introduction to Computer and Operating system**

Computer Types, Functional Units, Basic Operational Concepts, Number Representation and Arithmetic Operations, Character Representation, Performance, Historical Perspective, Memory Locations and Addresses, Memory operations, Instructions and Instruction Sequencing, Addressing modes Architecture Operating System Structure, Operations Process, Memory, Storage Management, Protection and Security Computing Environments Operating System Services User Operating System Interface System Calls Types System Programs OS Structure OS Generation System Boot.

**UNIT II Process, Threads and Scheduling**

Process Concept Scheduling Operations on Processes Cooperating Processes Inter-Process Communication Threads - Multithreading Models -Thread Libraries- Threading Issues – Scheduling Criteria Scheduling Algorithms Algorithm Evaluation.

**UNIT III Process Synchronization and Deadlocks**

The Critical-Section Problem Synchronization Hardware Mutex Locks -Semaphores Classic Problems of Synchronization Critical Regions Monitors Deadlocks System Model Deadlock Characterization Methods for Handling Deadlocks Deadlock Prevention Deadlock Avoidance Deadlock Detection Recovery from Deadlock.

**UNIT IV Memory Management**

Introduction - Swapping Contiguous Memory Allocation Paging Segmentation- Structure of the Page Table - Virtual Memory- Background Demand Paging Copy on Write Page Replacement Allocation of Frames Thrashing.

**UNIT V Input/ Output and Files**

Overview of Mass Storage Structure - Disk Structure - Disk Scheduling and Management-File System Interface File Concept - Access Methods -Directory and Disk Structure- Directory Implementation - Allocation Methods- I/O Systems I/O Hardware- Application I/O Interface - Kernel I/O Subsystem.

**Textbooks:**

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.
2. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating Systems Concepts, Ninth Edition, Wiley,2012.

**Reference Books:**

1. William Stallings, Operating Systems: Internals and Design Principles, Ninth Edition, Prentice-Hall, 2018.
2. Andrew Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall, 2009.

**Online Learning Resources:**

<https://nptel.ac.in/courses/106/106/106106144/>  
<http://peterindia.net/OperatingSystems.html>





**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem** **L T P C**  
**3 0 0 3**

**(20A05605b) FOUNDATIONS OF MACHINE LEARNING**

**Open Elective Course– II**

**Course Objectives:**

- Acquire theoretical knowledge on setting hypothesis for pattern recognition.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms and to provide solution for various real-world applications.

**Course Outcomes (CO):**

After completion of the course, students will be able to

1. Understand the characteristics of machine learning strategies.
2. Apply various supervised learning methods to appropriate problems.
3. Identify and integrate more than one technique to enhance the performance of learning.
4. Create probabilistic and unsupervised learning models for handling unknown pattern.
5. Analyse the co-occurrence of data to find interesting frequent patterns.
6. Pre-process the data before applying to any real-world problem and can evaluate its performance

**UNIT - I Introduction to Machine Learning Lecture 8Hrs**

What is machine learning, learning associations, classification, regression, unsupervised learning, reinforcement learning

Supervised Learning: learning a class from examples, learning multiple classes, model selection and generalization

**UNIT - II Parametric, Non-Parametric methods Lecture 9Hrs**

Parametric Methods: Introduction, maximum likelihood estimation, evaluating an estimator, parametric classification, regression, model selection procedures

Nonparametric Methods: Introduction, nonparametric density estimation: histogram estimator, kernel estimator, k-nearest neighbour estimator

**UNIT - III Multivariate Methods Lecture 9Hrs**

Multivariate Methods: Multivariate data, parameter estimation, estimation of missing values, multivariate normal distribution, multi variate classification

**UNIT - IV Dimensionality Reduction, Clustering Lecture 8Hrs**

Dimensionality Reduction: Introduction, subset selection, principal component analysis, singular value decomposition and matrix factorization

Clustering: Mixture densities, k-means clustering, expectation-maximization algorithm, mixtures of latent variables

**UNIT - V Deep Learning Lecture 8Hrs**

Deep Learning: Introduction, train multiple hidden layers, improving training convergence, regularization, convolution layers, tuning the network structure, learning sequences.

**Textbooks:**

1. EthemAlpaydin, Introduction to Machine Learning, Fourth Edition, MIT Press, Fourth Edition, 2020
2. MehryarMohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press, 2012

**Reference Books:**

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2019.
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, CRC Press, 2015.
3. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.

**Online Learning Resources:**

1. <https://bloomberg.github.io/foml/>
2. [https://d1rkab7tlqy5f1.cloudfront.net/EWI/Over%20de%20faculteit/Afdelingen/Intelligent%20Systems/Pattern%20Recognition%20Laboratory/PR/Reading%20Group/Foundations\\_of\\_Machine\\_Learning.pdf](https://d1rkab7tlqy5f1.cloudfront.net/EWI/Over%20de%20faculteit/Afdelingen/Intelligent%20Systems/Pattern%20Recognition%20Laboratory/PR/Reading%20Group/Foundations_of_Machine_Learning.pdf)



**(20A05605c) DATA ANALYTICS USING R**  
**(Open Elective-II)**

**Course Objectives:**

- Facilitate students to understand R programming
- Help students to gain a basic understanding of Data Analytics
- Inculcate working knowledge of plotting

**Course Outcomes:**

- Identify and execute basic syntax and programs in R
- Perform the Matrix operations using R built in functions
- Apply nonnumeric values in vectors
- Create the list and data frames
- Exploit the graph using ggplot2.

**UNIT I Introduction to R Programming**

History and Overview of R- Basic Features of R-Design of the R System- Installation of R- Console and Editor Panes- Comments- Installing and Loading R Packages- Help Files and Function Documentation-Saving Work and Exiting R- Conventions- R for Basic Math- Arithmetic- Logarithms and Exponentials - E-Notation - Assigning Objects – Vectors - Creating a Vector- Sequences, Repetition, Sorting and Lengths – Subsetting and Element Extraction -Vector – Oriented Behavior.

**UNIT II Matrices and Arrays**

Defining a Matrix – Defining a Matrix- Filling Direction- Row and Column Bindings- Matrix Dimensions-Subsetting- Row, Column, and Diagonal Extractions- Omitting and Overwriting- Matrix Operations and Algebra- Matrix Transpose- Identity Matrix- Matrix Addition and Subtraction- Matrix Multiplication-Matrix Inversion-Multidimensional Arrays-Subsets, Extractions and Replacements.

**UNIT III Non-Numeric values**

Logical Values- Relational Operators- Characters- Creating a String- Concatenation- Escape Sequences-Substrings and Matching- Factors- Identifying Categories- Defining and Ordering Levels- Combining and Cutting.

**UNIT IV Lists and Data frames**

List of Objects - Component Access – Naming – Nesting - Data Frames - Adding Data Columns and Combining Data Frames – Logical Record Subsets – Some Special Values – Infinity – NaN – NA - NULL – Attributes – Object - Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions

**UNIT V Basic Plotting**

Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels-Color-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an ExistingPlot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms—Reading and Writing Files- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots-AdHoc Object Read/Write Operations

**Textbooks:**

1. Tilman M. Davies, “The Book of R-A First Programming, Statistics” Library of Congress Cataloging-in-Publication Data, 2016.

**Reference Books:**

1. Hadley Wickham, Garrett Golemund, ”R for Data Science”, Oreilly Publication, 2017.
2. Roger D. Peng, “R Programming for Data Science” Lean Publishing, 2016.
3. Steven Keller, “R Programming for Beginners”, CreateSpace Independent Publishing Platform 2016.

**Online Learning Resources:**

1. <https://www.coursera.org/learn/data-analysis-r>
2. <https://www.careers360.com/courses-certifications/data-analysis-with-r-courses-brpg>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem** **L T P C**  
**3 0 0 3**  
**(20A27605) FOOD REFRIGERATION AND COLD CHAIN MANAGEMENT**  
**OPEN ELECTIVE II**

**Course Objectives:**

- To know the equipment available to store perishable items for a long time
- To understand to increase the storage life of food items

**Course Outcomes**

By the end of the course, the students will

- Understand various principles and theories involved in refrigeration systems
- Understand the different equipment useful to store the food items for a long period.
- Understand how to increase the storage life of food items

**UNIT I**

Principles of refrigeration: Definition, background with second law of thermodynamics, unit of refrigerating capacity, coefficient of performance; Production of low temperatures: Expansion of a liquid with flashing, reversible/ irreversible adiabatic expansion of a gas/ real gas, thermoelectric cooling, adiabatic demagnetization; Air refrigerators working on reverse Carnot cycle: Carnot cycle, reversed Carnot cycle, selection of operating temperatures;

**UNIT II**

Air refrigerators working on Bell Coleman cycle: Reversed Brayton or Joule or Bell Coleman cycle, analysis of gas cycle, polytropic and multistage compression; Vapour refrigeration: Vapor as a refrigerant in reversed Carnot cycle with p-V and T-s diagrams, limitations of reversed Carnot cycle; Vapour compression system: Modifications in reverse Carnot cycle with vapour as a refrigerant (dry vs wet compression, throttling vs isentropic expansion), representation of vapor compression cycle on pressure- enthalpy diagram, super heating, sub cooling;

**UNIT III**

Liquid-vapour regenerative heat exchanger for vapour compression system, effect of suction vapour super heat and liquid sub cooling, actual vapour compression cycle; Vapour-absorption refrigeration system: Process, calculations, maximum coefficient of performance of a heat operated refrigerating machine, Common refrigerants and their properties: classification, nomenclature, desirable properties of refrigerants- physical, chemical, safety, thermodynamic and economical; Azeotropes; Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve;

**UNIT IV**

Ice manufacture, principles and systems of ice production, Treatment of water for making ice, brines, freezing tanks, ice cans, air agitation, quality of ice; Cold storage: Cold store, design of cold storage for different categories of food resources, size and shape, construction and material, insulation, vapour barriers, floors, frost-heave, interior finish and fitting, evaporators, automated cold stores, security of operations; Refrigerated transport: Handling and distribution, cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display;

**UNIT V**

Air-conditioning: Meaning, factors affecting comfort air-conditioning, classification, sensible heat factor, industrial air-conditioning, problems on sensible heat factor; Winter/summer/year round air-conditioning, unitary air-conditioning systems, central air-conditioning, physiological principles in air-conditioning, air distribution and duct design methods; design of complete air-conditioning systems; humidifiers and dehumidifiers; Cooling load calculations: Load sources, product cooling, conducted heat, convected heat, internal heat sources, heat of respiration, peak load; etc.

**Textbooks:**

1. Arora, C. P. "Refrigeration and Air Conditioning". Tata MC Graw Hill Publishing Co.Ltd., New Delhi. 1993.

**References:**

1. Adithan, M. and Laroia, S. C. "Practical Refrigeration and Air Conditioning". Wiley Estern Ltd., New Delhi 1991



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem**

**L T P C**  
**3 0 0 3**

**(20A54701) WAVELET TRANSFORMS AND ITS APPLICATIONS**  
**(Open Elective-II)**

**Course Objectives:**

This course provides the students to understand Wavelet transforms and its applications.

**Course Outcomes:**

- Understand wavelets and wavelet expansion systems.
- Illustrate the multi resolution analysis and scaling functions.
- Form fine scale to coarse scale analysis.
- Find the lattices and lifting.
- Perform numerical complexity of discrete wavelet transforms.
- Find the frames and tight frames using fourier series.

**UNIT I** Wavelets

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets - effectiveness of Wavelet Analysis -The Discrete Wavelet Transform the Discrete-Time and Continuous Wavelet Transforms.

**UNIT II** A Multiresolution Formulation of Wavelet Systems

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

**UNIT III** Filter Banks and the Discrete Wavelet Transform

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

**UNIT IV** Time-Frequency and Complexity

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

**UNIT V** Bases and Matrix Examples

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

**Textbooks:**

1. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).
2. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).

**Reference Books:**

1. Raghuvver Rao, "Wavelet Transforms", Pearson Education, Asia.

**Online Learning Resources:**

<https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem** **L T P C**  
**3 0 0 3**  
**(20A56701) PHYSICS OF ELECTRONIC MATERIALS AND DEVICES**  
**(Open Elective-II)**

**Course Objectives:**

- To impart the fundamental knowledge on various materials, their properties and applications.
- To provide insight into various semiconducting materials, and their properties.
- To enlighten the characteristic behavior of various semiconductor devices.
- To provide the basics of dielectric and piezoelectric materials and their properties.
- To explain different categories of magnetic materials, mechanism and their advanced applications.

**Course Outcome:** At the end of the course the student will be able

- To understand the fundamentals of various materials.
- To exploit the physics of semiconducting materials
- To familiarize with the working principles of semiconductor-based devices.
- To understand the behaviour of dielectric and piezoelectric materials.
- To identify the magnetic materials and their advanced applications.

**UNIT I Fundamentals of Materials Science**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Basic idea of point, line and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge).

**UNIT II Semiconductors**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

**UNIT III Physics of Semiconductor devices**

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Construction and working principles of: Light emitting diodes, Heterojunctions, Transistors, FET and MOSFETs.

**UNIT IV Dielectric Materials and their applications:**

Introduction, Dielectric properties, Electronic polarizability and susceptibility, Dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties.

**UNIT V Magnetic Materials and their applications**

Introduction, Magnetism & various contributions to para and dia magnetism, Ferro and Ferri magnetism and ferrites, Concepts of Spin waves and Magnons, Anti-ferromagnetism, Domains and domain walls, Coercive force, Hysteresis, Nano-magnetism, Super-paramagnetism – Properties and applications.

**Textbooks**

1. Principles of Electronic Materials and Devices- S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd., 3rd edition, 2007.
2. Electronic Components and Materials- Grover and Jamwal, Dhanpat Rai and Co.

**Reference Books:**

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning, 6th edition
2. Electronic Materials Science- Eugene A. Irene, , Wiley, 2005
3. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd., , 2nd Edition,2011
4. A First Course In Material Science- by Raghvan, McGraw Hill Pub.
5. The Science and Engineering of materials- Donald R.Askeland, Chapman& Hall Pub.

**NPTEL courses links:**<https://nptel.ac.in/courses/113/106/113106062/>

[https://onlinecourses.nptel.ac.in/noc20\\_mm02/preview](https://onlinecourses.nptel.ac.in/noc20_mm02/preview),

<https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem**

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**3 0 0 3**

**(20A51701) CHEMISTRY OF POLYMERS AND ITS APPLICATIONS**

**Course Objectives:**

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

**Course Outcome**

- At the end of the course, the student will be able to:
- Understand the state of art synthesis of Polymeric materials
- Understand the hydro gels preparation, properties and applications in drug delivery system.
- Characterize polymers materials using IR, NMR, XRD.
- Analyze surface phenomenon fo micelles and characterise using photoelectron spectroscopy, ESCA and Auger spectroscopy

**UNIT I : Polymers-Basics and Characterization**

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: condensation, addition, radical chain, ionic and coordination and copolymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

**UNIT II : Synthetic Polymers**

Addition and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization.

Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications.

Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, XRD.

**UNIT III : Natural Polymers & Modified cellulotics**

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulotics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEAK.

Learning Outcomes:

**UNIT IV: Hydrogels of Polymer networks and Drug delivery**

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

**UNIT V : Surface phenomena**

Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.



**References :**

1. A Text book of Polymer science, Billmayer
2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A01704) COST EFFECTIVE HOUSING TECHNIQUES**  
**(Open Elective Course - III)**

**Course Objectives:**

- To understand the requirements of structural safety for future construction.
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- To know the traditional practices of rural housing
- To know the different innovative cost-effective construction techniques
- To know the alternative building materials for low-cost housing.

**Course Outcomes:**

- To know the repair and restore action of earthquake damaged non engineered buildings and ability to understand the requirements of structural safety for future construction
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- Apply the traditional practices of rural housing
- Understand the different innovative cost-effective construction techniques
- Suggest the alternative building materials for low-cost housing

**UNIT I**

- Housing Scenario: Introducing** - Status of urban housing - Status of Rural Housing
- Housing Finance:** Introducing - Existing finance system in India - Government role as facilitator - Status at Rural Housing Finance - Impedimently in housing finance and related issues
- Land use and physical planning for housing: Introduction-** Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye lass - Residential Densities
- Housing the urban poor: Introduction** - Living conditions in slums - Approaches and strategies for housing urban poor

**UNIT II**

**Development and adoption of low-cost housing technology**

Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements in partial prefatroids - Adopting of total prefabrication of mass housing in India- General remarks on pre cast roofing/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall – Fly-ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

**UNIT III**

**Alternative building materials for low cost housing**

Introduction - Substitute for scarce materials – Ferro-cement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - alternative building maintenance

**Low cost Infrastructure services:**

Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy

**UNIT IV**

**Rural Housing:** Introduction traditional practice of rural housing continuous - Mud Housing technology Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs

**UNIT V**





**Housing in Disaster prone areas:**

Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirement's of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

**Textbooks:**

1. Building materials for low – income houses – International council for building research studies and documentation.
2. Hand book of low cost housing by A.K.Lal – Newage international publishers.
3. Low cost Housing – G.C. Mathur by South Asia Books

**Reference Books:**

1. Properties of concrete – Neville A.m. Pitman Publishing Limited, London.
2. Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.
3. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Rama chandra Murthy &G.Annamalai. E. & F. N. Spon Publishers

**Online Learning Resources:**

<https://nptel.ac.in/courses/124107001>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

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**3 0 0 3**

**(20A03704) PRODUCT DESIGN AND DEVELOPMENT**

**(Open Elective-III)**

**Course Objectives:**

- To Design products creatively while applying engineering design principles.
- To Apply principles of human factors, ethics and environmental factors in product design.
- To Work in groups or individually in their pursuit of innovative product design.
- To implement value design for optimum product cost.

**Course Outcomes:** After successful completion of the course, the student will be able to

- Apply knowledge of basic science and engineering fundamentals
- Undertake problem identification, formulation and solution
- Understanding of the principles of sustainable design and development
- Understanding of professional and ethical responsibilities and commitment to them

**UNIT I** Product Development Process

General problem-solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behaviour.

**UNIT II** Task Clarification

Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and extending the requirements, Compiling the requirements list, Examples. Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

**UNIT III** Conceptual Design

Steps in Conceptual Design. Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem. Formulation, Identifying the essential problems from the requirements list, establishing functions structures, Overall function, Breaking a function down into sub-functions. Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures. Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of working structures. Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

**UNIT IV** Embodiment Design

Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of Tasks, Principles of Self-Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design to Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards. Evaluation of Embodiment Designs.

**UNIT V** Mechanical Connections, Mechatronics And Adaptronics:

Mechanical Connections - General functions and General Behaviour, Material connections, From Connections, Force connections, Applications. Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solution, Examples. Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.



**Textbooks:**

1. G.Paul; W. Beitzetal, Engineering Design, Springer International Education, 2010.
2. Kevin Otto: K. Wood, Product Design And Development, Pearson Education, 2013.

**References:**

1. Kenith B. Kahu, Product Planning Essentials, Yes dee Publishing, 2011.
2. K.T. Ulrich, Product Design and Development, TMH Publishers, 2011.

**Online Learning Resources:**

- <https://nptel.ac.in/courses/112107217>
- <https://nptel.ac.in/courses/112104230>
- <https://www.youtube.com/watch?v=mvaqZAFdL6U>
- <https://nptel.ac.in/courses/107103082>
- <https://quizxp.com/nptel-product-design-and-manufacturing-assignment-5/>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A04704) ELECTRONIC SENSORS**  
**(Open Elective Course –III)**

**Course Objectives:**

- Learn the characterization of sensors.
- Known the working of Electromechanical, Thermal, Magnetic and radiation sensors
- Understand the concepts of Electro analytic and smart sensors
- Able to use sensors in different applications

**Course Outcomes:**

- Learn about sensor Principle, Classification and Characterization.
- Explore the working of Electromechanical, Thermal, Magnetic, radiation and Electro analytic sensors
- Understand the basic concepts of Smart Sensors
- Design a system with sensors

**UNIT I**

**Sensors / Transducers:** Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization

**Electromechanical Sensors:** Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors

**UNIT II**

**Thermal Sensors:** Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor ,Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors

**UNIT III**

**Magnetic sensors:** Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

**UNIT IV**

**Radiation Sensors:** Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors

**Electro analytical Sensors:** The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

**UNIT V**

**Smart Sensors:** Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring

**Textbooks:**

1. “Sensors and Transducers - D. Patranabis” –PHI Learning Private Limited., 2003.
2. Introduction to sensors- John veteline, aravindraghu, CRC press, 2011

**References:**

1. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
2. Make sensors: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media,2014.
3. Sensors handbook- Sabriesoloman, 2nd Ed. TMH, 2009



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A05704a) WEB TECHNOLOGIES**  
**(Open Elective-III)**

**Course Objectives:**

The course is designed to Introduce the key technologies that have been developed as part of the birth and maturation of the World Wide Web.

**Course Outcomes:**

- Understand the Web essentials.
- Develop web pages using XHTML
- Apply style to web pages using CSS
- Write scripts for client side
- Develop and transform XML documents.

**UNIT I Web Essentials: Clients, Servers, and Communication**

The Internet, Basic Internet protocols, WWW, HTTP request message, HTTP response message, Web clients, Web Servers, Case study.

**UNIT II Markup Languages: XHTML 1.0**

An introduction to HTML, Basic XHTML syntax and semantics, fundamental HTML elements, Relative URLs, Lists, Tables, Frames, Forms, Defining XHTML's abstract syntax, Creating HTML documents.

**UNIT III Cascading Style Sheets**

Introduction, features, core syntax, style sheets and HTML, style rule cascading and inheritance, text properties, Box model, normal flow box layout, beyond the normal flow, lists, tables, cursor styles.

**UNIT IV Client-side programming: JavaScript**

Basic syntax, variables and data types, statements, operators, literals, functions, objects, Arrays, built-in objects, JavaScript debuggers.

**UNIT V Representing Web Data: XML**

Documents and vocabularies, Versions and declaration, Namespaces, Ajax, DOM and SAX parsers, transforming XML documents, XPath, XSLT, Displaying XML documents in Web browsers.

**Textbooks:**

1. J.C. Jackson, Web technologies: A computer science perspective, Pearson.

**Reference Books:**

1. Sebesta, Programming world wide web, Pearson.
2. Dietel and Nieto , Internet and World Wide Web – How to program, Pearson Education
3. Chris Bates , Web Programming, building internet applications, 2nd edition, WILEY, Dreamtech

**Online Learning Resources:**

<http://getbootstrap.com/>

<https://www.w3schools.com/whatis/>

<https://nptel.ac.in/courses/106105084>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A05704b) VR & AR FOR ENGINEERS**  
**(Open Elective Course – III)**

**Course Objectives:**

- Introduce to the design of visualization tools
- Demonstrate Virtual reality
- Learn Virtual reality animation and 3D Art optimization
- Understand the foundational principles describing how hardware, computer vision algorithms function
- Explore the history of spatial computing and design interactions

**Course Outcomes:**

- Apply VR/MR/AR in various fields in industry
- Design Data visualization tools
- Design audio and video interaction paradigms
- Apply technical and creative approaches to make successful applications and experiences.
- Explain how the humans interact with computers

**UNIT I**

**Computer generated worlds:** what is augmented reality? what is virtual reality?

**Understanding virtual space:** defining visual space and content, defining position and orientation in three dimensions, navigation

**The Mechanics of Sight:** the visual path way, spatial vision, and Depth Cues.

**Component Technologies of Head mounted Displays:** Display fundamentals, related terminology and concepts, optical Architectures.

**UNIT II**

**Augmented Displays:** Binocular augmenting displays, Monocular augmenting displays.

**Fully immersive Displays:** PC-Console driven displays, smartphone based displays, CAVES and Walls, Hemispheres and Domes.

**The Mechanics of hearing:** Defining sound, the auditory pathway, sound cues and localization, the vestibular system.

**Audio displays:** Conventional audio

**UNIT III**

**The Mechanics of Feeling:** The Science of feeling, Anatomy and Composition of the skin.

**Tactile and force feedback Devices:**Haptic illusions, tactile feedback devices, Force feedback devices.

**Sensors for tracking Position, and orientation and motion:** introduction to sensor technologies, optical trackers, beacon trackers,electromagnetic trackers, inertial sensors, acoustic sensors.

**Devices to enable navigation and interaction:** 2D vs 3D interaction and navigation, the importance of a manual interface, hand and gesture tracking, whole body tracking, gaming and entertainment interfaces, navigating with your mind.

**UNIT IV**

**Gaming and Entertainment:**Virtual reality and the arts, gaming, immersive video/ cinematic virtual reality.

**Architecture and Construction:**Artificial spaces, architectural design: Manage group architectures, Construction management, real estate sales applications, architectural acoustics.

**Science and engineering:** Simulate and innovate, naval architecture and marine engineering, automotive engineering, aerospace engineering, nuclear engineering and manufacturing.



**Health and medicine:** advancing the field of medicine, training applications, treatment applications.

#### UNIT V

**Aerospace and Defence:** Flight simulation and training, mission planning and rehearsal, dismounted soldier situational awareness, advanced cockpit avionics, space operations.

**Education:** Tangible skills education, theory, knowledge acquisition and concept formation.

**Information control and big data visualization:** What is big data?, big data analytics and human vision.

**Telerobotics and Telepresence:** Defining Telerobotics and Telepresence, space applications and robonaut, undersea applications, Terrestrial and airborne applications.

#### Textbooks:

1. Steve Aukstakalnis, “Practical Augmented Reality”, Pearson Education, 2017.

#### Reference Books:

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, “Creating Augmented& Virtual Realities”, O'REILLY

#### Online Learning Resources:

1. <https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality-technologies-applications-issues>
2. <https://www.coursera.org/learn/ar>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech IV-I Sem****L T P C**  
**3 0 0 3****(20A05704b) SOFTWARE ENGINEERING**  
**(Open Elective Course – III)****Course Objectives:**

- To learn the basic concepts of software engineering and life cycle models
- To explore the issues in software requirements specification and enable to write SRS documents for software development problems
- To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems
- To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- To reveal the basic concepts in software project management

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Obtain basic software life cycle activity skills.
- Design software requirements specifications for given problems.
- Implement structure, object oriented analysis and design for given problems.
- Design test cases for given problems.
- Apply quality management concepts at the application level.

**UNIT - I                      Basic concepts in software engineering and software project management                      Lecture 8Hrs**

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

**UNIT - II                      Requirements analysis and specification                      Lecture 8Hrs**

The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.

**UNIT - III                      Software Design                      Lecture 9Hrs**

Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.

**UNIT - IV                      Coding and Testing                      Lecture 9Hrs**

Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.

**UNIT - V                      Software quality, reliability, and other issues                      Lecture 9Hrs**

Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.

**Textbooks:**

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. Pressman R, "Software Engineering- Practioner Approach", McGraw Hill.





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### Reference Books:

1. Somerville, “Software Engineering”, Pearson 2.
2. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill.
3. JalotePankaj, “An integrated approach to Software Engineering”, Narosa

### Online Learning Resources:

<https://nptel.ac.in/courses/106/105/106105182/>

<http://peterindia.net/SoftwareDevelopment.html>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A27704) HUMAN NUTRITION**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To get knowledge on Concepts and content of nutrition source and metabolic functions.
- To know about Balanced diets for various groups; Diets and disorders, recommended dietary allowances
- To learn about Epidemiology of under nutrition and over nutrition.
- To understand Nutrition and immunity.

**Course Outcomes:**

- To study the Salient features of Concepts and content of nutrition, Malnutrition, Nutrition education
- Assessment of nutritional status, disorders Food fad and faddism.

**UNIT I**

Concepts and content of nutrition: Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolic function of nutrients. Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings;

**UNIT II**

Water and energy balance: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR Formulation of diets: Classification of balanced diet; Balanced diets for various groups; Diets and disorders. Recommended dietary allowances (RDA); For various age group; According physiological status; Athletic and sports man; Geriatric persons

**UNIT III**

Malnutrition: Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition and immunity.

**UNIT IV**

Nutrition education Assessment of nutritional status: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information

**UNIT V**

Blood constituents; Hormone types; Miscellaneous disorders Food fad and faddism. Potentially toxic substances in human food.

**Textbooks:**

1. Swaminathan M, Advanced Text Book on Food & Nutrition (Volume I and II) , The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006
2. Stewart Truswell, ABC of Nutrition (4th edition) , BMJ Publishing Group 2003, ISBN 0727916645.
3. Martin Eastwood, Principles of Human Nutrition , Blackwell Publishing, Boca Rotan

**Reference:**

1. Mike Lean and E. Combet ,Barasi's Human Nutrition – A Health Perspective , Second Edition CRC Press, London
2. Introduction to Human Nutrition, Micheal J. G., Susan A.L. Aedin C. and Hester H.V, Wiley-Blackwell Publication, UK 2009 , ISBN 9781405168076
3. Bogert L.J., Goerge M.B, Doris H.C., Nutrition and Physical Fitness, W.B. Saunders Company, Toronto, Canada



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A54702) NUMERICAL METHODS FOR ENGINEERS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

**Course Outcomes:**

- Apply numerical methods to solve algebraic and transcendental equations.
- Understand fitting of several kinds of curves.
- Derive interpolating polynomials using interpolation formulae.
- Solve differential and integral equations numerically.

**UNIT I Solution of Algebraic & Transcendental Equations**

Introduction-Bisection Method-Iterative method-Regula falsi method-Newton Raphson method.  
System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

**UNIT II Curve Fitting**

Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.

**UNIT III Interpolation**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae  
Gauss forward and backward formula, Stirling's formula, Bessel's formula

**UNIT IV Numerical Integration**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

**UNIT V Solution of Initial value problems to Ordinary differential equations**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

**Textbooks:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

**Reference Books:**

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

**Online Learning Resources:**

<https://slideplayer.com/slide/8588078/>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A56702) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To provide exposure to various kinds of sensors and actuators and their engineering applications.
- To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
- To enlighten the operating principles of various sensors and actuators
- To educate the fabrication of sensors
- To identify the required sensor and actuator for interdisciplinary application

**Course Outcomes:**

- To recognize the need of sensors and actuators
- To understand working principles of various sensors and actuators
- To identify different type of sensors and actuators used in real life applications
- To exploit basics in common methods for converting a physical parameter into an electrical quantity
- To make use of sensors and actuators for different applications

**UNIT I Introduction to Sensors and Actuators**

**Sensors:** Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

**Actuators:** Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, piezo-electric and piezo-resistive actuators, Simple applications of Actuators.

**UNIT II Temperature and Mechanical Sensors**

**Temperature Sensors:** Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

**Mechanical Sensors:** Types of Mechanical sensors and their basic principle of working: Force sensors: strain gauges, tactile sensors, Pressure sensors: semiconductor, piezoresistive, capacitive, VRP.

**UNIT III Optical and Acoustic Sensors**

**Optical Sensors:** Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors: thermal, PIR, thermopiles

**Acoustic Sensors:** Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

**UNIT IV Magnetic, Electromagnetic Sensors and Actuators**

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

**UNIT V Chemical and Radiation Sensors**

**Chemical Sensors:** Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

**Radiation Sensors:** Principle and working of Ionization detectors, Scintillation detectors, Geiger-Mueller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)



**Textbooks:**

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2<sup>nd</sup> Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

**Reference Books:**

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
5. Principles of Industrial Instrumentation By D. Patranabhis

**NPTEL courses links**

[https://onlinecourses.nptel.ac.in/noc21\\_ee32/preview](https://onlinecourses.nptel.ac.in/noc21_ee32/preview)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A51702) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To understand synthetic principles of Nanomaterials by various methods
- To characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

**Course Outcomes:**

- Understand the state of art synthesis of nano materials
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
- Analyze nanoscale structure in metals, polymers and ceramics
- Analyze structure-property relationship in coarser scale structures
- Understand structures of carbon nano tubes

**UNIT I**

Introduction: Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Synthetic Methods: Bottom-Up approach: Sol-gel synthesis, microemulsions or reverse micelles, coprecipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

**UNIT II**

Top-Down approach: Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

**UNIT III**

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

**UNIT IV**

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self-assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

**UNIT V**

Engineering Applications of Nanomaterials

**Textbooks:**

1. NANO: The Essentials: T Pradeep, McGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

**References:**

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials Chemistry, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A01705) HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT PRACTICES**  
**(Open Elective Course-IV)**

**Course Objectives:**

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard control, environmental issues and management
- To get exposed to accidents modeling, accident investigation and reporting, concepts of HAZOP and PHA
- To be familiar with safety measures in design and process operations.
- To get exposed to risk assessment and management, principles and methods

**Course Outcomes:**

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard.
- To get exposed to accidents modelling, accident investigation and reporting control, environmental issues and management
- To get concepts of HAZOP and PHA.
- To be familiar with safety measures in design and process operations.

**UNIT I**

Introduction to safety, health and environmental management - Basic terms and their definitions - Importance of safety - Safety assurance and assessment - Safety in design and operation - Organizing for safety.

**UNIT II**

Hazard classification and assessment - Hazard evaluation and hazard control. Environmental issues and Management - Atmospheric pollution - Flaring and fugitive release - Water pollution - Environmental monitoring - Environmental management.

**UNIT III**

Accidents modelling - Release modelling - Fire and explosion modelling - Toxic release and dispersion Modelling

**UNIT IV**

Accident investigation and reporting - concepts of HAZOP and PHA. Safety measures in design and process operations - Inserting, explosion, fire prevention, sprinkler systems.

**UNIT V**

Risk assessment and management - Risk picture - Definition and characteristics - Risk acceptance criteria - Quantified risk assessment - Hazard assessment - Fatality risk assessment - Risk management principles and methods.

**Textbooks:**

1. Process Safety Analysis, by Skelton. B, Gulf Publishing Company, Houston, 210pp., 1997.
2. Risk Management with Applications from Offshore Petroleum Industry, by Terje Aven and Jan Erik Vinnem, Springer, 200pp., 2007.

**Reference Books:**

1. Introduction to Safety and Reliability of Structures, by Jorg Schneider
2. Structural Engineering Documents Vol. 5, International Association for Bridge and Structural Engineering (IABSE), 138pp., 1997.
3. Safety and Health for Engineers, by Roger L. Brauer, John Wiley and Sons Inc. pp. 645-663, 2006.
4. Health, Safety and Environmental Management in Offshore and Petroleum Engineering, Srinivasan Chandrasekaran, John Wiley and Sons, 2016.

**Online Learning Resources:** <https://nptel.ac.in/courses/114106017>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A03705) INTRODUCTION TO COMPOSITE MATERIALS**  
**(Open Elective-IV)**

**Course Objectives:**

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

**Course Outcomes:**

- Identify the practical applications of composites. (L3)
- Identify the polymer matrix composites. (L3)
- Classify of bio- degradable composites. (L2)
- Outline the various types of ceramic matrix materials. (L2)

**UNIT I Introduction to composites**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

**UNIT II Polymer matrix composites**

Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Autoclave based methods - Injection moulding – sheet moulding compound – properties and applications of PMCs.

**UNIT III Metal matrix composites**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMCs.

**UNIT IV Ceramic matrix composites**

Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – Insitu chemical reaction techniques – solgel polymer pyrolysis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

**UNIT V Advances & Applications of composites**

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications. Bio degradability, introduction of bio composites, classification, processing of bio composites, applications of bio composites - Mechanical, Biomedical, automobile Engineering.

**Textbooks:**

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

**Reference Books:**

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME Publications, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bio plastics & Bio composites for Engineering applications, John Wiley publications, 2011.

**Online Learning Resources:**

- <https://nptel.ac.in/courses/112104229>
- <https://nptel.ac.in/courses/112104168>
- <https://nptel.ac.in/courses/101104010>
- <https://nptel.ac.in/courses/105108124>
- <https://nptel.ac.in/courses/112104221>





**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A05705a) CYBER SECURITY**  
**(Open Elective-IV)**

**Course Objectives:**

The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cybercrime.

**Course Outcomes:**

- Classify the cybercrimes and understand the Indian ITA 2000
- Analyse the vulnerabilities in any computing system and find the solutions
- Predict the security threats of the future
- Investigate the protection mechanisms
- Design security solutions for organizations

**UNIT I Introduction to Cybercrime**

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

**UNIT II Cyber Offenses: How Criminals Plan Them**

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

**UNIT III Cybercrime: Mobile and Wireless Devices**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT IV Tools and Methods Used in Cybercrime**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

**UNIT V Cyber Security: Organizational Implications**

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

**Textbooks:**

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

**Reference Books:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin. CRC Press T&F Group

**Online Learning Resources:**

<http://nptel.ac.in/courses/106105031/40>  
<http://nptel.ac.in/courses/106105031/39>  
<http://nptel.ac.in/courses/106105031/38>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A05705b) INTRODUCTION TO FULL STACK DEVELOPMENT**

**(Open Elective Course – IV)**

**Course Objectives:**

- To build foundation on HTML this will help developer to use HTML concepts for building responsive web application.
- To Develop HTML based Single application for Browsers.
- To Understand OOPs concepts and its applications by building competency in object –oriented Programming.
- To implement frontend and backend scenarios using Web Sockets.
- To become proficient in Bootstrap concepts.

**Course Outcomes:**

- Able to how to program a browser like using JavaScript, jQuery, Angular, or Vue.
- Distinguishing trends in multi-device implementation.
- Create webpages that function using external data.
- Disambiguate the different structures that a no SQL database may represent.
- Derive information from data and implement data into applications.

**UNIT I**

**e The Modern Web:** Rise of the Web, Mobile Web, The State of HTML, Applications vs Web Sites, Keeping Up.

**Planning Your Work: Identifying** Requirements, Defining the Work, Tracking the Work Continuous Improvement, Prioritization & Estimation, Managing Bugs, Continuous Delivery

**User Experience:** Information Architecture, Getting the User Experience Right, Polishing the User Experience, Implementing the User Experience.

**UNIT II**

**Designing Systems:** System Architectures, Identifying Concepts, Identifying User Interactions, Handling Commonalities, Working with Legacy and External Dependencies, Component Interactions, Applications vs. Modules, Cross-Functional Requirements, Caching, Designing for Failure, Designing Modules, Refactoring, Tools, Changing Your Architecture.

**Ethics:** Privacy, Cognitive Load, Energy Usage, Trust.

**Front End:** HTML, From Server to Browser, Styling, Components, Responsive Design, Progressive Enhancement to Progressively Enhance, or Not? Mobile First, Feature Detection, Progressive Enhancement of Style, When Not Using Progressive Enhancement, Search Engine Optimization, Build Tools.

**UNIT III**

**Testing:** Test-Driven Development, Test Pyramid, Behaviour-Driven Development, Three Amigos, Manual Testing, Visual Testing, Cross-Functional Testing,

**JavaScript:** Asynchronicity, JavaScript in the Browser, Offline-First Development, Document Object Model, Server-Side JavaScript, Table of Contents viii JavaScript Modules, Structuring Your JavaScript, JavaScript Types, Object-Oriented Programming, Functional Programming, Communicating Between Components, Connecting Components Together, Testing, Build Tools.

**Accessibility:** Accessible from the Start, Working with Assistive Technologies, Dealing with Interactive UI, Testing for Accessibility, Avoiding Common Mistakes.

**UNIT IV**

**APIs:** API Responsibilities, designing a REST API, Securing Your API, Event-Based APIs, Discovering APIs, Using APIs

**Storing Data:** Types of Databases, To SQL, or NoSQL?, Where to Store Your Data, Accessing Data from Your App, Managing Your Data, Protecting Your Data.

**Security:** Trust, Responding to Incidents, The Golden Rule, Threats, Security Checklists, Passwords, Indirect Attacks.



## UNIT V

**Deployment:** Twelve Factor Apps, Developer Machines, Production Environments, Moving Code into Production, Configuring Your Box, Infrastructure, Immutable Infrastructure, Continuous Delivery & Continuous Deployment.

**In Production:** Fire Drills, Run Books, Monitoring, Responding to Incidents

**Constant Learning:** Collecting, Experiments, Analysing Results, Hypothesis-Driven.

### **Textbook:**

1. Chris Northwood, The full Stack Developer, Apress, 2018.

### **Reference Books:**

1. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Frank Zammetti.
2. Full Stack Web Development for Beginners, Riaz Ahmed.

### **Online Learning Resources:**

1. [Learn Full Stack Web Development with 40+ Projects and Exercises | Udemy](#)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A05705c) INDUSTRIAL IOT**  
**(Open Elective-IV)**

**Course Objectives:**

- Acquire theoretical knowledge on Industrial Internet of Things.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms for sensors and data transmission.

**Course Outcomes:**

- Understand the characteristics of Internet of Things and its industry strategies.
- Apply various Internet of Things models to appropriate problems.
- Identify and integrate more than one technology to enhance the performance.
- Understand the sensors and data transmission used in Internet of Things.
- Analyse the co-occurrence of data to find interesting frequent patterns.
- Pre-process the data before applying to any real-world problem and can evaluate its performance.

**UNIT I Overview of Internet of Things**

Introduction, IOT Architecture, Application –based IOT protocols, Cloud Computing, Fog Computing, Sensor Cloud, Big Data.

Overview of Industry 4.0 and Industrial Internet of Things: IIoT- Prerequisites of IIOT, Basics of CPS, CPS and IIOT, Applications of IIoT.

**UNIT II Industrial Internet of Things**

Introduction, Industrial Internet Systems, Industrial sensing, Industrial Processes. Business Models and Reference Architecture of IIoT: Definition of a business model, Business models of IOT, Business models of IIOT.

**UNIT III Key and On-site Technologies**

Key Technologies: Off-site Technologies- Introduction, Cloud Computing- Necessity, Cloud Computing and IIot, Industrial Cloud Platform Providers, SLA, Requirements of Industry 4.0, Fog Computing.

On-site Technologies- Introduction, Augmented Reality- History, Categorization, Applications, Virtual Reality- History, Categorization, Applications.

**UNIT IV Sensors and Data Transmission**

Sensors: Introduction to Sensors, Characteristics-Sensor calibration, Sensor profile, Operating voltage, Sensor Categories. Actuators: Introduction, Thermal Actuators, Hydraulic Actuators, Pneumatic Actuators, Electromechanical Actuators.

Industrial Data Transmission: Foundation fieldbus, Profibus, HART, Interbus, Bitbus.

**UNIT V Machine learning and Data science, applications in healthcare**

Machine Learning and Data Science in Industries: Introduction, Machine Learning, Categorization on ML, Applications and Data Science of ML in industries, Deep Learning, Applications of Deep Learning in industries.

Applications of Healthcare in Industries: Smart Devices, Advanced Technologies using in Healthcare, Open Research Issues to be Addressed.



**Textbooks:**

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

**Reference Books:**

1. Industrial IoT. Available online: <https://medium.com/iotforall/whatproduct-managers-need-to-know-about-industrial-iot-8c92eec1d9d2>
2. IIoT Cloud Platforms. Available online: <https://fr.farnell.com/willthere-be-a-dominant-iiot-cloud-platform>.
3. Kajima, T. and Kawamura, Y., 1995. Development of a high-speed solenoid valve: Investigation of solenoids. IEEE Transactions on industrial electronics, 42(1), pp.1-8.

**Online Learning Resources:**

1. <https://www.coursera.org/learn/industrial-internet-of-things>
2. <https://www.coursera.org/specializations/developing-industrial-iot>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A27705) WASTE AND EFFLUENT MANAGEMENT**  
**(OPEN ELECTIVE-IV)**

**Course Objectives:**

- To understand the wastewater treatment process.
- To gain knowledge on waste disposal in various ways.
- To know about advances in wastewater treatment.

**Course Outcomes:**

- Acquires knowledge on technologies used for chemical and biological methods of wastewater and effluent treatment

**UNIT I**

Wastewater Treatment an Overview: Terminology – Regulations – Health and Environment Concerns in wastewater management – Constituents in waste water inorganic – Organic and metallic constituents. Process Analysis and Selection: Components of waste water flows – Analysis of Data – Reactors used in waste water treatment – Mass Balance Analysis – Modeling of ideal and non ideal flow in Reactors – Process Selection

**UNIT II**

Waste disposal methods – Physical, Chemical & Biological; Economical aspects of waste treatment and disposal. Treatment methods of solid wastes: Biological composting, drying and incineration; Design of Solid Waste Management System: Landfill Digester, Vermicomposting Pit.

**UNIT III**

Introduction: Classification and characterization of food industrial wastes from Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry. Chemical Unit Processes: Role of unit processes in waste water treatment chemical coagulation – Chemical precipitation for improved plant performance chemical oxidation – Neutralization – Chemical Storage

**UNIT IV**

Biological Treatment: Overview of biological Treatment – Microbial metabolism – Bacterial growth and energetics – Aerobic biological oxidation – Anaerobic fermentation and oxidation – Trickling filters – Rotating biological contractors – Combined aerobic processes – Activated sludge film packing.

**UNIT V**

Advanced Wastewater Treatment: Technologies used in advanced treatment – Classification of technologies. Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration- Absorption – Ion Exchange – Advanced oxidation process.

**Textbooks:**

1. Herzka A & Booth RG; “Food Industry Wastes: Disposal and Recovery”; Applied Science Pub Ltd. 1981,
2. Fair GM, Geyer JC & Okun DA; “Water & Wastewater Engineering”; John Wiley & Sons, Inc. 1986,

**References:**

1. GE; “Symposium: Processing Agricultural & Municipal Wastes”; AVI. 1973,
2. Inglett Green JH & Kramer A; “Food Processing Waste Management”; AVI. 1979,
3. Rittmann BE & McCarty PL; “Environmental Biotechnology: Principles and Applications”; Mc-Graw-Hill International editions 2001.,
4. Bhattacharyya B C & Banerjee R; “Environmental Biotechnology”; Oxford University Press.
5. Bartlett RE; “Wastewater Treatment; Applied Science” Pub Ltd.
6. G. Tchobanoglous, FI Biston, “Waste water Engineering Treatment and Reuse”: Mc Graw Hill, 2002.
7. “Industrial Waste Water Management Treatment and Disposal by Waste Water” 3<sup>rd</sup> Edition Mc Graw Hill 2008



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A54703) NUMBER THEORY AND ITS APPLICATIONS**  
**(OPEN ELECTIVE-IV)**

**Course Objectives:**

This course enables the students to learn the concepts of number theory and its applications to information security.

**Course Outcomes:**

- Understand number theory and its properties.
- Understand principles on congruences
- Develop the knowledge to apply various applications
- Develop various encryption methods and its applications.

**UNIT I Integers, Greatest common divisors and prime Factorization**

The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations

**UNIT II Congruences**

Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences

**UNIT III Applications of Congruences**

Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem- Pseudo primes- Euler's theorem-Euler's  $\phi$ -function- The sum and number of divisors- Perfect numbers and Mersenne primes.

**UNIT IV Finite fields & Primality, factoring**

Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases.

**UNIT V Cryptology**

Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers-Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.

**Textbooks:**

1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories.
2. A course in Number theory & Cryptography, Neal Koblitz, Springer.

**Reference Books:**

1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers
2. Introduction to Analytic number theory-Tom M Apostol, springer
3. Elementary number theory, VK Krishnan, Universities press

**Online Learning Resources:**

<https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A56703) SMART MATERIALS AND DEVICES**  
**(OPEN ELECTIVE-IV)**

**Course Objectives:**

- To provide exposure to smart materials and their engineering applications.
- To impart knowledge on the basics and phenomenon behind the working of smart materials
- To enlighten the properties exhibited by smart materials
- To educate various techniques used to synthesize and characterize smart materials
- To identify the required smart material for distinct applications/devices

**Course Outcomes:**

- to recognize the need of smart materials
- to understand the working principles of smart materials
- to know different techniques used to synthesize and characterize smart materials
- to exploit the properties of smart materials
- to make use of smart materials for different applications

**UNIT I**

**Introduction:** Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

**UNIT II: Properties of Smart Materials:** Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials

**UNIT III: Synthesis of smart materials:** Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Co-precipitation. Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Sol-gel, spray pyrolysis.

**UNIT IV: Characterization techniques:** X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

**UNIT V: Materials and Devices:** Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials.

Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

**Textbooks:**

1. Encyclopaedia of Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002
2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Chapman and Hall, 1992

**References:**

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, , Elsevier, 2005.
2. Characterization and Application of smart Materials -R. Rai, Synthesis, , Nova Science, 2011.
3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, 2<sup>nd</sup>Edn., John Wiley & Sons, 2003.
4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1. Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, 2002.
5. Optical Metamaterials: Fundamentals and Applications -W. Cai and V. Shalaev, springer,2010.
6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

**NPTEL courses links**

<https://nptel.ac.in/courses/112/104/112104173/>

<https://nptel.ac.in/courses/112/104/112104251/>

[https://nptel.ac.in/content/storage2/courses/112104173/Mod\\_1\\_smart\\_mat Lec](https://nptel.ac.in/content/storage2/courses/112104173/Mod_1_smart_mat Lec)





**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A51703) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OPEN ELECTIVE-IV)**

**Course Objectives:**

- Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

**Course Outcomes:**

- Recognize and acquire green chemistry concepts and apply these ideas to develop respect for the inter connectedness of our world and an ethic of environmental care and sustainability.

**UNIT I: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

**UNIT II: CATALYSIS AND GREEN CHEMISTRY**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

**UNIT III: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water-based coatings, Ionic liquids as catalyst and solvent

**UNIT IV: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES**

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

**UNIT V: GREEN PROCESSES FOR GREEN NANOSCIENCE**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

**Textbooks:**

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4<sup>th</sup> Edition, Oxford University Press, USA

**References:**

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisPerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:Green Nanoscience, wiley-VCH, 2013.



JNTUA B.Tech. R20 Regulations

# HONORS



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)**

**L T P C**  
**3 1 0 4**

**(20A02H01) ELECTRIC VEHICLE TECHNOLOGY & MOBILITY**

**Course Objectives:**

- Understand the fundamental concepts and principles of Electric vehicles
- Apply the concepts to implement battery technology
- Apply the concepts to implement charging technology
- Understand the future trends in EVs

**Course Outcomes:**

The students will be able to:

- Understand the operation principle of electric vehicles, different policy perspectives and innovation in future mobility
- Choose suitable motors and analyse different power electronics in EVs.
- Understand the battery technology.
- Understand future technology for EVs such as smart charging, wireless charging and solar EVs.

**UNIT I INTRODUCTION**

Introduction to electric vehicles: EV versus gasoline vehicles, vehicle dynamics fundamentals, e-drivetrain, Electric motor, Power electronic in electric vehicles, Regenerative braking.

**UNIT II BATTERY TECHNOLOGY**

Battery Technology for EVs: Storage technologies for EV, Battery working principles, Battery losses, Li-ion batteries, Battery pack and battery management system.

**UNIT III CHARGING TECHNOLOGY**

Charging Technology of EVs: AC charging - Type 1,2,3, DC charging, Fast charging and its limitations, Smart charging and applications, Vehicle to X(V2X), X2V technology.

**UNIT IV FUTURE TRENDS IN EVs**

Future trends in e-Vehicles: Wireless charging of EV, On-road charging of EV, Battery swap technology, Solar powered EVs, Charging EVs from renewables.

**UNIT V E-MOBILITY**

E-mobility: electrification challenges, business, connected mobility and autonomous mobility case study in Indian Roadmap Perspective, Policy- EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs.

**Textbooks:**

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
2. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.

**Reference Books:**

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
3. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000
4. Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108106170>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)**

**L T P C**  
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**(20A02H02) BATTERY MANAGEMENT SYSTEMS**

**Course Objectives:**

- Understand the basics of batteries and its parameters
- Apply the concepts to create Battery Management System
- Create Physical and Simulation models for Battery Management System
- Design different Battery Management Systems

**Course Outcomes:**

After completion of this course, student will be able to

- Understand the role of battery management system
- Identify the requirements of Battery Management System
- Interpret the concept associated with battery charging / discharging process
- Analyze various parameters of battery and battery pack
- Design the model of battery pack

**UNIT I INTRODUCTION**

Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging

**UNIT II BATTERY MANAGEMENT SYSTEM**

Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power

**UNIT III BATTERY STATE OF CHARGE AND STATE OF HEALTH ESTIMATION**

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing

**UNIT IV MODELLING AND SIMULATION**

Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs

**UNIT V DESIGN OF BATTERY MANAGEMENT SYSTEMS**

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system

**Textbooks:**

1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.

**Reference Books:**

1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L “Battery Management Systems -Design by Modelling” Philips Research Book Series 2002.
2. Davide Andrea,” Battery Management Systems for Large Lithium-ion Battery Packs” Artech House, 2010
3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.

Online Learning Resources:



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)**

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**(20A02H03) SPECIAL MACHINES FOR ELECTRIC VEHICLES**

**Course Objectives:**

- Understand various Motor Drives useful for EV applications
- Apply the concepts to implement various designs
- Analyze performance of various Motor Drives
- Evaluate the usage of specific drive for EV application

**Course Outcomes:**

After completion of this course, student will be able to

- Understand different special machines for electric vehicle application
- Evaluate the performance of special machines for EVs
- Determine the special machine and their drive requirement for EV application
- Analyze the performance of multiphase machine for EVs

**UNIT I PERMANENT MAGNET (PM) BRUSHLESS MOTOR DRIVES**

Structure of PM Brushless Machines, Principle of PM Brushless Machines Modeling of PM Brushless Machines, Inverters for PM Brushless Motors Motor Control, Design Criteria of PM Brushless Motor Drives for EVs, Design Examples of PM Brushless Motor Drives for EVs, Application, Advantages and Limitations for EVs.

**UNIT II SWITCHED RELUCTANCE MOTOR DRIVE**

Structure of SR Machines, Principle of SR Machines, SR Converters Topologies, SR Motor Control, Design Criteria of SR Motor Drives for EVs, Examples of SR Motor Drives for EVs, Application, Advantages and Limitations for EVs.

**UNIT III STATOR-PM MOTOR DRIVES**

Doubly-Salient PM Motor Drives, Flux-Reversal PM Motor Drives, Flux-Switching PM Motor Drives, Hybrid-Excited PM Motor Drives Flux-Mnemonic PM Motor Drives, Design Criteria of Stator-PM Motor Drives for EVs, Application, Advantages and Limitations for EVs.

**UNIT IV MAGNETIC-GEARED MOTOR DRIVES**

Principle of MG Machines, Modeling of MG Machines, Inverters for MG Motors, MG Motor Control, Design Criteria of MG Motor Drives for EVs, Application, Advantages and Limitations for EVs

**UNIT V ADVANCED MAGNETLESS MOTOR DRIVES AND MULTIPHASE MOTOR DRIVES**

Introduction of Advanced Magnetless technology, Synchronous Reluctance Motor Drives, Doubly-Salient DC Motor Drives, Flux-Switching DC Motor Drives, Design Criteria of Advanced Magnetless Motor Drives for EVs, Application, Advantages and Limitations for EVs.

Multiphase Induction Motor drives – principle, operation and control, Multiphase PMSM machine – principle, operation and control, Fault tolerant operation of multiphase drives

**Textbooks:**

1. Mehrdad Ehsani, Yimin Gao, Sebatién Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
2. James Larminie and John Lory, “Electric Vehicle Technology – Explained”, John Wiley & Sons Ltd, 2003.



**Reference Books:**

1. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth – Heinemann, 2002.
2. Ronald K Jurgen, “Electric and Hybrid – Electric Vehicles”, SAE, 2002.
3. Ron Hodgkinson and John Fenton, “Light Weight Electric/Hybrid Vehicle Design”, Butterworth – Heinemann, 2001.
4. Iqbal Husain, “Electric and Hybrid Vehicles- Design Fundamentals” CRC Press, 2011.

Online Learning Resources:



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)**

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**(20A02H04) GRID INTERFACE OF ELECTRIC VEHICLES**

**Course Objectives:**

- Understand the Grid interfacing concept of EVs
- Analyze the EV impact on grid
- Design new types of charging facilities for EVs
- Evaluate the role of EV as ancillary service

**Course Outcomes:**

After completion of this course, student will be able to

- Understand the role of PEV as source in smart grid
- Analyze Impact of EV on smart grid
- Analyze the performance of EV parking lot on smart distribution system
- Evaluate the role of EV as ancillary service

**UNIT I INTRODUCTION TO SMART GRID AND PEV**

Introduction to smart grid and microgrid, Impact of PEVs on Distributed Energy Resources in the Smart Grid, V2G Technology and PEVs Charging Infrastructures

**UNIT II IMPACT OF EV AND V2G ON THE SMART GRID AND RENEWABLE ENERGY SYSTEMS**

Types of Electric Vehicles, Motor Vehicle Ownership and EV Migration, Impact of Estimated EVs on Electrical Network, Impact on Drivers and the Smart Grid, Standardization and Plug-and-Play

**UNIT III POWER CONVERSION TECHNOLOGY IN THE SMART GRID AND EV**

Impacts of EV Penetration on Grid Power Profile, Requirements of Its Control and Monitoring, Hybrid EV Powertrain Architectures, Control, Monitoring and Management Strategies of EV, V2G Communication System, System model of EV, Case study of three phase fault and its impact

**UNIT IV PLANNING, CONTROL AND MANAGEMENT STRATEGIES FOR PARKING LOTS FOR PEVs**

Introduction to PEV Charging Facility, Long-Term Planning for PEV Parking Lots, Control and Management of PEV Parking Lots - stages of implementation

**UNIT V PEV AS ANCILLARY SERVICE IN SMART GRID**

Introduction to Ancillary Services, PEV Charger Optimization, PEV as ancillary source, Control Strategies for PEVs to Follow the Individual Operation Values, Systems and Control Algorithm for Smart PEV Chargers, Avoiding the Harmonic Propagation Within the Grid, Case study

**Textbooks:**

1. Lu, J. and Hossain, J., Vehicle-to-grid: linking electric vehicles to the smart grid. Institution of Engineering and Technology, 2015.
2. Rajakaruna, S., Shahnian, F. and Ghosh, A. eds., Plug In Electric Vehicles in Smart Grids: Integration Techniques. Springer, 2014.

**Reference Books:**

1. Rajakaruna, S., Shahnian, F. and Ghosh, A. eds., Plug in electric vehicles in smart grids: charging strategies. Springer, 2014.
2. Salman, S.K., Introduction to the Smart Grid: Concepts, Technologies and Evolution (Vol. 94). IET., 2017.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
(Established by Govt. of A.P., ACT No.30 of 2008)  
**ANANTHAPURAMU – 515 002 (A.P) INDIA**

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## **B. Tech (Regular-Full time)**

(Effective for the students admitted into I year from the Academic  
Year **2023-24** onwards)

**ELECTRICAL AND ELECTRONICS ENGINEERING**  
**I YEAR COURSE STRUCTURE AND SYLLABUS**



**B.TECH. –EEE- COURSE STRUCTURE & SYLLABUS – R23**  
**(Applicable from the academic year 2023-24 onwards)**

**INDUCTION PROGRAMME**

<b>S.No.</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P-C</b>
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

**B.Tech. – I Year I Semester**

S.No.	Course code	Title	L	T	P	Credits
1	23A52201T	Communicative English	2	0	0	2
2	23A51202T	Chemistry	3	0	0	3
3	23A54101	Linear Algebra & Calculus	3	0	0	3
4	23A01201T	Basic Civil & Mechanical Engineering	3	0	0	3
5	23A05101T	Introduction to Programming	3	0	0	3
6	23A52201P	Communicative English Lab	0	0	2	1
7	23A51202P	Chemistry Lab	0	0	2	1
8	23A03201	Engineering Workshop	0	0	3	1.5
9	23A05101P	Computer Programming Lab	0	0	3	1.5
10	23A99201	Health and wellness, Yoga and Sports	-	-	1	0.5
<b>Total</b>			<b>14</b>	<b>0</b>	<b>11</b>	<b>19.5</b>

**B.Tech. – I Year II Semester**

S.No.	Course code	Title	L/D	T	P	Credits
1	23A56101T	Engineering Physics	3	0	0	3
2	23A54201	Differential Equations & Vector Calculus	3	0	0	3
3	23A02101T	Basic Electrical & Electronics Engineering	3	0	0	3
4	23A03101T	Engineering Graphics	1	0	4	3
5	23A05102	IT Workshop	0	0	2	1
6	23A02201T	Electrical Circuit Analysis-I	3	0	0	3
7	23A56101P	Engineering Physics Lab	0	0	2	1
8	23A02101P	Electrical & Electronics Engineering Workshop	0	0	3	1.5
9	23A02201P	Electrical Circuit Analysis-I Lab	0	0	3	1.5
10	23A99101	NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
<b>Total</b>			<b>13</b>	<b>00</b>	<b>15</b>	<b>20.5</b>

## I Year B.Tech. EEE – I Semester

L	T	P	C
2	0	0	2

**(23A52201T) COMMUNICATIVE ENGLISH**

(Common to All Branches of Engineering)

**Course Objectives:**

The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

**Course Outcomes:**

**CO1:** Understand the context, topic, and pieces of specific information from social or Transactional dialogues.

**CO2:** Apply grammatical structures to formulate sentences and correct word forms.

**CO3:** Analyze discourse markers to speak clearly on a specific topic in informal discussions.

**CO4:** Evaluate reading / listening text and to write summaries based on global – Comprehension of these texts.

**CO5:** Create a coherent paragraph, essay, and resume.

**UNIT I****Lesson: HUMAN VALUES: Gift of Magi (Short Story)**

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

**Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.

**Writing:** Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

**Grammar:** Parts of Speech, Basic Sentence Structures-forming questions

**Vocabulary:** Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

**UNIT II****Lesson: NATURE: The Brook by Alfred Tennyson (Poem)**

**Listening:** Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

**Speaking:** Discussion in pairs /small groups on specific topics followed by short structure talks.

**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Writing:** Structure of a paragraph - Paragraph writing (specific topics)

**Grammar:** Cohesive devices -linkers, use of articles and zero article; prepositions.

**Vocabulary:** Homonyms, Homophones, Homographs.

**UNIT III****Lesson: BIOGRAPHY: Elon Musk**

- Listening:** Listening for global comprehension and summarizing what is listened to.
- Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed
- Reading:** Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
- Writing:** Summarizing, Note-making, paraphrasing
- Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations
- Vocabulary:** Compound words, Collocations

**UNIT IV****Lesson: INSPIRATION: The Toys of Peace by Saki**

- Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
- Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
- Reading:** Studying the use of graphic elements in text to convey information, reveal trends /patterns/ relationships, communicate processes or display complicated data.
- Writing:** Letter Writing: Official Letters, Resumes
- Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice
- Vocabulary:** Words often confused, Jargons

**UNIT V****Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)**

- Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
- Speaking:** Formal oral presentations on topics from academic contexts
- Reading:** Reading comprehension.
- Writing:** Writing structured essays on specific topics.
- Grammar:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
- Vocabulary:** Technical Jargons

**Textbooks:**

1. Pathfinder: Communicative English for Undergraduate Students, 1<sup>st</sup> Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

**Reference Books:**

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.

4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

**Web Resources:**

**GRAMMAR:**

1. [www.bbc.co.uk/learningenglish](http://www.bbc.co.uk/learningenglish)
2. <https://dictionary.cambridge.org/grammar/british-grammar/>
3. [www.eslpod.com/index.html](http://www.eslpod.com/index.html)
4. <https://www.learngrammar.net/>
5. <https://english4today.com/english-grammar-online-with-quizzes/>
6. <https://www.talkenglish.com/grammar/grammar.aspx>

**VOCABULARY**

1. <https://www.youtube.com/c/DailyVideoVocabulary/videos>
2. [https://www.youtube.com/channel/UC4cmBAit8i\\_NJZE8qK8sfpA](https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA)

**I Year B.Tech. EEE – I Semester**

L	T	P	C
3	0	0	3

**(23A51202T) CHEMISTRY**

(Common to EEE, ECE, CSE, IT) &amp; allied branches)

**Course Objectives:**

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electro chemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

**Course Outcomes:** At the end of the course, the students will be able to:**CO1:** Compare the materials of construction for battery and electro chemical sensors.**CO2:** Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.**CO3:** Explain the principles of spectrometry, scinseparation of solid and liquid mixtures.**CO4:** ApplytheprincipleofBanddiagramsintheapplicationofconductorsandsemiconductors.**CO5:** Summarize the concepts of Instrumental methods.**UNIT I Structure and Bonding Models:**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of  $\Psi$  and  $\Psi^2$ , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O<sub>2</sub> and CO, etc.  $\pi$ -molecular orbital's of butadiene and benzene, calculation of bond order.

**UNIT II Modern Engineering materials**

Semiconductors – Introduction, basic concept, application

Super conductors-Introduction basic concept, applications.

Super capacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

**UNIT III Electrochemistry and Applications**

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conduct metric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

**UNIT IV Polymer Chemistry**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

**UNIT V Instrumental Methods and Applications**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

**Textbooks:**

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Juliode Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

**Reference Books:**

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> Edition, Wiley Publications, Feb. 2008
3. Textbook of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition

## I Year B.Tech. EEE – I Semester

L	T	P	C
3	0	0	3

**(23A54101) LINEAR ALGEBRA & CALCULUS**  
(Common to All Branches of Engineering)

**Course Objectives:**

- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

**Course Outcomes:** At the end of the course, the student will be able to

**CO1:** Develop and use of matrix algebra techniques that are needed by engineers for the practical applications.

**CO2:** Utilize mean value theorems to real life problems.

**CO3:** Familiarize with functions of several variables which is useful in optimization.

**CO4:** Learn important tools of calculus in higher dimensions.

**CO5:** Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

**UNIT I      Matrices**

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

**UNIT II      Eigen values, Eigenvectors and Orthogonal Transformation**

Eigen values, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

**UNIT III      Calculus**

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

**UNIT IV      Partial differentiation and Applications (Multi variable calculus)**

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

**UNIT V      Multiple Integrals (Multi variable Calculus)**



Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**Textbooks:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers, 2017, 44<sup>th</sup> Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10<sup>th</sup> Edition.

**Reference Books:**

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14<sup>th</sup> Edition.
2. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Alpha Science International Ltd., 2021 5<sup>th</sup> Edition (9<sup>th</sup> reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5<sup>th</sup> Edition.
4. Advanced Engineering Mathematics, Michael Greenberg, Pearson publishers, 9<sup>th</sup> edition
5. Higher Engineering Mathematics, H. K. Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

**I Year B.Tech. EEE – I Semester**

L	T	P	C
3	0	0	3

**(23A01201T) BASIC CIVIL AND MECHANICAL ENGINEERING**  
**(Common to All branches of Engineering)**

**Course Objectives:**

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

**Course Outcomes:** On completion of the course, the student should be able to:

- CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
- CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
- CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
- CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
- CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

**UNIT I**

**Basics of Civil Engineering:** Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

**UNIT II**

**Surveying:** Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

**UNIT III**

**Transportation Engineering** Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

**Water Resources and Environmental Engineering:** Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

**Textbooks:**

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

**Reference Books:**

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38<sup>th</sup> Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10<sup>th</sup> Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

**PART B: BASIC MECHANICAL ENGINEERING**

**Course Objectives:** The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

**Course Outcomes:** On completion of the course, the student should be able to

CO1: Understand the different manufacturing processes.

CO2: Explain the basics of thermal engineering and its applications.

CO3: Describe the working of different mechanical power transmission systems and power plants.

CO4: Describe the basics of robotics and its applications.

**UNIT I**

**Introduction to Mechanical Engineering:** Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Engineering Materials** - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

**UNIT II**

**Manufacturing Processes:** Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

**Thermal Engineering** – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

### UNIT III

**Power plants** – working principle of Steam, Diesel, Hydro, Nuclear power plants.

**Mechanical Power Transmission** - Belt Drives, Chain, Ropedrives, Gear Drives and their applications.

**Introduction to Robotics** - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

#### Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

#### Reference Books:

1. AppuuKuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

## I Year B.Tech. EEE– I Semester

L	T	P	C
3	0	0	3

**(23A05101T) INTRODUCTION TO PROGRAMMING**

(Common to All branches of Engineering)

**Course Objectives:**

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

**Course Outcomes:** A student after completion of the course will be able to

CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.

CO2: Analyse a problem and develop an algorithm to solve it.

CO3: Implement various algorithms using the C programming language.

CO4: Understand more advanced features of C language.

CO5: Develop problem-solving skills and the ability to debug and optimize the code.

**UNIT I Introduction to Programming and Problem Solving**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

**UNIT II Control Structures**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

**UNIT III Arrays and Strings**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

**UNIT IV Pointers & User Defined Data types**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

**UNIT V Functions & File Handling**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

**Note:** The syllabus is designed with C Language as the fundamental language of implementation.

**Textbooks:**

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

**Reference Books:**

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2<sup>nd</sup> edition
3. C Programming, A ProblemSolving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3<sup>rd</sup> edition

**I Year B.Tech. EEE– I Semester**

L	T	P	C
0	0	2	1

**(23A52201P) COMMUNICATIVE ENGLISH LAB**

(Common to All Branches of Engineering)

**Course Objectives:**

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

**Course Outcomes:**

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.

CO5: Create effective Course Objectives:

**List of Topics:**

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

**Suggested Software:**

- Walden Infotech
- Young India Films

**Reference Books:**

1. Raman Meenakshi, Sangeeta- Sharma. *Technical Communication*. Oxford Press.2018.
2. TaylorGrant:*EnglishConversationPractice*,TataMcGraw-HillEducationIndia,2016
3. Hewing's, Martin. *Cambridge Academic English(B2)*.CUP,2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2<sup>nd</sup>Ed)Kindle, 2013

**Web Resources:**

**Spoken English:**

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishmedialab.com](http://www.englishmedialab.com)
3. [www.englishinteractive.net](http://www.englishinteractive.net)
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. [https://www.youtube.com/c/mmmEnglish\\_Emma/featured](https://www.youtube.com/c/mmmEnglish_Emma/featured)
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. [https://www.youtube.com/channel/UCV1h\\_cBE0Drdx19qkTM0WNw](https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw)

**Voice & Accent:**

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. [https://www.youtube.com/channel/UC\\_OskgZBoS4dAnVUgJVexc](https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc)
4. [https://www.youtube.com/channel/UCNfm92h83W2i2ije5Xwp\\_IA](https://www.youtube.com/channel/UCNfm92h83W2i2ije5Xwp_IA)



**I Year B.Tech. EEE – I Semester**

L	T	P	C
0	0	2	1

**(23A51202P) CHEMISTRY LAB**

(Common to EEE, ECE, CSE, IT &amp; allied branches)

**Course Objectives:**

- Verify the fundamental concepts with experiments.

**Course Outcomes:** At the end of the course, the students will be able to

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer Bakelite materials.

CO3: Measure the strength of an acid present in secondary batteries.

CO4: Analyse the IR spectra of some organic compounds.

CO5: Calculate strength of acid in Pb-Acid battery.

**List of Experiments:**

1. Measurement of  $10Dq$  by spectro photometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometer - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

**Reference:**

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

## I Year B.Tech. EEE – I Semester

L	T	P	C
0	0	3	1.5

**(23A03201) ENGINEERING WORKSHOP****(Common to All branches of Engineering)****Course Objectives:**

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

**Course Outcomes:**

- CO1: Identify workshop tools and their operational capabilities.  
 CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.  
 CO3: Apply fitting operations in various applications.  
 CO4: Apply basic electrical engineering knowledge for House Wiring Practice

**SYLLABUS**

- Demonstration:** Safety practices and precautions to be observed in workshop.
- Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
  - Half – Lap joint
  - Mortise and Ten on joint
  - Corner Dovetail joint or Bridle joint
- Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
  - Tapered tray
  - Conical funnel
  - Elbow pipe
  - Brazing
- Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
  - V-fit
  - Dovetail fit
  - Semi-circular fit
  - Bicycle tire puncture and change of two-wheeler tyre
- Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.
  - Parallel and series
  - Two-way switch
  - God own lighting
  - Tube light
  - Three phase motor
  - Soldering of wires
- Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
- Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
- Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

**Textbooks:**

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

**Reference Books:**

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

## I Year B.Tech. EEE– I Semester

L	T	P	C
0	0	3	1.5

**(23A05101P) COMPUTER PROGRAMMING LAB**  
(Common to All branches of Engineering)

**Course Objectives:**

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

**Course Outcomes:**

CO1: Read, understand, and trace the execution of programs written in C language.

CO2: Select the right control structure for solving the problem.

CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.

CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

**UNIT I****WEEK 1**

**Objective:** Getting familiar with the programming environment on the computer and writing the first program.

**Suggested Experiments/Activities:**

**Tutorial 1:** Problem-solving using Computers.

**Lab1:** Familiarization with programming environment

- i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- ii) Exposure to Turbo C, gcc
- iii) Writing simple programs using printf(), scanf()

**WEEK 2**

**Objective:** Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

**Suggested Experiments /Activities:**

**Tutorial 2:** Problem-solving using Algorithms and Flow charts.

**Lab 1:** Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

- i) Sum and average of 3 numbers
- ii) Conversion of Fahrenheit to Celsius and vice versa
- iii) Simple interest calculation

**WEEK 3**

**Objective:** Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

**Suggested Experiments/Activities:**

**Tutorial 3:** Variable types and type conversions:

**Lab 3:** Simple computational problems using arithmetic expressions.

- i) Finding the square root of a given number
- ii) Finding compound interest
- iii) Area of a triangle using heron's formulae
- iv) Distance travelled by an object

**UNIT II****WEEK 4**

**Objective:** Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

**Suggested Experiments/Activities:**

**Tutorial4:** Operators and the precedence and as associativity:

**Lab4:** Simple computational problems using the operator' precedence and associativity

- i) Evaluate the following expressions.
  - a.  $A+B*C+(D*E) + F*G$
  - b.  $A/B*C-B+A*D/3$
  - c.  $A+++B---A$
  - d.  $J= (i++) + (++i)$
- ii) Find the maximum of three numbers using conditional operator
- iii) Take marks of 5 subjects in integers, and find the total, average in float

**WEEK 5**

**Objective:** Explore the full scope of different variants of “if construct” namely if-else, null-else, if-else if\*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for “if construct”.

**Suggested Experiments/Activities:**

**Tutorial 5:** Branching and logical expressions:

**Lab 5:** Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Write a C program to simulate a calculator using switch case.
- v) Write a C program to find the given year is a leap year or not.

**WEEK 6**

**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

**Suggested Experiments/Activities:****Tutorial 6:** Loops, while and for loops**Lab 6:** Iterative problems e.g., the sum of series

- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not.
- iii) Compute sine and cos series
- iv) Checking a number palindrome
- v) Construct a pyramid of numbers.

**UNIT III****WEEK 7:**

**Objective:** Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

**Suggested Experiments/Activities:****Tutorial 7:** 1 D Arrays: searching.**Lab 7:** 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array.
- iii) The reverse of a 1D integer array
- iv) Find 2's complement of the given binary number.
- v) Eliminate duplicate elements in an array.

**WEEK 8:**

**Objective:** Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

**Suggested Experiments/Activities:****Tutorial 8:** 2 D arrays, sorting and Strings.**Lab 8:** Matrix problems, String operations, Bubble sort

- i) Addition of two matrices
- ii) Multiplication two matrices
- iii) Sort array elements using bubble sort
- iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

**UNIT IV****WEEK9:**

**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

**Suggested Experiments/Activities:**

**Tutorial 9:** Pointers, structures and dynamic memory allocation

**Lab 9:** Pointers and structures, memory dereference.

- i) Write a C program to find the sum of a 1D array using malloc()
- ii) Write a C program to find the total, average of n students using structures
- iii) Enter n students data using calloc() and display failed students list
- iv) Read student name and marks from the command line and display the student details along with the total.
- v) Write a C program to implement realloc()

**WEEK 10:**

**Objective:** Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

**Suggested Experiments/Activities:**

**Tutorial 10:** Bitfields, Self-Referential Structures, Linked lists

**Lab10 :** Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

- i) Create and display a singly linked list using self-referential structure.
- ii) Demonstrate the differences between structures and unions using a C program.
- iii) Write a C program to shift/rotate using bitfields.
- iv) Write a C program to copy one structure variable to another structure of the same type.

**UNIT V**

**WEEK 11:**

**Objective:** Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

**Suggested Experiments/Activities:**

**Tutorial 11:** Functions, call by value, scope and extent,

**Lab 11:** Simple functions using call by value, solving differential equations using Eulers theorem.

- i) Write a C function to calculate NCR value.
- ii) Write a C function to find the length of a string.
- iii) Write a C function to transpose of a matrix.
- iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

**WEEK 12:**

**Objective:** Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

**Suggested Experiments/Activities:**

**Tutorial 12:** Recursion, the structure of recursive calls

**Lab 12:** Recursive functions

- i) Write a recursive function to generate Fibonacci series.
- ii) Write a recursive function to find the lcm of two numbers.

- iii) Write a recursive function to find the factorial of a number.
- iv) Write a C Program to implement Ackermann function using recursion.
- v) Write a recursive function to find the sum of series.

**WEEK 13:**

**Objective:** Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

**Suggested Experiments/Activities:**

**Tutorial 13:** Call by reference, dangling pointers

**Lab 13:** Simple functions using Call by reference, Dangling pointers.

- i) Write a C program to swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem using a C program.
- iii) Write a C program to copy one string into another using pointer.
- iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**WEEK14:**

**Objective:** To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

**Suggested Experiments/Activities:**

**Tutorial 14:** File handling

**Lab 14:** File operations

- i) Write a C program to write and read text into a file.
- ii) Write a C program to write and read text into a binary file using fread() and fwrite()
- iii) Copy the contents of one file to another file.
- iv) Write a C program to merge two files into the third file using command-line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Write a C program to print last n characters of a given file.

**Textbooks:**

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

**Reference Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE



**I Year B.Tech. EEE– I Semester**

L	T	P	C
0	0	1	0.5

**(23A99201) HEALTH AND WELLNESS, YOGA AND SPORTS****(Common to All branches of Engineering)****Course Objectives:**

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

**Course Outcomes:** After completion of the course the student will be able to

- CO1:** Understand the importance of yoga and sports for Physical fitness and sound health.
- CO2:** Demonstrate an understanding of health-related fitness components.
- CO3:** Compare and contrast various activities that help enhance their health.
- CO4:** Assess current personal fitness levels.
- CO5:** Develop Positive Personality

**UNIT I**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

**Activities:**

- i) Organizing health awareness programmes in community
- ii) Preparation of health profile
- iii) Preparation of chart for balance diet for all age groups

**UNIT II**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

**Activities:**

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

**UNIT III**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

**Activities:**

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball,

Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.

Practicing general and specific warm up, aerobics

- ii) Practicing cardio respiratory fitness, treadmill, run test, 9 min walk, skipping and running.

**Reference Books:**

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

**General Guidelines:**

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.

A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

**I Year B.Tech. EEE – II Semester**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**(23A56101) ENGINEERING PHYSICS**

(Common for all branches of Engineering)

**Course Objectives:**

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

**Course Outcomes:**

- CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.  
 CO2: Familiarize with the basics of crystals and their structures.  
 CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.  
 CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials.  
 CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.  
 CO6: Identify the type of semiconductor using Hall effect.

**UNIT I Wave Optics**

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

**UNIT II Crystallography and X-ray diffraction**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

**UNIT III Dielectric and Magnetic Materials**

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and

Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

#### **UNIT IV Quantum Mechanics and Free electron Theory**

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

#### **UNIT V Semiconductors**

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

#### **Textbooks:**

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

#### **Reference Books:**

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics” - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

**Web Resources:**<https://www.loc.gov/rr/scitech/selected-internet/physics.html>

**I Year B.Tech. EEE- II Semester**

L	T	P	C
3	0	0	3

**(23A54201) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**  
**(Common to All Branches of Engineering)**

**Course Objectives:**

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

**Course Outcomes:** At the end of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.

CO2: Identify solution methods for partial differential equations that model physical processes.

CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO4: Estimate the work done against a field, circulation and flux using vector calculus.

**UNIT I                      Differential equations of first order and first degree**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

**UNIT II                    Linear differential equations of higher order (Constant Coefficients)**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

**UNIT III                  Partial Differential Equations**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

**UNIT IV                    Vector differentiation**

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions- Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

**UNIT V      Vector integration**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

**Textbooks:**

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

**Reference Books:**

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

**I Year B.Tech. EEE-II Semester**

L	T	P	C
3	0	0	3

**(23A02101T) BASIC ELECTRICAL & ELECTRONICS ENGINEERING**  
(Common to All branches of Engineering)

**Course Objectives**

To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

**Course Outcomes:** After the completion of the course students will be able to

**Course Outcomes:**

**CO1:** Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.

**CO2:** Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

**CO3:** Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

**CO4:** Analyze different electrical circuits, performance of machines and measuring instruments.

**CO5:** Evaluate different circuit configurations, Machine performance and Power systems operation.

**PART A: BASIC ELECTRICAL ENGINEERING****UNIT I DC & AC Circuits**

**DC Circuits:** Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

**AC Circuits:** A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

**UNIT II Machines and Measuring Instruments**

**Machines:** Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

**Measuring Instruments:** Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

### **UNIT III Energy Resources, Electricity Bill & Safety Measures**

**Energy Resources:** Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

**Electricity bill:** Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of “unit” used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

**Equipment Safety Measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

#### **Textbooks:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

#### **Reference Books:**

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Person Publications, 2018, Second Edition.

#### **Web Resources:**

1. <https://nptel.ac.in/courses/108105053>
2. <https://nptel.ac.in/courses/108108076>

## **PART B: BASIC ELECTRONICS ENGINEERING**

### **Course Objectives:**

This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

### **Course Outcomes:**

CO1: Apply the concept of science and mathematics to understand the working of diodes, transistors, and their applications.

CO2: Explain the characteristics of diodes and transistors.

CO3: Familiarize with the number systems, codes, Boolean algebra and logic gates.



C04: Understand the working mechanism of different combinational, sequential circuits and their role in the digital systems.

### **UNIT I SEMICONDUCTOR DEVICES**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

### **UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION**

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

### **UNIT III DIGITAL ELECTRONICS**

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

#### **Textbooks:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4<sup>th</sup> Edition, Tata Mc Graw Hill, 2009

#### **Reference Books:**

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

**I Year B.Tech. EEE-II Semester**

L	T	P	C
1	0	4	3

**(23A03101T) ENGINEERING GRAPHICS**  
**(Common to All branches of Engineering)**

**Course Objectives:**

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

**Course Outcomes:**

CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.

CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.

CO3: Understand and draw projection of solids in various positions in first quadrant.

CO4: Explain principles behind development of surfaces.

CO5: Prepare isometric and perspective sections of simple solids.

**UNIT I**

**Introduction:** Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

**Curves:** construction of ellipse, parabola and hyperbola by general, Cycloids, Involute, Normal and tangent to Curves.

**Scales:** Plain scales, diagonal scales and vernier scales.

**UNIT II**

**Orthographic Projections:** Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

**Projections of Straight Lines:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

**Projections of Planes:** regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

### UNIT III

**Projections of Solids:** Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

### UNIT IV

**Sections of Solids:** Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

**Development of Surfaces:** Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

### UNIT V

**Conversion of Views:** Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

**Computer graphics:** Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

### Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

### Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B. Shah and B.C. Rana, Pearson Education Inc, 2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

**I Year B.Tech. EEE-II Semester**

L	T	P	C
0	0	2	1

**(2305102) IT WORKSHOP**  
(Common to all branches of Engineering)

**Course Objectives:**

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

**Course Outcomes:**

CO1: Perform Hardware troubleshooting.

CO2: Understand Hardware components and inter dependencies.

CO3: Safeguard computer systems from viruses/worms.

CO4: Document/ Presentation preparation.

CO5: Perform calculations using spreadsheets.

**PC Hardware & Software Installation**

**Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

**Task 3:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

**Task 4:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

**Task 5:** Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

**Internet & World Wide Web**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting.

Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

**Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

**Task 3:** Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

### **LaTeX and WORD**

**Task 1 – Word Orientation:** The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

**Task 2:** Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

**Task 3:** Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

### **EXCEL**

**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

**Task 2:** Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

### **LOOKUP/VLOOKUP**

**Task 3:** Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

### **POWER POINT**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

**Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

**Task 3:** Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

### **AI TOOLS – ChatGPT**

**Task 1:** Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

**Task 2:** Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

**Task 3:** Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

### **Reference Books:**

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2<sup>nd</sup> edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfinson and Ken Quamme. – CISCO Press, Pearson Education, 3<sup>rd</sup> edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3<sup>rd</sup> edition

## I Year B.Tech. EEE–II Semester

L	T	P	C
3	0	0	3

**(23A02201T) ELECTRICAL CIRCUIT ANALYSIS -I**  
(EEE & allied branches)

**Course Objectives:**

To develop an understanding of the fundamental laws, elements of electrical circuits and to apply circuit analysis to DC and AC circuits.

**Course Outcomes:**

**CO1:** Remembering the basic electrical elements and different fundamental laws.

**CO2:** Understand the network reduction techniques, transformations, concept of self-inductance and mutual inductance, phasor diagrams, resonance and network theorems.

**CO3:** Apply the concepts to obtain various mathematical and graphical representations.

**CO4:** Analyse nodal and mesh networks, series and parallel circuits, steady state response, different circuit topologies (with R, L and C components).

**CO5:** Evaluation of Network theorems, electrical, magnetic and single-phase circuits.

**UNIT I INTRODUCTION TO ELECTRICAL CIRCUITS**

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources, node and mesh analysis.

**UNIT II MAGNETIC CIRCUITS**

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

**UNIT III SINGLE PHASE CIRCUITS**

Characteristics of periodic functions, Average value, R.M.S. value, form factor, representation of a sine function, concept of phasor, phasor diagrams, node and mesh analysis. Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit.

**UNIT IV RESONANCE AND LOCUS DIAGRAMS**

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L and C variables.

### **UNIT V NETWORK THEOREMS (DC & AC EXCITATIONS)**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem

#### **Textbooks:**

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

#### **Reference Books:**

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.
3. Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.
4. Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023, Fourteenth Edition.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

#### **Web Resources:**

1. [https://onlinecourses.nptel.ac.in/noc23\\_ee81/preview](https://onlinecourses.nptel.ac.in/noc23_ee81/preview)
2. <https://nptel.ac.in/courses/108104139>
3. <https://nptel.ac.in/courses/108106172>
4. <https://nptel.ac.in/courses/117106108>



I Year B.Tech. EEE–II Semester

L	T	P	C
0	0	2	1

**(23A56101P) ENGINEERING PHYSICS LAB**  
(Common to All Branches of Engineering)

**Course Objectives:**

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

**Course Outcomes:** The students will be able to

CO1: Operate optical instruments like travelling microscope and spectrometer.

CO2: Estimate the wavelengths of different colours using diffraction grating.

CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.

CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.

CO5: Calculate the band gap of a given semiconductor.

CO6: Identify the type of semiconductor using Hall effect.

**List of Experiments:**

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.

18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

**Note:** Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

**References:**

- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

**Web Resources**

- [www.vlab.co.in](http://www.vlab.co.in)
- <https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype>

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**I Year B.Tech. EEE –II Semester**

L	T	P	C
0	0	3	1.5

**(23A02101P) ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP**  
(Common to All branches of Engineering)

**Course Objectives:**

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

**Course Outcomes:**

**CO1:** Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.

**CO2:** Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.

**CO3:** Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.

**CO4:** Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.

**CO5:** Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

**Activities:**

- Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
  - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
- Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
  - Provide some exercises so that measuring instruments are learned to be used by the students.
- Components:
  - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
  - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

**PART A: ELECTRICAL ENGINEERING LAB****List of experiments:**

- Verification of KCL and KVL

2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

**Reference Books:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

**Note:** Minimum Six Experiments to be performed.

**PART B: ELECTRONICS ENGINEERING LAB****Course Objectives:**

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

**Course Outcomes:** At the end of the course, the student will be able to

- CO1: Identify & testing of various electronic components.  
CO2: Understand the usage of electronic measuring instruments.  
CO3: Plot and discuss the characteristics of various electron devices.  
CO4: Explain the operation of a digital circuit.

**List of Experiments:**

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

**References:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4<sup>th</sup> Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

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**I Year B.Tech. EEE- II Semester**

L	T	P	C
0	0	3	1.5

**(23A02201P) ELECTRICAL CIRCUITS LAB**  
(EEE & allied branches)

**Course Objectives:**

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics. It also gives practical exposure to the usage of different circuits with different conditions.

**Course Outcomes:**

**CO1:** Understand the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams.

**CO2:** Apply various theorems to compare practical results obtained with theoretical calculations.

**CO3:** Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil.

**CO4:** Analyse different circuit characteristics with the help of fundamental laws and various configurations.

**CO5:** Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.

**List of Experiments:**

1. Verification of Kirchhoff's circuit laws.
2. Verification of node and mesh analysis.
3. Verification of network reduction techniques.
4. Determination of cold and hot resistance of an electric lamp
5. Determination of Parameters of a choke coil.
6. Determination of self, mutual inductances, and coefficient of coupling
7. Series and parallel resonance
8. Locus diagrams of R-L (L Variable) and R-C (C Variable) series circuits
9. Verification of Superposition theorem
10. Verification of Thevenin's and Norton's Theorems
11. Verification of Maximum power transfer theorem
12. Verification of Compensation theorem
13. Verification of Reciprocity and Millman's Theorems

**Reference Books:**

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

**I Year B.Tech. EEE – II Semester**

L	T	P	C
0	0	1	0.5

**(23A99101) NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE**  
(Common to All branches of Engineering)

**Course Objectives:**

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

**Course Outcomes:** After completion of the course the students will be able to

**CO1:** Understand the importance of discipline, character and service motto.

**CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques.

**CO3:** Explore human relationships by analyzing social problems.

**CO4:** Determine to extend their help for the fellow beings and downtrodden people.

**CO5:** Develop leadership skills and civic responsibilities.

**UNIT I Orientation**

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

**Activities:**

- i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
- iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
- iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

**UNIT II Nature & Care****Activities:**

- i) Best out of waste competition.
- ii) Poster and signs making competition to spread environmental awareness.
- iii) Recycling and environmental pollution article writing competition.
- iv) Organising Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

**UNIT III Community Service****Activities:**

- i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media-authorities-experts-etc.
- ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
- iii) Conducting consumer Awareness. Explaining various legal provisions etc.
- iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.

**Reference Books:**

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021 ( ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps – Standing Instructions Vol I & II*, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., “Introduction to Environmental Engineering”, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. “Introduction to Environmental Engineering and Science”, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

**General Guidelines:**

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.



**B.Tech. II Year-I Semester**

<b>S.No.</b>	<b>Category</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	BS	Complex Variables & Numerical Methods	3	0	0	3
2	HSMC	Universal Human Values- Understanding Harmony	2	1	0	3
3	Engineering Science	Electromagnetic Field Theory	3	0	0	3
4	Professional Core	Electrical Circuit Analysis-II	3	0	0	3
5	Professional Core	DC Machines & Transformers	3	0	0	3
6	Professional Core	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5
7	Professional Core	DC Machines & Transformers Lab	0	0	3	1.5
8	Skill Enhancement Course	Data Structures	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
<b>Total</b>			<b>15</b>	<b>2</b>	<b>10</b>	<b>20</b>

**B.Tech. II Year-II Semester**

<b>S.No.</b>	<b>Category</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	Management Elective- I	Managerial Economics &	2	0	0	2

		Financial Analysis / Business Environment / Organizational Behaviour				
2	Engineering Science/Basic Science	Analog Circuits	3	0	0	3
3	Professional Core	Power Systems-I	3	0	0	3
4	Professional Core	Induction and Synchronous Machines	3	0	0	3
5	Professional Core	Control Systems	3	0	0	3
6	Professional Core	Induction and Synchronous Machines Lab	0	0	3	1.5
7	Professional Core	Control Systems Lab	0	0	3	1.5
8	Skill Enhancement course	Python Programming	0	1	2	2
9	Engineering	Design Thinking	1	0	2	2

	Science	& Innovation				
<b>Total</b>			15	1	10	21
<p align="center"><b>Mandatory Community Service Project of 08 weeks duration during summer vacation</b></p>						

**B.Tech. III Year-I Semester**

<b>S.No.</b>	<b>Category</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	Professional Core	Power Electronics	3	0	0	3
2	Professional Core	Digital Circuits	3	0	0	3
3	Professional Core	Power Systems-II	3	0	0	3
4	Professional Elective-I	1. Signals and Systems 2. Computer Architecture and Organization 3. Communication systems	3	0	0	3
5	Open Elective-I		3	0	0	3
6	Professional Core	Power Electronics Lab	0	0	3	1.5
7	Professional Core	Analog and Digital Circuits Lab	0	0	3	1.5
8	Skill Enhancement course	Soft Skills	0	1	2	2
9	Engineering Science	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship	-	-	-	-	2
<b>Total</b>			<b>15</b>	<b>1</b>	<b>10</b>	<b>23</b>

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### B.Tech. III Year-II Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core	Electrical Measurements and Instrumentation	3	0	0	3
2	Professional Core	Microprocessors and Microcontrollers	3	0	0	3
3	Professional Core	Power System Analysis	3	0	0	3
4	Professional Elective-II	1. Switchgear and Protection 2. Advanced Control Systems 3. Renewable and Distributed Energy Technologies	3	0	0	3
5	Professional Elective-III	1. Electric Drives 2. Digital Signal Processing 3. High Voltage Engineering	3	0	0	3

6	Open Elective - II		3	0	0	3
7	Professional Core	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
8	Professional Core	Microprocessors and Microcontrollers Lab	0	0	3	1.5
9	Skill Enhancement course	IoT Applications of Electrical Engineering	0	1	2	2
10	Audit Course	Technical paper Writing & IPR	2	0	0	-
<b>Total</b>			<b>20</b>	<b>1</b>	<b>08</b>	<b>23</b>
<b>Mandatory Industry Internship of 08 weeks duration during summer vacation</b>						

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B.Tech. IV Year-I Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core	Power System Operation and Control	3	0	0	3
2	Management Course- II	Energy Management & Auditing	2	0	0	2
3	Professional Elective-IV	1. Programmable Logic Controllers 2. HVDC & FACTS 3. Electrical Distribution System	3	0	0	3
4	Professional Elective-V	1. Hybrid Electric Vehicles 2. Switched Mode Power Conversion	3	0	0	3

		3. Utilization of Electrical Energy				
5	Open Elective - III		3	0	0	3
6	Open Elective-IV		3	0	0	3
7	Skill Enhancement Course	Power Systems and Simulation Lab	0	0	4	2
8	Audit Course	Gender Sensitization / Constitution of India	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
<b>Total</b>			<b>16</b>	<b>1</b>	<b>02</b>	<b>21</b>

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**B.Tech. IV Year-II Semester**

<b>S.No.</b>	<b>Category</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	PR	Internship and Project	-	-	24	12

## OPEN ELECTIVES

S.No.	Category	Title	L	T	P	C
1	Open Elective-I	1. Renewable Energy Sources 2. Concepts of Control Systems 3. Concepts of Energy Auditing & Management	3	0	0	3
2	Open Elective - II	1. Fundamentals of utilization of Electrical Energy 2. Fundamentals of Power Electronics 3. Concepts of Power System Engineering	3	0	0	3
3	Open Elective - III	1. Fundamentals of Electric	3	0	0	3

		<p>Vehicles</p> <p>2. Battery Management Systems and Charging Stations</p> <p>3. Concepts of Smart Grid Technologies</p>				
4	Open Elective-IV	<p>1. Concepts of Microprocessors and Microcontrollers</p> <p>2. Concepts of Power Quality</p> <p>3. Intelligent Control Systems</p>	3	0	0	3

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<b>Course Code:</b>	<b>ELECTROMAGNETIC FIELD THEORY</b>	<b>Credits3-0-0:3</b>
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**Course Outcomes:**

CO	Statements	Blooms Level
CO1	Remember the concepts of vector algebra, vector calculus, various fundamental laws, self and mutual inductance	L1
CO2	Understand the concepts of electrostatics, conductors, dielectrics, capacitance, magneto statics, magnetic fields, time varying fields, self and mutual inductances	L2
CO3	Apply vector calculus, Coulomb's law, Gauss's law, Ohm's law in point form, Biot-Savart's law, Ampere's circuital law, Maxwell's third equation, self and mutual inductances, Faraday's laws, Maxwell's fourth equation, Poynting theorem to solve various numerical problems	L3
CO4	Analyze vector calculus, electrostatic fields, behavior of conductor in electric field, Biot-Savart's law and its applications	L4
CO5		

Analyze magnetic force, moving charges in a magnetic field, self-inductance of different cables, mutual inductance between different wires and time varying fields	L4
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## UNIT I

### Vector Analysis:

**Vector Algebra:** Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector.

**Coordinate Systems:** Rectangular, Cylindrical and Spherical coordinate systems.

**Vector Calculus:** Differential length, Area and Volume. Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a vector and Stoke's theorem (definition only), Laplacian of a scalar

### Electrostatics:

Coulomb's law and Electric field intensity (EFI) — EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Gauss's law (Maxwell's first equation, ), Applications of Gauss's law, Electric Potential, Work done in moving a point charge in an electrostatic field (second Maxwell's equation for static electric fields, ), Potential gradient, Laplace's and Poisson's equations.

## UNIT II

### Conductors — Dielectrics and Capacitance:

Behaviour of conductor in Electric field, Electric dipole and dipole moment — Potential and EFI due to an electric dipole, Torque on an

Electric dipole placed in an electric field, Current density-conduction and convection current densities, Ohm's law in point form, Behaviour of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field, Coupled and decoupled capacitors.

### UNIT III

**Magneto statics, Ampere's Law and Force in magnetic fields:**

Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire — Magnetic flux density and Maxwell's second Equation ( $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 \mathbf{I}$ ), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation ( $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$ ).

Magnetic force, moving charges in a magnetic field — Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.

### UNIT IV

**Self and mutual inductance:**

Self and mutual inductance — determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane — Energy stored and energy density in a magnetic field.

## UNIT V

### Time Varying Fields:

Faraday's laws of electromagnetic induction, Maxwell's fourth equation, integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector.

### Textbooks:

1. "Elements of Electromagnetics" by Matthew N O Sadiku, Oxford Publications, 7<sup>th</sup> edition, 2018.
2. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill, 7<sup>th</sup> Editon.2006.

### Reference Books:

1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2<sup>nd</sup> edition.
2. "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1<sup>st</sup> edition, 2011.
3. "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, Oxford University Press, 2012.
4. Schaum's Outline of Electromagnetics by Joseph A. Edminister, Mahamood Navi, 4<sup>th</sup> Edition,2014.



## Web Resources:

1. <https://archive.nptel.ac.in/courses/108/106/108106073/>
2. <https://nptel.ac.in/courses/117103065>

<b>Course Code:</b>	<b>ELECTRICAL CIRCUIT ANALYSIS-II</b>	<b>Credits3- 0-0:3</b>
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**Course Outcomes:**

CO	Statements	Blooms Level
CO1	Remember the concepts of Laplace transforms, formulation of various circuit topologies (R, L and C components) and basic filters	L1
CO2	Understand three phase balanced and unbalanced circuits, different circuit configurations and it's mathematical modeling, network parameters and various filters	L2
CO3	Apply Laplace transforms to solve various electrical network topologies and filter design concepts	L3
CO4	Analyze three phase circuits, transient response of various network topologies, electric circuits with periodic excitations and filter characteristics	L4
CO5	Design suitable electrical circuits and various filters for different applications	L5

**UNIT I**

**Analysis of three phase balanced circuits:**

Phase sequence, star and delta connection of sources and loads, relation between line and phase quantities, analysis of balanced three phase

circuits, measurement of active and reactive power.

**Analysis of three phase unbalanced circuits:**

Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of three phase power.

**UNIT II**

**Laplace transforms** – Definition and Laplace transforms of standard functions— Shifting theorem – Transforms of derivatives and integrals, Inverse Laplace transforms and applications.

**Transient Analysis:** Transient response of R-L, R-C and R-L-C circuits (Series and parallel combinations) for D.C. and sinusoidal excitations – Initial conditions - Solution using differential equation approach and Laplace transform approach.

**UNIT III**

**Network Parameters:** Impedance parameters, Admittance parameters, Hybrid parameters, Transmission (ABCD) parameters, conversion of Parameters from one form to other, Conditions for Reciprocity and Symmetry, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations- problems.

**UNIT IV**

**Analysis of Electric Circuits with Periodic Excitation:** Fourier series and evaluation of Fourier coefficients, Trigonometric and complex Fourier series for periodic waveforms, Application to Electrical Systems –

Effective value and average value of non-sinusoidal periodic waveforms, power factor, effect of harmonics

## UNIT V

**Filters:** Classification of filters-Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters -Low pass and High Pass, Design of Filters.

### Textbooks:

1. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 8th Edition McGraw-Hill, 2013
2. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2019

### Reference Books:

1. Network Analysis, M. E. Van Valkenburg, 3<sup>rd</sup> Edition, PHI, 2019.
2. Network Theory, N. C. Jagan and C. Lakshminarayana, 1<sup>st</sup> Edition, B. S. Publications, 2012.
3. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli, 5<sup>th</sup> Edition, Tata McGraw-Hill, 2017.
4. Engineering Network Analysis and Filter Design (Including Synthesis of One Port Networks)- [Durgesh C. Kulshreshtha](#), [Gopal G. Bhise](#), [Prem R. Chadha](#), Umesh Publications 2012.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, 7<sup>th</sup> Revised Edition.

### Web Resources:

1. <https://archive.nptel.ac.in/courses/117/106/117106108/>

2. <https://archive.nptel.ac.in/courses/108/105/108105159/>

<b>Course Code:</b>	<b>DC MACHINES &amp; TRANSFORMERS</b>	<b>Credits3-0-0:3</b>
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**Course Outcomes:**

CO	Statements	Blooms Level
CO1	Understand the process of voltage build-up in DC generators and characteristics.	L2
CO2	Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics.	L2
CO3	Obtain the equivalent circuit of single-phase transformer, auto transformer and determine its efficiency & regulation.	L3
CO4	Apply various testing methods for transformers and speed control of DC motors	L3
CO5	Analyze various configurations of three-phase transformers.	L4

**UNIT I**

**DC Generators:**

Construction and principle of operation of DC machines – EMF equation for generator –

Excitation techniques— characteristics of DC generators —applications of DC Generators, Back-emf and torque equations of DC motor — Armature reaction and commutation, Applications.

## **UNIT II**

### **Starting, Speed Control and Testing of DC Machines:**

Characteristics of DC motors — losses and efficiency — applications of DC motors. Necessity of a starter — starting by 3-point and 4-point starters — speed control by armature voltage and field current control — testing of DC machines — brake test, Swinburne's test —Hopkinson's test—Field Test.

## **UNIT III**

### **Single-phase Transformers:**

Introduction to single-phase Transformers (Construction and principle of operation) — emf equation — operation on no-load and on load — lagging, leading and unity power factors loads —phasor diagrams— equivalent circuit — regulation — losses and efficiency — effect of variation of frequency and supply voltage on losses — all day efficiency, Applications.

## **UNIT IV**

### **Testing of Transformers:**

Open Circuit and Short Circuit tests — Sumpner's test — separation of losses— Parallel operation with equal and unequal voltage ratios — auto

transformer — equivalent circuit — comparison with two winding transformers.

## UNIT V

### Three-Phase Transformers:

Polyphase connections- Y/Y, Y/ $\Delta$ ,  $\Delta$ /Y,  $\Delta$ / $\Delta$ , open  $\Delta$  and Vector groups — third harmonics in phase voltages — Parallel operation— three winding transformers- transients in switching — off load and on load tap changers — Scott connection.

### Textbooks:

1. Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, New Delhi,1995.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

### Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011.
3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7<sup>th</sup> Edition, Khanna Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons,2007
5. Electric Machinery by Fitzgerald, A.F.Kingsley, Jr.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

### Web Resources:



1. [nptel.ac.in/courses/108/105/108105112](https://nptel.ac.in/courses/108/105/108105112)
2. [nptel.ac.in/courses/108/105/108105155](https://nptel.ac.in/courses/108/105/108105155)

<b>Course Code:</b>	<b>ANALOG CIRCUITS</b>	<b>Credits3- 0-0:3</b>
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**Course Outcomes:**

CO	Statements	Blooms Level
CO1	Understand the concepts of diode clipping and clamping circuits, different amplifier configurations, operation of oscillator circuits, operational amplifiers, timers, ADC and DAC	L2
CO2	Apply the above concepts for different circuit design	L3
CO3	Analyze various circuit characteristics by using Amplifiers, Transistors, Comparators, Wave form generators, ADC and DAC	L4
CO4	Analyze various circuit characteristics by using timers, Phase locked loops and operational amplifiers	L4
CO5	Evaluate different system configurations by using various amplifier, transistor and waveform generators	L5

**UNIT I**

**Diode clipping and clamping circuits:** Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.

**DC biasing of BJTs:** Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in  $V_{BE}$  and  $\beta$  for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

## UNIT II

**Small Signals Modeling of BJT:** Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

**Feedback Amplifiers:** Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

## UNIT III

**Oscillator Circuits:** Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

**Operational Amplifiers:** Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

## UNIT IV

**OP-AMPS Applications:** Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

**Comparators and Waveform Generators:** Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

## UNIT V

**Timers and Phase Locked Loop:** Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

**Digital To Analog And Analog To Digital Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

### Textbooks:

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2<sup>nd</sup> Edition, 2010.

2. Linear Integrated Circuits — D. Roy Choudhury, New Age International (p) Ltd, 2<sup>nd</sup> Edition, 2003.

**Reference Books:**

1. Electronic Devices and Circuit Theory — Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits—G.K. Mithal, Khanna Publisher, 23<sup>rd</sup> Edition, 2017.
3. Electronic Devices and Circuits — David Bell, Oxford, 5<sup>th</sup> Edition, 2008.
4. Electronic Principles—Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits — Gayakwad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits —Sanjay Sharma, Kataria & Sons, 2<sup>nd</sup> Edition, 2010.
7. Design of Analog CMOS Integrated Circuits - Behzad Razavi

**Web Resources:**

1. <https://nptel.ac.in/courses/122106025>.
2. <https://nptel.ac.in/courses/108102112>.

<b>Course Code:</b>	<b>POWER SYSTEMS-I</b>	<b>Credits3- 0-0:3</b>
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**Course Outcomes:**

CO	Statements	Blooms Level
CO1	Understand the different types of power plants, operation of power plants	L2
CO2	Understand the concepts of distribution systems, underground cables, economic aspects and tariff	L2
CO3	Understand various substations that are located in distribution systems	L2
CO4	Apply the above concepts to illustrate different power generation layouts	L3
CO5	Analyze various economic aspects related to power generation and distribution	L4

**UNIT I**

**Hydroelectric Power Stations:**

Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation

**Thermal Power Stations:**

Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

## UNIT II

### **Nuclear Power Stations:**

Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

## UNIT III

### **Substations:**

**Air Insulated Substations** — indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

**Gas Insulated Substations (GIS)** — advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

## UNIT IV

### **Distribution Systems:**

Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, Design considerations in Distribution system.

### **Underground Cables:**

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.

## UNIT V

### **Economic Aspects & Tariff:**

**Economic Aspects** — load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

**Tariff Methods**— Costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three—part, and power factor tariff methods, Time of Day (ToD) tariff and Time of Use (ToU) tariff.



### **Textbooks:**

1. S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010
2. J. B. Gupta, Transmission and Distribution of Electrical Power, S. K. Kataria and sons, 10<sup>th</sup> Edition, 2012

### **Reference Books:**

1. I. J. Nagarath & D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3<sup>rd</sup> Edition, 2019.
2. C. L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6<sup>th</sup> Edition, 2018.
3. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand, 4<sup>th</sup> Edition, 2005.
4. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
5. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

### **Web Resources:**

1. <https://nptel.ac.in/courses/108102047>

<b>Course Code:</b>	<b>INDUCTION AND SYNCHRONOUS MACHINES</b>	<b>Credits3- 0-0:3</b>
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**Course Outcomes:**

CO	Statements	Blooms Level
CO1	Understand the construction, principle and operation of single phase and three phase induction motors	L2
CO2	Understand the construction, principle and operation of synchronous generator and synchronous motor	L2
CO3	Understand various applications of various alternating machines	L2
CO4	Apply the above concepts to solve various mathematical and complex problems	L3
CO5	Analyze the characteristics of induction motor, synchronous motor and synchronous generators	L4

**UNIT I**

**3-phase induction motors:**

Construction of Squirrel cage and Slipring induction motors— production of rotating magnetic field — principle of operation — rotor emf and rotor frequency — rotor current and power factor at standstill and during running conditions— rotor power input, rotor copper loss and mechanical

power developed and their inter-relationship — equivalent circuit — phasor diagram, Applications.

## UNIT II

### **Performance of 3-Phase induction motors:**

Torque equation — expressions for maximum torque and starting torque — torque-slip characteristics — double cage and deep bar rotors — No load, Brake test and Blocked rotor tests — circle diagram for predetermination of performance- methods of starting — starting current and torque calculations - speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique — crawling and cogging — induction generator operation.

## UNIT III

### **Single Phase Motors:**

Single phase induction motors — constructional features — double revolving field theory, Cross field theory — equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor, Applications.

## UNIT IV

### **Synchronous Generator:**

Constructional features of non-salient and salient pole type alternators- armature windings — distributed and concentrated windings — distribution & pitch factors — E.M.F equation — armature reaction —

voltage regulation by synchronous impedance method – MMF method and Potier triangle method – two reaction analysis of salient pole machines - methods of synchronization- Slip test – Parallel operation of alternators.

## UNIT V

### **Synchronous Motor:**

Synchronous motor principle and theory of operation – Effect of excitation on current and power factor— synchronous condenser – expression for power developed – hunting and its suppression – methods of starting, Applications.

### **Textbooks:**

1. Electrical Machinery Dr P.S. Bhimbra, Khanna Publishing, 2021, First Edition.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

### **Reference Books:**

1. Electrical machines [D P Kothari](#) and [I.J. Nagrath](#), McGraw Hill Education, 2017, Fifth Edition.
2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons, 2007.
3. Electric Machinery A F Fitzgerald Charles kingsley, Stephen D.Umans, McGraw-Hill, 2020, Seventh edition.

### **Web Resources:**

1. <https://nptel.ac.in/courses/108/105/108105131>
2. <https://nptel.ac.in/courses/108106072>

Course Code:	<b>CONTROL SYSTEMS</b>	Credits3- 0-0:3
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**Course Outcomes:**

CO	Statements	Blooms Level
CO1	Understand the concepts of various mathematical representations of control systems, Time response of first order and second order systems, stability, frequency response and fundamentals of modern control systems	L2
CO2	Apply Block diagram reduction, Signal flow graph, Routh criterion, Root locus, Bode, Polar, Nyquist concepts for solving various numerical problems	L3
CO3	Analyze time response characteristics, frequency response characteristics, stability analysis of various control systems	L4
CO4	Design various compensators and controllers for different control systems by using design procedures	L5
CO5	Create suitable control systems for various real time applications	L5

**UNIT I**

**CONTROL SYSTEMS CONCEPTS**

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros.

## **UNIT II**

### **TIME RESPONSE ANALYSIS**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

## **UNIT III**

### **STABILITY ANALYSIS IN TIME DOMAIN**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to  $G(s)H(s)$  on the root loci.

## **UNIT IV**

## **FREQUENCY RESPONSE ANALYSIS**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

## **UNIT V**

### **STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

#### **Textbooks:**

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5<sup>th</sup> edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5<sup>th</sup> edition, 2007.



## Reference Books:

1. Control Systems Principles & Design by M.Gopal, 4<sup>th</sup> Edition, Mc Graw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, 2<sup>nd</sup> Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6<sup>th</sup> Edition, Pearson, 2010.

## Web Resources:

1. <https://nptel.ac.in/courses/108102043>
2. <https://nptel.ac.in/courses/108106098>.

<b>Course Code:</b>	<b>INDUCTION AND SYNCHRONOUS MACHINES LAB</b>	<b>Credits 0-0-3: 1.5</b>
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**Course Outcomes:**

)	Statements	Blooms Level
1	Analyze various performance characteristics of 3-phase and 1-phase induction motors	L4
2	Evaluate the performance of 3-phase Induction Motor by obtaining the circle diagram and equivalent circuit of 3-phase Induction Motor and single phase induction motor	L4
3	Adapt the power factor improvement methods for single phase Induction Motor	L3
4	Pre-determine the regulation of 3-phase alternator	L3
5	Determine the synchronous machine reactance of 3-phase alternator	L3

**List of Experiments:**

**Any 10 experiments of the following are required to be conducted**

1. Brake test on three phase Induction Motor.
2. Circle diagram of three phase induction motor.
3. Speed control of three phase induction motor by V/f method.

4. Equivalent circuit of single-phase induction motor.
5. Power factor improvement of single-phase induction motor by using capacitors.
6. Load test on single phase induction motor.
7. Regulation of a three -phase alternator by synchronous impedance & MMF methods.
8. Regulation of three-phase alternator by Potier triangle method.
9. V and Inverted V curves of a three-phase synchronous motor.
10. Determination of  $X_d$ ,  $X_q$  & Regulation of a salient pole synchronous generator.
11. Determination of efficiency of three phase alternator by loading with three phase induction motor.
12. Parallel operation of three-phase alternator under no-load and load conditions.
13. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

**Reference:**

1. <https://em-coep.vlabs.ac.in/List%20of%20experiments.html>

<b>Course Code:</b>	<b>CONTROL SYSTEMS LAB</b>	<b>Credits 0-0-3: 1.5</b>
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**Course Outcomes:**

)	Statements	Blooms Level
1	Understand how to use feedback control system to determine transfer function of DC servo motor and any other given circuit with R, L and C components	L2
2	Model the systems and able to design the controllers and compensators.	L3
3	Get the knowledge about the effect of poles and zeros location on transient and steady state behavior of second order systems and implement through software tools	L4
4	Determine the performance and time domain specifications of first and second order systems.	L4
5	Understand the stability analysis	L2

**List of Experiments:**

**Any 10 of the Following Experiments are to be conducted.**

1. Time response of Second order system

2. Characteristics of Synchronos
3. Programmable logic controller — Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order system
7. Lag and lead compensation — Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
12. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
13. State space model for classical transfer function using MATLAB — Verification.

<b>Course</b>	<b>ELECTRICAL CIRCUIT ANALYSIS-II</b>	<b>Credits</b>
<b>Code:</b>	<b>AND SIMULATION LAB</b>	<b>0-0-3:</b>
		<b>1.5</b>

**Course Outcomes:**

	<b>Statements</b>	<b>Blooms Level</b>
1	Understand the power calculations in three phase circuits.	L2
2	Analyze the time response of given network.	L4
3	Determination of two port network parameters.	L4
4	Simulate and analyze electrical circuits using software tools	L4
5	Apply various theorems to solve different electrical networks using simulation tools	L3

**List of Experiments:**

**Any 10 of the following experiments are to be conducted:**

1. Measurement of Active Power and Reactive Power for balanced loads.
2. Measurement of Active Power and Reactive Power for unbalanced loads.
3. Determination of Z and Y parameters.
4. Determination of ABCD and hybrid parameters
5. Verification of Kirchhoff's current law and voltage law using simulation tools.

6. Verification of mesh and nodal analysis using simulation tools.
7. Verification of super position and maximum power transfer theorems using simulation tools.
8. Verification of Reciprocity and Compensation theorems using simulation tools.
9. Verification of Thevenin's and Norton's theorems using simulation tools.
10. Verification of series and parallel resonance using simulation tools.
11. Simulation and analysis of transient response of RL, RC and RLC circuits.
12. Verification of self-inductance and mutual inductance by using simulation tools.

<b>Course Code:</b>	<b>DC MACHINES &amp; TRANSFORMERS LAB</b>	<b>Credits</b> 0-0-3: 1.5
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**Course Outcomes:**

	<b>Statements</b>	<b>Blooms Level</b>
1	Demonstrate starting and speed control methods of DC Machines.	L2
2	Apply theoretical concepts to determine the performance characteristics of DC Machines.	L3
3	Analyze the parallel operation of single phase transformers	L4
4	Determine the performance parameters of single-phase transformer.	L3
5	Analyze the performance analysis of transformers using various tests	L4

**List of Experiments:**

**Any 10 of the following experiments are to be conducted:**

1. Speed control of DC shunt motor by Field Current and Armature Voltage Control.
2. Brake test on DC shunt motor- Determination of performance curves.



3. Swinburne's test - Predetermination of efficiencies as DC Generator and Motor.
4. Hopkinson's test on DC shunt Machines.
5. Load test on DC compound generator-Determination of characteristics.
6. Load test on DC shunt generator-Determination of characteristics.
7. Fields test on DC series machines-Determination of efficiency.
8. Brake test on DC compound motor-Determination of performance curves.
9. OC & SC tests on single phase transformer.
10. Sumpner's test on single phase transformer.
11. Scott connection of transformers.
12. Parallel operation of Single-phase Transformers.
13. Separation of core losses of a single-phase transformer.

**Reference:**

1. <https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html>