# Jawaharlal Nehru Technological University Anantapur

*(Established by Govt. of A.P., Act. No. 30 of 2008)*

**Ananthapuramu–515 002 (A.P) India**

## First Year B.Tech

## Course Structures and Syllabi under R20 Regulations

**Semester-0**

## Induction Program: 3 weeks
### (Common for All Branches of Engineering)

| S.No | Course No | Course Name | Category | L-T-P-C |
|------|-----------|-------------|----------|---------|
| 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 |

**CSE (Data Science)**
**Course Structure (R20)**

| | | Semester - 1 (Theory - 5, Lab - 4) | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1. | 20A54101 | Linear Algebra and Calculus | BS | 3-0-0 | 3 |
| 2. | 20A51101T | Chemistry | BS | 3-0-0 | 3 |
| 3. | 20A05201T | C-Programming & Data Structures | ES | 3-0-0 | 3 |
| 4. | 20A02101T | Basic Electrical & Electronics Engineering | ES | 3-0-0 | 3 |
| 5. | 20A03202 | Engineering Workshop | LC | 0-0-3 | 1.5 |
| 6. | 20A05202 | IT Workshop | LC | 0-0-3 | 1.5 |
| 7. | 20A51101P | Chemistry Lab | BS | 0-0-3 | 1.5 |
| 8. | 20A05201P | C-Programming & Data Structures Lab | ES | 0-0-3 | 1.5 |
| 9. | 20A02101P | Basic Electrical & Electronics Engineering Lab | ES | 0-0-2 | 1.5 |
| | | | | **Total** | **19.5** |

| | | Semester – 2 (Theory – 5, Lab – 5) | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P/D** | **Credits** |
| 1. | 20A54202 | Probability & Statistics | BS | 3-0-0 | 3 |
| 2. | 20A56201T | Applied Physics | BS | 3-0-0 | 3 |
| 3. | 20A52101T | Communicative English | HS | 3-0-0 | 3 |
| 4. | 20A05101T | Python Programming & Data Science | ES | 3-0-0 | 3 |
| 5. | 20A03101T | Engineering Drawing | ES | 1-0-0/2 | 2 |
| 6. | 20A03101P | Engineering Graphics Lab | ES | 0-0-2 | 1 |
| 7. | 20A52101P | Communicative English Lab | HS | 0-0-3 | 1.5 |
| 8. | 20A56201P | Applied Physics Lab | BS | 0-0-3 | 1.5 |
| 9. | 20A05101P | Python Programming & Data Science Lab | ES | 0-0-3 | 1.5 |
| 10 | 20A52201 | Universal Human Values | MC | 3-0-0 | 0.0 |
| | | | | **Total** | **19.5** |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**B.Tech -CSE (Data Science)– I Sem**                     **L  T  P  C**
                                                          **3  0  0  3**

## (20A54101) LINEAR 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.

## UNIT -1

### Matrices

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

**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, eigen values and eigenvectors (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

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

**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

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

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

**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

### Beta and Gamma functions

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. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

**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, 2011.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9th 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, McGraw Hill Education

9. H. k Das, Er. RajnishVerma, 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-CSE (Data Science) – I Sem | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**(20A51101T)  CHEMISTRY**

(CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT, ECE, 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:**

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of $\Psi$ and $\Psi^2$, applications to hydrogen, 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 ofbond order.

**Learning Outcomes:**

At the end of this unit, the students will be able to
- Apply Schrodinger wave equation to hydrogen atom (L3)
- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Explain the calculation of bond order of  $O_2$ and  Co molecules (L2)
- Discuss the basic concept of molecular orbital theory (L3)

**Unit 2: Modern Engineering materials**:

Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour.
Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.
Supercapacitors:       Introduction, Basic concept-Classification – Applications.
Nanochemistry: Introduction, classification of nanometerials, properties and applications of Fullerenes, carbonnano tubes and Graphines nanoparticles.

**Learning Outcomes:**

At the end of this unit, the students will be able to
- Explain splitting in octahedral and tetrahedral geometryof complexes (L2).
- Discuss the magnetic behaviour and colour of coordination compounds (L3).
- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nano tubes and Graphines nanoparticles (L2).

**Unit 3: Electrochemistry and Applications:**

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems,

potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries-working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

**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 4: Polymer Chemistry:**

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 – PVC, Teflon, Bakelite, Nylon-6,6, 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-6,6, 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 5: Instrumental Methods and Applications**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle and applications of pH metry, UV-Visible,IR Spectroscopies. Solid-Liquid Chromatography–TLC, retention time.

**Learning outcomes:**

After completion of Unit 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)

**Text Books:**
1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

**Reference Books:**
1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. 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, slc in separation of solid and liquid mixtures (l2)
- Apply the principle of Band diagrams in application of conductors and semiconductors (L3)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**B.Tech -CSE (Data Science)– I Sem**          **L   T   P   C**
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**(20A05201T)  C-PROGRAMMING & DATA STRUCTURES**
(Common to All Branches of Engineering)

**Course Objectives:**

- To illustrate the basic concepts of C programming language.
- To discuss the concepts of Functions, Arrays, Pointers and Structures.
- To familiarize with Stack, Queue and Linked lists data structures.
- To explain the concepts of non-linear data structures like graphs and trees.
- To learn different types of searching and sorting techniques.

**UNIT-1**

**Introduction to C Language** - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Use C basic concepts to write simple C programs. (L3)
- Use iterative statements for writing the C programs (L3)
- Use arrays to process multiple homogeneous data. (L3)
- Test and execute the programs and correct syntax and logical errors. (L4)
- Translate algorithms into programs. (L4)
- Implement conditional branching, iteration and recursion. (L2)

**UNIT – 2**

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions,  and Command line arguments.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Writing structured programs using C Functions. (L5)
- Writing C programs using various storage classes to control variable access. (L5)
- Apply String handling functions and pointers. (L3)
- Use arrays, pointers and structures to formulate algorithms and write programs.(L3)

**UNIT-3**

**Data Structures**, Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Describe the operations of Stack. (L2)
- Explain the different notations of arithmetic expression. (L5)
- Develop various operations on Queues. (L6)

**UNIT – 4**

**Linked Lists** – Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Analyze various operations on singly linked list. (L4)
- Interpret operations of doubly linked lists. (L2)
- Apply various operations on Circular linked lists. (L6)

**UNIT-5**

**Trees** - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Develop the representation of Tress. (L3)
- Identify the various Binary tree traversals. (L3)
- Illustrate different Graph traversals like BFS and DFS. (L2)
- Design the different sorting techniques (L6)
- Apply programming to solve searching and sorting problems. (L3)

**Text Books:**

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

**Reference Books:**

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

**Course Outcomes:**

1. Analyse the basicconcepts of C Programming language. (L4)
2. Design applications in C, using functions, arrays, pointers and structures. (L6)
3. Apply the concepts of Stacks and Queues in solving the problems. (L3)
4. Explore various operations on Linked lists. (L5)
5. Demonstrate various tree traversals and graph traversal techniques. (L2)
6. Design searching and sorting methods  (L3)

**B.Tech -CSE (Data Science)– I Sem**　　　　　　　　　　**L　T　P　C**

**3　0　0　3**

**(20A02101T) BASIC ELECTRICAL & ELECTRONICS ENGINEERING**

(Civil, Mechanical, CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT and Food Technology)

### Part A: Basic Electrical Engineering

**Course Objectives:**

- To introduce basics of electric circuits.
- To teach DC and AC electrical circuit analysis.
- To explain working principles of transformers and electrical machines.
- To impart knowledge on Power system generation, transmission and distribution

## UNIT -1

**DC & AC Circuits:**
Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

**Learning Outcomes**

At the end of this unit, the student will be able to

- Recall Kirchoff laws
- Analyze simple electric circuits with DC excitation
- Apply network theorems to simple circuits
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations

## UNIT -2

**DC & AC Machines:**
Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC tests on transformer - Principle and operation of 3-phase AC machines  [ Elementary treatment only ]

**Learning Outcomes**

At the end of this unit, the student will be able to
- Explain principle and operation of DC Generator & Motor.
- Perform speed control of DC Motor
- Explain operation of transformer and induction motor.
- Explain construction & working of induction motor - DC motor

**UNIT -3**

**Basics of Power Systems:**
Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.

**Learning Outcomes**

At the end of this unit, the student will be able to
- Understand working operation of various generating stations
- Explain the types of Transmission and Distribution systems

**Text Books:**
1. D. P. Kothari and I. J. Nagrath - "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Power System" – S.Chand – 2018.

**References:**
1. L. S. Bobrow - "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.
3. C.L. Wadhwa – "Generation Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International Publications.

**Course Outcomes:**

The student should be able to
- Apply concepts of KVL/KCL in solving DC circuits
- Understand and choose correct rating of a transformer for a specific application
- Illustrate working principles of DC Motor
- Identify type of electrical machine based on their operation
- Understand the basics of Power generation, Transmission and Distribution


# Part 'B'- Electronics Engineering

**COURSE OBJECTIVES**

- Understand principles and terminology of electronics.
- Familiar with the theory, construction, and operation of electronic devices.
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers.
- Understand the concept & principles of logic devices.

**Unit-1:**

**Diodes and Applications:** Semiconductor Diode,Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications ofZener Diode, LED, Photo Diode.

**Transistor Characteristics:** Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

**Learning outcomes:**

At the end of this unit, the student will be able to
- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes. (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

**Unit-2:**

**Operational Amplifiers and Applications:** Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

**Learning outcomes:**

At the end of this unit, the student will be able to
- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

**Unit-3:**

**Digital Electronics:** Logic Gates,Simple combinational circuits–Half and Full Adders, BCD Adder.Latches and Flip-Flops (S-R, JK andD), Shift Registers and Counters.Introduction to Microcontrollers and their applications (Block diagram approach only).

**Learning outcomes:**

At the end of this unit, the student will be able to
- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Analyze standard combinational and sequential circuits. (L4)
- Distinguish between 8085 & 8086 microprocessors also summarize features of a microprocessor. (L5)

**Text Books:**

1. R.L.Boylestad& Louis Nashlesky, Electronic Devices &Circuit Theory, Pearson Education,2007.
2. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, 4$^{th}$Edition, Pearson, 2017.

3. R. P. Jain, Modern Digital Electronics,3$^{rd}$ Edition, Tata Mcgraw Hill,2003.
4. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2$^{nd}$ Edition, Pearson, 2012.

**Reference Books:**

1. SantiramKal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India,2002.
2. R. S. Sedha, A Text Book of Electronic Devices and Circuits, S.Chand& Co,2010.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

**COURSE OUTCOMES:**

After the completion of the course students will able to

- Explain the theory, construction, and operation of electronic devices.

- Apply the concept of science and mathematics to explain the working of diodes and its applications, working of transistor and to solve the simple problems based on the applications

- Analyze small signal amplifier circuits to find the amplifier parameters

- Design small signal amplifiers using proper biasing circuits to fix up proper Q point.

- Distinguish features of different active devices including Microprocessors.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech–CSE (Data Science)– I Sem**  **L  T  P  C**

**0  0  3  1.5**

**(20A03202) ENGINEERING WORKSHOP**

(Common to All Branches of Engineering)

**Course Objective:**

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

**List of Topics**

**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
 • Apply wood working skills in real world applications. (l3)
 • Build different objects with metal sheets in real world applications. (l3)
 • Apply fitting operations in various applications. (l3)
 • Apply different types of basic electric circuit connections. (l3)
 • Use soldering and brazing techniques. (l2)

**Note: In each section a minimum of three exercises are to be carried out.**

**B.Tech -CSE (AI)– I Sem**                                     **L   T   P   C**
                                                              **0   0   3   1.5**

## (20A05202) IT WORKSHOP

(Common to All Branches of Engineering)

**Course Objectives:**

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

**Preparing your Computer**

**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

**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**

**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**

**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 colour, 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, Image Manipulation tools.

**Task 9:**
**Presentations:** creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, 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.

**Task 10:**
**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

**Task 11:**
**LateX:** Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic

tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

**References:**

1. Introduction to Computers, Peter Norton, McGraw 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
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

**Course Outcomes:**

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAteX.
- 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.

**Note:** Use open source tools for implementation of the above exercises.

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**B.Tech-CSE(Data Science) – I Sem**                          **L   T   P   C**

                                                             **0   0   3   1.5**

**(20A51101P)   CHEMISTRY LAB**

(CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT**, ECE, 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. Conductometrictitration 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 Bakelite and measurement of its mechanical properties (strength.).
8. Verify Lambert-Beer's law
9. Thin layer chromatography
10. Identification of simple organic compounds by IR.
11. Preparation of nanomaterial's by precipitation
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 Bakelite materials (L2)
- Measure the strength of an acid present in secondary batteries (L3)
- Analysethe IR of some organic compounds (L3)

**B.Tech-CSE(Data Science)-I Sem**          **L   T   P   C**
                                             **0   0   3   1.5**
### (20A05201P) C-PROGRAMMING & DATA STRUCTURES LAB
(Common to All Branches of Engineering)

**Course Objectives:**

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate Binary search tree traversal techniques.
- To design searching and sorting techniques.

**Week l**

Write C programs that use both recursive and non-recursive functions

   i)   To find the factorial of a given integer.
   ii)  To find the GCD (greatest common divisor) of two given integers.
   iii) To solve Towers of Hanoi problem.

**Week 2**

   a) Write a C program to find both the largest and smallest number in a list of integers.
   b) Write a C program that uses functions to perform the following:
      i) Addition of Two Matrices    ii) Multiplication of Two Matrices

**Week 3**
   a) Write a C program that uses functions to perform the following operations:
      i) To insert a sub-string in to a given main string from a given position.
      ii) To delete n characters from a given position in a given string.

**Week 4**
   a) Write a C program that displays the position or index in the string S where the string T
      begins, or – 1 if S doesn't contain T.

   b) Write a C program to count the lines, words and characters in a given text.

**Week 5**

   a) Write a C Program to perform various arithmetic operations on pointer variables.
   b) Write a C Program to demonstrate the following parameter passing mechanisms:
      i) call-by-value                ii) call-by-reference

**Week 6**

Write a C program that uses functions to perform the following operations:

    i)     Reading a complex number
    ii)    Writing a complex number
    iii)   Addition of two complex numbers
    iv)   Multiplication of two complex numbers

  (Note: represent complex number using a structure.)

**Week 7**

Write C programs that implement stack (its operations) using

    i)     Arrays
    ii)    Pointers

**Week 8**

Write C programs that implement Queue (its operations) using
    i)     Arrays
    ii)    Pointers

**Week 9**

 Write a C program that uses Stack operations to perform the following:

    i)     Converting infix expression into postfix expression
    ii)    Evaluating the postfix expression

**Week 10**

Write a C program that uses functions to perform the following operations on singly linked list.

    i) Creation     ii) Insertion     iii) Deletion   iv) Traversal

**Week 11**

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

    i) Creation     ii) Insertion   iii) Deletion   iv) Traversal

**Week 12**

Write a C program that uses functions to perform the following operations on circular linkedlist.

    i) Creation     ii) Insertion   iii) Deletion   iv) Traversal

**Week 13**

Write a C program that uses functions to perform the following:

    i) Creating a Binary Tree of integers

    ii) Traversing the above binary tree in preorder, inorder and postorder.

**Week 14**

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

    i)     Linear search
    ii)    Binary search

**Week 15**

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

    i)     Bubble sort
    ii)    Selection sort
    iii)   Insertion sort

**Text Books:**
1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

**Reference Books:**
1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

**Course Outcomes**

- Demonstrate basic concepts of C programming language. (L2)
- Develop C programs using functions, arrays, structures and pointers. (L6)
- Illustrate the concepts Stacks and Queues. (L2)
- Design operations on Linked lists. (L6)
- Apply various Binary tree traversal techniques. (L3)
- Develop searching and sorting methods. (L6)

**B.Tech–CSE (Data Science)– I Sem**                          **L   T   P   C**

                                                             **0   0   3   1.5**


**(20A02101P)   BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB**
(Civil, Mechanical, CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT and Food Technology)

### Part A: Electrical Engineering Lab

**Course Objectives:**

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines.
- To perform various tests on 1- Phase Transformer.
- To Study the I – V Characteristics of Solar PV Cell


**List of experiments: -**

1. Verification of Kirchhoff laws.
2.  Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.


**Course Outcomes:**

After completing the course, the student will be able to

- Understand Kirchoff's Laws & Superposition theorem.
- Analyze the various characteristics on DC Machines by conducting various tests.
- Analyze I – V Characteristics of PV Cell
- Apply the knowledge to perform various tests on 1-phase transformer


# Part B: Electronics Engineering Lab

**Course Objectives:**

- To verify the theoretical concepts practically from all the experiments.
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT.
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits.

**List Of Experiments:**

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.

2. Zener diode characteristics and Zener as voltage Regulator.

3. Full Wave Rectifier with & without filter.

4. Wave Shaping Circuits. (Clippers & Clampers)

5. Input & Output characteristics of Transistor in CB / CE configuration.

6. Frequency response of CE amplifier.

7. Inverting and Non-inverting amplifiers using Op-AMPs.

8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.

9. 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.

**Course outcomes:**

- Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.
- Construct the given circuit in the lab
- Analyze the application of diode as rectifiers, clippers and clampers and other circuits.
- Design simple electronic circuits and verify its functioning.

Note: Minimum Six Experiments to be performed in each section.

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**B.Tech-CSE  (Data Science)– II Sem**                     **L   T   P   C**
                                                            **3   0   0   3**

## (20A54202) PROBABILITY AND STATISTICS
(Common to CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML) and  IT)

**Course Objectives:**

- To familiarize the students with the foundations of probability and statistical methods
- To impart probability concepts and statistical methods in various applications Engineering

**Unit 1:**

**Descriptive statistics**
Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, method of least squares, regression lines, regression coefficients and their properties.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- summarize  the basic concepts of data science and its importance in engineering (L2)
- analyze the data  quantitatively or categorically , measure of  averages, variability  (L4)
- adopt   correlation methods and principle of least squares, regression analysis (L5)

**UNIT 2: Probability**

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Define the terms trial, events, sample space, probability,  and laws of probability  (L1)
- Make use of  probabilities of events in finite sample spaces from experiments (L3)
- Apply Baye's theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value(L2)

**UNIT 3:**

**Probability distributions**
Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Apply  Binomial  and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications  (L2)

**Unit4:**

**Estimation and Testing of hypothesis, large sample tests**
Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Explain  the concept of estimation, interval estimation and confidence intervals (L2)
- Apply  the concept of hypothesis testing for large samples (L4)

**Unit 5:**

**Small sample tests**
Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi2$ - test for goodness of fit, $\chi2$ - test for independence of attributes.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

**Text Books:**
1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

**Reference Books:**
1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
3. Peyton Z. Peebles ,Probability, Random Variables & Random Signal Principles -, McGraw Hill Education, 4th Edition, 2001.

**Course Outcomes:**

Upon successful completion of this course, the student should be able to
- Make use of the concepts of probability and their applications (L3)
- Apply discrete and continuous probability distributions (L3)
- Classify the concepts of data science and its importance (L4)
- Interpret the association of characteristics and through correlation and regression tools (L4)
- Design the components of a classical hypothesis test      (L6)
- Infer  the statistical inferential methods based on small and large sampling tests      (L6)

**B.Tech-CSE  (Data Science)– II Sem**                               **L   T   P   C**
                                                                      **3   0   0   3**

## 20A56201T   APPLIED PHYSICS
(ECE, EEE, CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT)

**Course Objectives**

- To make a bridge between the physics in school and engineering courses.

- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications

- To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.

- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.

- To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de'Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and band theory of solids.

- Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications.

**Unit-I:**

**Wave Optics**
**Interference**- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.
**Diffraction**- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

**Polarization**- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction - Nicol's Prism - Half wave and Quarter wave plates with applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Explain the need of coherent sources and the conditions for sustained interference (L2)
- Identify engineering applications of interference (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:**

**Lasers and Fiber optics**
**Lasers**- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser –  He-Ne laser – Applications of lasers.

**Fiber optics**- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (qualitative) – Applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Understand the basic concepts of LASER light Sources  (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- 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 various fields (L2)


**Unit-III:**

**Dielectric and Magnetic Materials**

**Dielectric Materials**- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

**Magnetic Materials**- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.


**Learning Outcomes:**

At the end of this unit, the student 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 IV:**

**Quantum Mechanics, Free Electron Theory and   Band theory of Solids**
**Quantum Mechanics**- Dual nature of matter – Schrodinger's time independent and dependent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

**Free Electron Theory**- Classical free electron theory (Merits and demerits only) – Quantum free electron theory – Equation for electrical conductivity based on quantum free electron theory – Fermi-Dirac distribution – Density of states – Fermi energy.

**Band theory of Solids**- Bloch's Theorem (Qualitative) – Kronig-Penney model (Qualitative) – E vs K diagram – Classification of crystalline solids – Effective mass of electron – $m^*$ vs K diagram – Concept of hole.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Explain the concept of dual nature of matter (L2)
- Understand the significance of wave function (L2)
- Interpret the concepts of classical and quantum free electron theories (L2)
- Explain the importance of K-P model
- Classify the materials based on band theory (L2)
- Apply the concept of effective mass of electron (L3)

**Unit – V:**

**Semiconductors and Superconductors**
**Semiconductors**- Introduction – 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 – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect.
**Superconductors**- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High $T_c$ superconductors – Applications of superconductors.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Classify the energy bands of semiconductors (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)
- 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)

**Text books:**
1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics – B.K. Pandey and S. Chaturvedi, Cengage Learning.

**Reference Books:**
1. Engineering Physics – Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
4. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill

**Course Outcomes**

- Study the different realms of physics and their applications in both scientific and technological systems through physical optics. (L2)
- Identify the wave properties of light and the interaction of energy with the matter (L3).
- Asses the electromagnetic wave propagation and its power in different media (L5).
- Understands the response of dielectric and magnetic materials to the applied electric and magnetic fields. (L3)
- Study the quantum mechanical picture of subatomic world along with the discrepancies between the classical estimates and laboratory observations of electron transportation phenomena by free electron theory and band theory. (L2)
- Elaborate the physical properties exhibited by materials through the understanding of properties of semiconductors and superconductors. (L5)

**B.Tech–CSE (Data Science)– II Sem**                                         **L   T   P   C**
                                                                              **3   0   0   3**

**(20A52101T)  COMMUNICATIVE ENGLISH**
(Common to All Branches of Engineering)

**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**

**Lesson: On the Conduct of Life: William Hazlitt**
**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:** Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; 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**

**Lesson: The Brook: Alfred Tennyson**
**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

**Lesson: The Death Trap: Saki**
**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, Paragraph Writing **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

## UNIT-4

**Lesson: Innovation: Muhammad Yunus**
**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:** Letter Writing: Official Letters/Report Writing **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice

**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**

**Lesson: Politics and the English Language:** George Orwell
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:**

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

**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. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

**Course Outcomes**

- Retrieve the knowledge of basic grammatical concepts
- 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

**Web links**

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html
www.myenglishpages.com

**B.Tech-CSE  (Data Science)– II Sem**　　　　　　　　　　　　　**L　T　P　C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**3　0　0　3**

**(20A05101T) PYTHON PROGRAMMING & DATA SCIENCE**
(CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT)

**Course Objectives**

- To learn the fundamentals of Python.
- To discuss the concepts of Functions and Exceptions.
- To familiarize with Python libraries for Data Analysis and Data Visualization.
- To introduce preliminary concepts in Pattern Recognition and Machine learning.
- To provide an overview of Deep Learning and Data Science models.

**Unit-I**

Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements.
Strings: Creating strings and basic operations on strings, string testing methods. Lists, Dictionaries, Tuples.

**Learning outcomes:**

At the end of this unit, the students will be able to
- List the basic constructs of Python. (L1)
- Apply the conditional execution of the program (L3)
- Design programs for manipulating strings (L6)
- Use the data structure lists, Dictionaries and Tuples (L3)

**Unit-II**

Functions: Defining a function, Calling a function, returning multiple values from a function, functions are first class objects, formal and actual arguments, positional arguments, recursive functions.
Exceptions: Errors in a Python program, exceptions, exception handling, types of exceptions, the except block, the assert statement, user-defined exceptions.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Solve the problems by applying the modularity principle. (L3)
- Classify exceptions and explain the ways of handling them. (L4)

**Unit-III**

Introduction to NumPy, Pandas, Matplotlib.

Exploratory Data Analysis (EDA),  Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA. Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps, etc.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Demonstrate various mathematical operations on arrays using NumPy (L2)
- Analyze and manipulate Data using Pandas (L4)
- Creating static, animated, and interactive visualizations using Matplotlib. (L6)

**Unit-IV**

Introduction to Pattern Recognition and Machine Learning: Patterns, features, pattern representation, the curse of dimensionality, dimensionality reduction. Classification—linear and non-linear. Bayesian, Perceptron, Nearest neighbor classifier, Logistic regression, Naïve-Bayes, decision trees and random forests; boosting and bagging.Clustering---partitional and hierarchical; k-means clustering. Regression.

Cost functions, training and testing a classifier. Cross-validation, Class-imbalance – ways of handling, Confusion matrix, evaluation metrics.

**Learning outcomes:**

At the end of this unit, the students will be able to
- Define Patterns  and their representation (L1)
- Describe the Classification and Clustering (L2)
- illustrate cost functions and class imbalance (L3)

**Unit-V**

Introduction to Deep Learning: Multilayer perceptron. Backpropagation. Loss functions. Hyperparameter tuning, Overview of RNN, CNN and LSTM.

Overview of Data Science Models: Applications to text, images, videos, recommender systems, image classification, Social network graphs.

At the end of this unit, the students will be able to
- Describe  RNN, CNN and  (L2)
- Explain the applications of Data Science (L2)

**Textbooks:**

1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.
2. Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from the Frontline. O'Reilly, 2013.
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

**References:**

1. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
2. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017
3. EMC2: Data Science and Big Data Analytics, EMC Education Services, EMC 2 , Wiley Publication, 2015.
4. V. Susheela Devi and M. Narasimha Murty. Pattern Recognition – An Introduction. Universities Press (Indian Edition; there is an expensive Springer version of the same)
5. Goodfellow and YoshuaBengio and Aaron Courville. Deep Learning. MIT Press. Book available online at https://www.deeplearningbook.org/.
6. J. Leskovec, A. Rajaraman, J.D. Ullman. Mining of Massive Datasets. Cambridge University Press. (Indian Edition; Online pdf is available for download)

**Course Outcomes:**

1. Apply the features of Python language in various real applications. (L3)
2. Identify the appropriate data structure of Python for solving a problem (L2)
3. Demonstrate data analysis, manipulation and visualization of data using Python libraries (L5)
4. Enumerate machine learning algorithms. (L1)
5. Analyze the various applications of Data Science. (L4)
6. Design solutions for real-world problems using Python. (L6)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech-CSE  (Data Science)– II Sem**                                L    T   P/D   C

                                                                                     1    0   0/ 2   2

**(20A03101T)  ENGINEERING DRAWING**

(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.

**Unit: I**

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance-Conventions in drawing-lettering - BIS conventions.

  a)Conic sections including the rectangular hyperbola- general method only,

  b) Cycloid, epicycloids and hypocycloid c) Involutes

**Learning Outcomes:**

At the end of this unit the student will be able to

- Understand  the significance of engineering drawing
- Know the conventions used in the engineering drawing
- Identify the curves obtained in different conic sections
- Draw different curves such as cycloid, involute and hyperbola

**Unit: II**

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.

**Learning Outcomes:**

At the end of this unit the student will be able to

- Understand the meaning of projection
- Know how to draw the projections of points, lines
- Differentiate between projected length and true length
- Find the true length of the lines

**Unit: III**

**Projections of solids:** Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

**Learning Outcomes:**

At the end of this unit the student will be able to
- Understand the procedure to draw projection of solids
- Differentiate between rotational method and auxillary view method.
- Draw the projection of solid inclined to one plain
- Draw the projection of solids inclined to both the plains

## Unit: IV

**Sections of solids:** Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

**Learning Outcomes:**

At the end of this unit the student will be able to
- Understand different sectional views of regular solids
- Obtain the true shapes of the sections of prism
- Draw the sectional views of prism, cylinder, pyramid and cone

## Unit: V

**Development of surfaces:** Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

**Learning Outcomes:**

At the end of this unit the student will be able to
- Understand the meaning of development of surfaces
- Draw the development of regular solids such as prism, cylinder, pyramid and cone
- Obtain the development of sectional parts of regular shapes

**Text Books:**
1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

**Reference Books:**
1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
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)

**Additional Sources**
Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

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**B.Tech-CSE (Data Science)– II Sem**                      **L   T   P   C**
                                                                                      **0   0   2   1**

### (20A03101P) ENGINEERING GRAPHICS LAB
(Common to All Branches of Engineering)

**Course Objectives:**

- 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.

**Computer Aided Drafting:**

**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.

Dimensioning principles and conventional representations.

**Orthographic Projections:** Systems of projections, conventions and application to orthographic projections - simple objects.

**Isometric Projections:** Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

**Text Books:**
1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

**Reference Books:**
1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
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

- Use computers as a drafting tool. (L2)
- Draw isometric and orthographic drawings using CAD packages. (L3)

**Additional Sources**

1. Youtube: http-sewor,Carleton.cag, kardos/88403/drawings.html conic sections-online, red woods.edu

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**B.Tech-CSE  (Data Science)– II Sem**                                       **L   T   P    C**

                                                                                                    **0    0   3   1.5**

### (20A52101P)  COMMUNICATIVE ENGLISH LAB

(Common to All Branches of Engineering)

**Course Objectives**

- students will be exposed to a variety of self instructional, learner friendly modes of language learning
- 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

**List of Topics**

1.  Phonetics
2.  Reading comprehension
3.  Describing objects/places/persons
4.  Role Play or Conversational Practice
5.  JAM
6.  Etiquettes of Telephonic Communication
7.  Information Transfer
8.  Note Making and Note Taking
9. E-mail Writing
10. Group Discussions-1
11. Resume Writing
12. Debates
13. Oral Presentations
14. Poster Presentation
15. Interviews Skills-1

**Suggested Software**

Orel, Walden Infotech, Young India Films

**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.
5.  A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

**Web Links**
  **www.esl-lab.com**
  **www.englishmedialab.com**
  www.englishinteractive.net

**Course Outcomes**

After completing the course, the student will be able to

- Listening and repeating the sounds of English Language
- 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.

**B.Tech-CSE  (Data Science)– II Sem**                                    **L   T   P   C**

                                                                          **0   0   3   1.5**

**(20A56201P)  APPLIED PHYSICS LAB**

(ECE, EEE, CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT)

**Course Objectives**:

- Understands the concepts of interference, 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 (minimum 10) must be performed in a semester**

<u>List of Applied Physics Experiments</u>

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. Determination of particle size using LASER.
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
8. Determination of dielectric constant by charging and discharging method.
9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
10. Measurement of magnetic susceptibility by Gouy's method
11. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
12. To determine the resistivity of semiconductor by Four probe method
13. To determine the energy gap of a semiconductor
14. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
15. Measurement of resistance with varying temperature.

**Course Outcomes:**

At the end of the course, the student 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 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**

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

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**B.Tech-CSE  (Data Science)– II Sem**                     **L   T   P   C**

                                                                         **0   0   3   1.5**

**(20A05101P) PYTHON PROGRAMMING & DATA SCIENCE LAB**

(CSE, AI & DS,CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT)

**Course Objectives:**

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- Practical understanding of building different types of  models and their evaluation

**List of Topics**

1. Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.
2. Write a program to create, append, and remove lists in Python.
3. Write a program to demonstrate working with tuples in Python.
4. Write a program to demonstrate working with dictionaries in Python.
5. Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.
6. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
7. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.
8. Write a program to demonstrate Regression analysis with residual plots on a given data set.
9. Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
10. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
11. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions using Java/Python ML library classes.
12. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.
13. Write a program to build Artificial Neural Network and test the same using appropriate data sets.

**Textbooks:**

1. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017
2. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3<sup>rd</sup> edition, Available at http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. Paul Barry, "Head First Python a Brain Friendly Guide" 2<sup>nd</sup> Edition, O'Reilly, 2016
4. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

**Course Outcomes:**

At the end of the course, the student will be able to
- Illustrate the use of various data structures. (L3)
- Analyze and manipulate Data using Pandas (L4)
- Creating static, animated, and interactive visualizations using Matplotlib. (L6)
- Understand the implementation procedures for the machine learning algorithms. (L2)
- Apply appropriate data sets to the Machine Learning algorithms (L3)
- Identify and apply Machine Learning algorithms to solve real-world problems (L1)

**B.Tech-CSE  (Data Science)– II Sem**           **L  T  P  C**
                                                                **3  0  0  0**

### (20A52201) UNIVERSAL HUMAN VALUES
### (Common to all branches)

**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", 2nd 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", 2nd 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 kantak, 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. FSchumacher. "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)

**MOE 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 THECOURSE:**

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.

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

**Comuper Science & Engineering (Data Science)**

## II B.TECH.

| S.No. | Course Code | Course Name | Category | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | **Semester-III** | | | | | |
| | | | | L | T | P | |
| 1. | 20A54304 | Discrete Mathematics & Graph Theory | BS | 3 | 0 | 0 | 3 |
| 2. | 20A04304T | Digital Electronics& Microprocessors | ES | 3 | 0 | 0 | 3 |
| 3. | 20A05301T | Advanced Data Structures & Algorithms | PC | 3 | 0 | 0 | 3 |
| 4. | 20A05303 | Computer Organization | PC | 3 | 0 | 0 | 3 |
| 5. | 20A32301T | Advanced Python Programming for Data Science | PC | 3 | 0 | 0 | 3 |
| 6. | 20A04304P | Digital Electronics& Microprocessors Lab | ES | 0 | 0 | 3 | 1.5 |
| 7. | 20A05301P | Advanced Data Structures and Algorithms Lab | PC | 0 | 0 | 3 | 1.5 |
| 8. | 20A32301P | Advanced Python Programming for Data Science Lab | PC | 0 | 0 | 3 | 1.5 |
| 9. | 20A32302 | **Skill Oriented Course – I** Working with Handoop | SC | 1 | 0 | 2 | 2 |
| 10. | 20A99201 | **Mandatory noncredit course  - II** Environmental Science | MC | 3 | 0 | 0 | 0 |
| | | | | | | **Total** | **21.5** |

| S.No. | Course Code | Course Name | Category | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | **Semester-IV** | | | | | |
| | | | | L | T | P | |
| 1. | 20A54405 | Statistical Methods for Data Science | BS | 3 | 0 | 0 | 3 |
| 2. | 20A05401T | Database Management Systems | PC | 3 | 0 | 0 | 3 |
| 3. | 20A05402T | Operating Systems | PC | 3 | 0 | 0 | 3 |
| 4. | 20A05403T | Software Engineering | PC | 3 | 0 | 0 | 3 |
| 5. | 20A52301 20A52302 20A52303 | **Humanities Elective– I** Managerial Economics & Financial Analysis Organizational Behaviour Business Environment | HS | 3 | 0 | 0 | 3 |
| 6. | 20A05401P | Database Management Systems lab | PC | 0 | 0 | 3 | 1.5 |
| 7. | 20A05402P | Operating SystemsLab | PC | 0 | 0 | 3 | 1.5 |
| 8. | 20A05403P | Software Engineering Lab | PC | 0 | 0 | 3 | 1.5 |
| 9. | 20A32401 | **Skill Oriented Course– II** Programmingwith R | SC | 1 | 0 | 2 | 2 |
| 10. | 20A99401 | **Mandatory noncredit course – III** Design Thinking for Innovation | MC | 2 | 1 | 0 | 0 |
| 11. | 20A99301 | NSS/NCC/NSO Activities | MC | 0 | 0 | 2 | 0 |
| | | | | | | **Total** | **21.5** |
| Community Service Internship/Project(Mandatory) for 6 weeks duration during summer vacation | | | | | | | |

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**Comuper Science & Engineering (Data Science)**

**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 fourth semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

*R 20 Regulations*

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**Comuper Science & Engineering (Data Science)**

| Course Code | Discrete Mathematics & Graph theory | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A54304** | **(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and  AI & DS)** | | **3** | **0** | **0** | **3** |
| **Pre-requisite** | **Basic Mathematics** | **Semester** | | **III** | | |

| | |
|---|---|

**Course Objectives:**

Introduce the concepts of mathematical logic and gain knowledge in sets, relations and functions and Solve problems using counting techniques and combinatorics and to introduce generating functions and recurrence relations. Use Graph Theory for solving real world problems

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Apply mathematical logic to solve problems.
- Understand the concepts and perform the operations related to sets, relations and functions.
- Gain the conceptual background needed and identify structures of algebraic nature.
- Apply basic counting techniques to solve combinatorial problems.
- Formulate problems and solve recurrence relations.
- Apply Graph Theory in solving computer science problems

| UNIT - I | **Mathematical Logic** | 8 Hrs |
|---|---|---|

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

| UNIT - II | **Set theory** | 9 Hrs |
|---|---|---|

Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion- Exclusion, Pigeon hole principle and its application,Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism.

| UNIT - III | **Elementary Combinatorics** | 8 Hrs |
|---|---|---|

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

| UNIT - IV | **Recurrence Relations** | 9 Hrs |
|---|---|---|

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

| UNIT - V | **Graphs** | 9 Hrs |
|---|---|---|

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem

| Textbooks: |
|---|

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**Comuper Science & Engineering (Data Science)**

| |
|---|
| 1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education. |
| 2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002. |
| Reference Books: |
| 1. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited. |
| 2. Graph Theory with Applications to Engineering and Computer Science byNarsinghDeo. |
| Online Learning Resources: |
| http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf |

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### Comuper Science & Engineering (Data Science)

| Course Code | DIGITAL ELECTRONICS & | L | T | P | C |
|---|---|---|---|---|---|
| **20A04304T** | **MICROPROCESSORS** | **3** | **0** | **0** | **3** |
| **Pre-requisite** | **Basic Electronics** | **Semester** | | **III** | |
| | | | | | |

**Course Objectives:**
- To understand all the concepts of Logic Gates and Boolean Functions.
- To learn about Combinational Logic and Sequential Logic Circuits.
- To design logic circuits using Programmable Logic Devices.
- To understand basics of 8086 Microprocessor and 8051 Microcontroller.
- To understand architecture of 8086 Microprocessor and 8051 Microcontroller.
- To learn Assembly Language Programming of 8086 and 8051.

**Course Outcomes (CO):**

After Completion of this course, the student will be able to:
- Design any Logic circuit using basic concepts of Boolean Algebra.
- Design any Logic circuit using basic concepts of PLDs.
- Design and develop any application using 8086 Microprocessor.
- Design and develop any application using 8051 Microcontroller.

| UNIT - I | Number Systems & Code Conversion |
|---|---|

Number Systems & Code conversion, Boolean Algebra & Logic Gates, Truth Tables, Universal Gates, Simplification of Boolean functions, SOP and POS methods – Simplification of Boolean functions using K-maps,Signed and Unsigned Binary Numbers.

| UNIT - II | Combinational Circuits |
|---|---|

Combinational Logic Circuits: Adders &Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Programmable Logic Devices.

| UNIT - III | Sequential Circuits |
|---|---|

Sequential Logic Circuits: RS, Clocked RS, D, JK, Master Slave JK, T Flip-Flops, Shift Registers, Types of Shift Registers, Counters, Ripple Counter, Synchronous Counters, Asynchronous Counters, Up-Down Counter.

| UNIT - IV | Microprocessors - I |
|---|---|

8085 microprocessor Review (brief details only), 8086 microprocessor, Functional Diagram, register organization 8086, Flag register of 8086 and its functions, Addressing modes of 8086, Pin diagram of 8086, Minimum mode & Maximum mode operation of 8086, Interrupts in 8086.

| UNIT – V | Microprocessors - II |
|---|---|

Instruction set of 8086, Assembler directives, Procedures and Macros, Simple programs involving arithmetic, logical, branch instructions, Ascending, Descending and Block move programs, String Manipulation Instructions. Overview of 8051 microcontroller, Architecture, I/O ports and Memory organization, addressing modes and instruction set of 8051(Brief details only), Simple Programs.

**Text Books:**

1.M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers,Oxford Publishers, 2010.
4. Advanced microprocessors and peripherals-A.K Ray and K.M.Bhurchandani, TMH, 2nd edition, 2006.

**Reference Books:**

1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.
4. Kenneth.J.Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning,2010.

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**Comuper Science & Engineering (Data Science)**

| Course Code | Advanced Data Structures & Algorithms | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A05301T** | **(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)** | | **3** | **0** | **0** | **3** |
| **Pre-requisite** | **Data Structures** | **Semester** | | **III** | | |

**Course Objectives:**

- Learn asymptotic notations, and analyze the performance of different algorithms.
- Understand and implement various data structures.
- Learn and implement greedy, divide and conquer, dynamic programming and backtracking algorithms using relevant data structures.
- Understand non-deterministic algorithms, polynomial and non-polynomial problems.

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Analyze the complexity of algorithms and apply asymptotic notations.
- Apply non-linear data structures and their operations.
- Understand and apply greedy, divide and conquer algorithms.
- Develop dynamic programming algorithms for various real-time applications.
- Illustrate Backtracking algorithms for various applications.

| UNIT - I | **Introduction to Algorithms** | 9 Hrs |
|---|---|---|

**Introduction to Algorithms:**
Algorithms, Pseudocode for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh, Omega, Theta notation and Little oh notation, Polynomial Vs Exponential Algorithms, Average, Best and Worst Case Complexities, Analysing Recursive Programs.

| UNIT - II | **Trees Part-I** | 8 Hrs |
|---|---|---|

**Trees Part-I**
**Binary Search Trees:** Definition and Operations, AVL Trees: Definition and Operations, Applications.
**B Trees:** Definition and Operations.

| UNIT - III | **Trees Part-II** | 8 Hrs |
|---|---|---|

**Trees Part-II**
Red-Black Trees, Splay Trees, Applications.
**Hash Tables:** Introduction, Hash Structure, Hash functions, Linear Open Addressing, Chaining and Applications.

| UNIT - IV | **Divide and conquer, Greedy method** | 9 Hrs |
|---|---|---|

**Divide and conquer:** General method, applications-Binary search, Finding Maximum and minimum, Quick sort, Merge sort, Strassen's matrix multiplication.
**Greedy method**: General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

| UNIT - V | **Dynamic Programming & Backtracking** | 9 Hrs |
|---|---|---|

**Dynamic Programming**: General method, applications- 0/1 knapsack problem, All pairs shortest path problem, Travelling salesperson problem, Reliability design.
**Backtracking**: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.
**Introduction to NP-Hard and NP-Complete problems**: Basic Concepts.

Textbooks:

1. Data Structures and algorithms: Concepts, Techniques and Applications, G A V Pai.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni and Rajasekharam, Galgotia publications Pvt. Ltd.

Reference Books:

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| |
|---|
| 1. Classic Data Structures by D. Samanta, 2005, PHI |
| 2. Design and Analysis of Computer Algorithms by Aho, Hopcraft, Ullman 1998, PEA. |
| 3. Introduction to the Design and Analysis of Algorithms by Goodman, Hedetniemi, TMG. |
| Online Learning Resources: |
| https://www.tutorialspoint.com/advanced_data_structures/index.asp<br>http://peterindia.net/Algorithms.html |

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**Comuper Science & Engineering (Data Science)**

| Course Code | Computer Organization | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A05303** | **(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)** | | **3** | **0** | **0** | **3** |
| **Pre-requisite** | **Digital Electronics** | **Semester** | | **III** | | |

**Course Objectives:**
- To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design
- To understand the structure and behavior of various functional modules of a computer.
- To learn the techniques that computers use to communicate with I/O devices
- To acquire the concept of pipelining and exploitation of processing speed.
- To learn the basic characteristics of multiprocessors

**Course Outcomes (CO):**

After completion of the course, students will be able to
- Understand computer architecture concepts related to the design of modern processors, memories and I/Os
- Identify the hardware requirements for cache memory and virtual memory
- Design algorithms to exploit pipelining and multiprocessors
- Understand the importance and trade-offs of different types of memories.
- Identify pipeline hazards and possible solutions to those hazards

| UNIT - I | **Basic Structure of Computer, Machine Instructions and Programs** | 8Hrs |
|---|---|---|

**Basic Structure of Computer**: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.
**Machine Instructions and Programs**: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.

| UNIT - II | **Arithmetic, Basic Processing Unit** | 9Hrs |
|---|---|---|

**Arithmetic**: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.
**Basic Processing Unit:** Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, and Multi programmed Control.

| UNIT - III | **The Memory System** | 8Hrs |
|---|---|---|

**The Memory System:** Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

| UNIT - IV | **Input/Output Organization** | 8Hrs |
|---|---|---|

**Input/Output Organization:** Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

| UNIT - V | **Pipelining, Large Computer Systems** | 9 Hrs |
|---|---|---|

**Pipelining:** Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets.
**Large Computer Systems:** Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.

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**Comuper Science & Engineering (Data Science)**

| |
|---|
| **Textbooks:** |
| 1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGraw Hill Education, 2013. |
| **Reference Books:** |
| 1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.<br>2. Themes and Variations, Alan Clements, "Computer Organization and Architecture", CENGAGE Learning.<br>3. SmrutiRanjanSarangi, "Computer Organization and Architecture", McGraw Hill Education.<br>4. John P.Hayes, "Computer Architecture and Organization", McGraw Hill Education |
| **Online Learning Resources:** |
| https://nptel.ac.in/courses/106/103/106103068/ |

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**Comuper Science & Engineering (Data Science)**

| Course Code | Advanced Python Programming for Data Science | L | T | P | C |
|---|---|---|---|---|---|
| 20A32301T | | 3 | 0 | 0 | 3 |
| Pre-requisite | Basics of Python Programming | Semester | III | | |
| | | | | | |

| Course Objectives: |
|---|
| The main objective of this course is to help students learn, understand, and practice dataanalytics using python, which include the study of modern computingbig data technologies and scaling up machine learning techniques focusing on industryapplications. Mainly the course objectives are conceptualization and summarization of data |

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Write relatively advanced, well structured, computer programs in Python
- Gain familiarity with principles and techniques for optimizing the performance of numeric applications
- Understand parallel computing and how parallel applications can be written in Python
- Experiment with developing GPU accelerated Python applications
- Learn the fundamentals of the most widely used Python packages; including NumPy, Pandas and Matplotlib
- Apply programming concepts in Data Analysis and Data Visualization projects

| UNIT - I | **The Role of Python in Data Science** | 9 Hrs |
|---|---|---|
| Introduction- Creating the Data Science Pipeline, Understanding Python's Role in Data Science, Learning to Use Python Fast, Setting Up Python for Data Science, Reviewing Basic Python |||

| UNIT - II | **Conditioning and Working with Real Data** | 10 Hrs |
|---|---|---|
| Uploading, Streaming, and Sampling Data, Accessing Data in Structured Flat-File Form, Sending Data in Unstructured File Form, Managing Data from Relational Databases, Interacting with Data from NoSQL Databases, Accessing Data from the Web,NumPy and pandas, Validating Your Data, Manipulating Categorical Variables, Dealing with Dates in Your Data, Slicing and Dicing: Filtering and Selecting Data, Aggregating Data at Any Level |||

| UNIT - III | **Shaping and Performing Action on Data** | 09 Hrs |
|---|---|---|
| Working with HTML Pages, Working with Raw Text, Using the Bag of Words Model and Beyond, Working with Graph Data, Contextualizing Problems and Data, Considering the Art of Feature Creation, Performing Operations on Arrays |||

| UNIT - IV | **MatPlotLib and Visualization of Data** | 09 Hrs |
|---|---|---|
| Starting with a Graph, Setting the Axis, Ticks, Grids, Defining the Line Appearance, Using Labels, Annotations, and Legends, Choosing the Right Graph, Creating Advanced Scatterplots, Plotting Time Series, Plotting Geographical Data, Visualizing Graphs |||

| UNIT - V | **Wrangling Data** | 09 Hrs |
|---|---|---|
| Playing with Scikit-learn, Performing the Hashing Trick, Considering Timing and Performance, Running in Parallel, Counting for Categorical Data, Understanding Correlation, Modifying Data Distributions, Reducing Dimensionality, Clustering, Detecting Outliers in Data |||

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| Textbooks: | |
|---|---|
| 1. | Python for Data Science for Dummies, 2ed, Luca Massaron John Paul Mueller, by ISBN: 978-1-118-84418-2 |
| Reference Books: | |
| 1. | Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Pearson; 2 edition (January 26, 2003), ISBN 978-0201648652 |
| 2. | Big Data: Principles and best practices of scalable realtime data systems, 1st Edition, Nathan Marz, James Warren, ISBN 978-1617290343 |

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**Comuper Science & Engineering (Data Science)**

| Course Code | DIGITAL ELECTRONICS & | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20a04304P** | **MICROPROCESSORS LAB** | | **0** | **0** | **3** | **1.5** |
| **Pre-requisite** | Basic Electronics Engineering | **Semester** | | **III** | | |

**Course Objectives:**
- To understand all the concepts of Logic Gates and Boolean Functions.
- To learn about Combinational Logic and Sequential Logic Circuits.
- To design logic circuits using Programmable Logic Devices.
- To understand basics of 8086 Microprocessor and 8051 Microcontroller.
- To understand architecture of 8086 Microprocessor and 8051 Microcontroller.
- To learn Assembly Language Programming of 8086 and 8051.

**Course Outcomes (CO):**
After Completion of this course, the student will be able to:
- Design any Logic circuit using basic concepts of Boolean Algebra.
- Design any Logic circuit using basic concepts of PLDs.
- Design and develop any application using 8086 Microprocessor.
- Design and develop any application using 8051 Microcontroller.

**List of Experiments:**

Note: Minimum of 12 (6+6) experiments shall be conducted from both the sections
given below:

**DIGITAL ELECTRONICS:**

    1. Verification of Truth Table for AND, OR, NOT, NAND, NOR
and EX-OR gates.
    2. Realisation of NOT, AND, OR, EX-OR gates with only NAND
and only NOR gates.
    3. Karnaughmap Reduction and Logic Circuit Implementation.
    4. Verification of DeMorgan's Laws.
    5. Implementation of Half-Adder and Half-Subtractor.
    6. Implementation of Full-Adder and Full-Subtractor.
    7. Four Bit Binary Adder
    8. Four Bit Binary Subtractor using 1's and 2's Complement.

**MICROPROCESSORS (8086 Assembly Language Programming)**

    1. 8 Bit Addition and Subtraction.
    2. 16 Bit Addition.
    3. BCD Addition .
    4. BCD Subtraction.
    5. 8 Bit Multiplication.
    6. 8 Bit Division.
    7. Searching for an Element in an Array.
    8. Sorting in Ascending and Descending Orders.
    9. Finding Largest and Smallest Elements from an Array.
10. Block Move

**Text Books:**

1.M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013.
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd.,
   2007.

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3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers,Oxford Publishers, 2010.
4. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition, 2006.

**Reference Books:**

1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.
4. Kenneth. J. Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning, 2010.

Online learning Resources/Virtual labs

https://www.vlab.co.in

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**Comuper Science & Engineering (Data Science)**

| Course Code | Advanced Data Structures and Algorithms Lab | L | T | P | C |
|---|---|---|---|---|---|
| 20A05301P | (Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and  AI & DS) | 0 | 0 | 3 | 1.5 |
| Pre-requisite | Basics of Data Structures | Semester | | III | |

**Course Objectives:**
- Learn data structures for various applications.
- Implement different operations of data structures by optimizing the performance.
- Develop applications using Greedy, Divide and Conquer, dynamic programming.
- Implement applications for backtracking algorithms using relevant data structures.

**Course Outcomes (CO):**
After completion of the course, students will be able to
- Understand and apply data structure operations.
- Understand and apply non-linear data structure operations.
- Apply Greedy, divide and conquer algorithms.
- Develop dynamic programming algorithms for various real-time applications.
- Illustrate and apply backtracking algorithms, further able to understand non-deterministic algorithms.

**List of Experiments:**
1. Write a program to implement the following operations on Binary Search Tree:
a) Insert                    b) Delete                    c) Search                    d) Display
2. Write a program to perform a Binary Search for a given set of integer values.
3. Write a program to implement Splay trees.
4. Write a program to implement Merge sort for the given list of integer values.
5. Write a program to implement Quicksort for the given list of integer values.
6. Write a program to find the solution for the knapsack problem using the greedy method.
7. Write a program to find minimum cost spanning tree using Prim's algorithm
8. Write a program to find minimum cost spanning tree using Kruskal's algorithm
9. Write a program to find a single source shortest path for a given graph.
10. Write a program to find the solution for job sequencing with deadlines problems.
11. Write a program to find the solution for a 0-1 knapsack problem using dynamic programming.
12. Write a program to solve Sum of subsets problem for a given set of distinct numbers using backtracking.
13. Implement N Queen's problem using Back Tracking.

References:

1. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers,2017.
3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.

Online Learning Resources/Virtual Labs:

http://cse01-iiith.vlabs.ac.in/
http://peterindia.net/Algorithms.html

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**Comuper Science & Engineering (Data Science)**

| Course Code | Advanced Python Programming for Data Science Lab | L | T | P | C |
|---|---|---|---|---|---|
| 20A32301P | | 0 | 0 | 3 | 1.5 |
| Pre-requisite | | Semester | III | | |

| | |
|---|---|

**Course Objectives:**

- Understand the python Programming Language libraries.
- Exposure on Solving of data science problems.
- Understand The classification and Regression Model.

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Apply principles and techniques for optimizing the performance of Python numeric applications
- Implementparallel computing applications using Python
- Develop GPU accelerated Python applications

**List of Experiments:**

| | |
|---|---|
| W-1 | The number of birds banded at a series of sampling sites has been counted by your field crew and entered into the following list. The first item in each sublist is an alphanumeric code for the site and the second value is the number of birds banded. Cut and paste the list into your assignment and then answer the following questions by printing them to the screen. <br><br> data = [['A1', 28], ['A2', 32], ['A3', 1], ['A4', 0], <br>  ['A5', 10], ['A6', 22], ['A7', 30], ['A8', 19], <br>      ['B1', 145], ['B2', 27], ['B3', 36], ['B4', 25], <br>      ['B5', 9], ['B6', 38], ['B7', 21], ['B8', 12], <br>      ['C1', 122], ['C2', 87], ['C3', 36], ['C4', 3], <br>      ['D1', 0], ['D2', 5], ['D3', 55], ['D4', 62], <br>      ['D5', 98], ['D6', 32]] <br> 1. How many sites are there? <br> 2. How many birds were counted at the 7th site? <br> 3. How many birds were counted at the last site? <br> 4. What is the total number of birds counted across all sites? <br> 5. What is the average number of birds seen on a site? <br> 6. What is the total number of birds counted on sites with codes beginning with C? (don't just identify this site by eye, in the real world there could be hundreds or thousands of sites) |
| W-2 | 1. Multiplication of two Matrices in Single line using Numpy in Python <br> 2. Transpose a matrix in Single line using Python <br> 3. Python program to print checkerboard pattern of nxn using numpy |
| W-3 | Reading different types of data sets (.txt, .csv) fromWeb and disk and writing in file in specific disk location. <br> Reading Excel data sheet |

**R 20 Regulations**

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| | |
|---|---|
| | Reading XML dataset |
| W-4 | 1. Find the data distributions using box and scatter plot.<br>2. Find the outliers using plot.<br>3. Plot the histogram, bar chart and pie chart on sample data |
| W-5 | 1. Find the correlation matrix.<br>2. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.<br>3. Analysis of covariance: variance (ANOVA), if data have categoricalvariables on iris data. |
| W-6 | Import a data from web storage. Name the dataset and now do LogisticRegression to find out relation between variables that are affecting theadmission of a student in a institute based on his or her GRE score,GPA obtained and rank of the student. Also check the model is fit ornot. Require (foreign), require (MASS). |
| w-7 | Decision Tree Classification, attribute selection measures, and how to build and optimize Decision Tree Classifier using Python Scikit-learn |
| W-8 | Apply multiple regressions, if data have a continuousindependent variable. Apply on above dataset. |
| W-9 | Apply regression Model techniques to predict the data |
| W-10 | 1. Install relevant package for classification.<br>2. Choose classifier for classification problem.<br>3. Evaluate the performance of classifier. |
| W-11 | Clustering algorithms for unsupervised classification.<br>Plot the cluster data using python with Matplotlib visualizations. |
| W-12 | **Case Study: Data Science in Education**<br>Data Science has also changed the way in which students interact with teachers and evaluate their performance. Instructors can use data science to analyse the feedback received from the students and use it to improve their teaching.<br>Use Predictive modeling Data Science that can predict the drop-out rate of students based on their performance and inform the instructors to take necessary precautions. |

References:
1. https://www.w3schools.com/datascience/
2. https://data-flair.training/blogs/data-science-tutorials-home/
3. https://www.javatpoint.com/data-science
4. https://www.tutorialspoint.com/python_data_science/index.htm
5. https://intellipaat.com/blog/tutorial/data-science-tutorial/

Online learning Resources/Virtual labs

https://www.vlab.co.in

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**Comuper Science & Engineering (Data Science)**

| Course Code | Working with Hadoop | | L | T | P | C |
|---|---|---|---|---|---|---|
| 20A32302 | | | 1 | 0 | 2 | 2 |
| Pre-requisite | NIL | Semester | III | | | |

| |
|---|

**Course Objectives:**

This skill course is **designed to provide knowledge and skills to become a successful Hadoop Developer**. In depth knowledge of concepts such as Hadoop Distributed File System, Hadoop Cluster – Single and multi-node, Hadoop 2.0, Map–Reduce etc.

**Course Outcomes (CO):**

After the completion of the course, the students will be able to analyse and work upon voluminous data on Hadoop platform of any organization from various perspectives and will be able to develop reports and trends may be seen and decisions with regards to business activities running in organizations may be taken.

**List of Experiments:**

Suggested topics learning:

- Basic Linux Commands, understanding how to connect to remote Linux server using putty kind of tool; Understanding VMware player setup and configuring Cloudera Bundle using player; Basic HDFS commands. HDFS commands in detail; Hadoop File System navigation and manipulation using commands.
- MapReduce Job submission to Hadoop Cluster from command line; WordCount MapReduce Job Development using eclipse IDE, packing and testing
- Using pig grunt shell; practicing pig commands from grunt shell. Writing pig scripts and running them. Processing different datasets using pig.

Tentative List of Experiments:

- Installation of Single Node Hadoop Cluster on Ubuntu 14.04.;
- Installation of Single Node Hadoop Cluster on Ubuntu.
- Hadoop Programming: Word Count MapReduce Program Using Eclipse.
- Implementing Matrix Multiplication Using One Map-Reduce Step. Implementing Relational Algorithm on Pig.
- Implementing database operations on Hive.
- Implementing Bloom Filter using Map-Reduce. Implementing Frequent Item set algorithm using Map-Reduce.
- Implementing Clustering algorithm using Map-Reduce.
- Implementing Page Rank algorithm using Map-Reduce.

References:

1. Mayank Bhushan , "Big Data and Hadoop – learn by Example", BPB publication 2018.
2. Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
3. Seema Acharya, Subhashini Chellappan, "Big Data Analytics" Wiley 2015.

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**Comuper Science & Engineering (Data Science)**

| Course Code | ENVIRONMENTAL SCIENCE | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A99201** | (Common to All Branches of Engineering) | | **3** | **0** | **0** | **0** |
| **Pre-requisite** | **NIL** | **Semester** | **III** | | | |

**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.

**Course Outcomes (CO):**

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.

| UNIT - I | | 8 Hrs |
|---|---|---|

**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 | | 12 Hrs |
|---|---|---|

**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.

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| UNIT - III | | 8 Hrs |
|---|---|---|

**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 | | 10 Hrs |
|---|---|---|

**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 | | 8 Hrs |
|---|---|---|

**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..

| **Textbooks:** |
|---|

  1.    Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.
  2.    Palaniswamy, "Environmental Studies", Pearson education
  3.    S.AzeemUnnisa, "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.

| **Reference Books:** |
|---|

  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.

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**Comuper Science & Engineering (Data Science)**

| Course Code | Statistical Methods for Data Science | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A54405** | **CSE (Data Science)** | | **3** | **0** | **0** | **3** |
| **Pre-requisite** | | **Semester** | **IV** | | | |

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**Course Objectives:**

This course aims at providing knowledge on basic concepts of Statistics, Estimation and testing of hypotheses for large and small samples.

**Course Outcomes (CO):** Student will be able to

- Understand the basic concepts of Statistics
- Analyze data and draw conclusion about collection of data under study using Point estimation
- Analyze data and draw conclusion about collection of data under study using Interval estimation
- Analyzing the tests and types of errors for large samples
- Apply testing of hypothesis for small samples.

| UNIT - I | Basic Concepts | 9 Hrs |
|---|---|---|

Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency – Factorization Theorem – Minimal sufficiency; Efficiency – Most efficient estimator, likelihood equivalence, Uniformly minimum variance unbiased estimator,applications of Lehmann-Scheffe's Theorem, Rao - Blackwell Theorem and applications

| UNIT - II | Point Estimation | 8 Hrs |
|---|---|---|

Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator(without proof)- applications , Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.

| UNIT - III | Interval Estimation | 8 Hrs |
|---|---|---|

Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.

| UNIT - IV | Testing of hypotheses | 9 Hrs |
|---|---|---|

Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.

| UNIT - V | Small sample tests | 9 Hrs |
|---|---|---|

Student's t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances,CRD,RBD,LSD; Chi-square test for goodness of fit and test for independence of attributes, $\chi2$ test for testing variance of a normal distribution

Sign test, Signed rank test, Median test, Mann-Whitney test, Run test and One sample Kolmogorov – Smirnov test ,Kruskal – Wallis H test(Description, properties and applications only).

**Textbooks:**

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| |
|---|
| 1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014. |
| 2. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference,9th edition,Pearson publishers,2013. |
| **Reference Books:** |
| 1. S.P.Gupta, Statistical Methods, 33rd Edition, Sultan Chand & Sons. |
| 2. Miller and John E Freund, Probability and Statistics for Engineers, 5th Edition. |
| **Online Learning Resources:** |
| 1. https://www.statstutor.ac.uk/resources/uploaded/1introduction3.pdf |
| 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996198/ |

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**Comuper Science & Engineering (Data Science)**

| Course Code | DATABASE MANAGEMENT SYSTEMS (Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and  AI & DS) | | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| **20A05401T** | | | | **3** | **0** | **0** | **3** |
| **Pre-requisite** | **NIL** | | **Semester** | | **IV** | | |

**Course Objectives:**

This course is designed to:
- Train in the fundamental concepts of database management systems, database modeling and design, SQL, PL/SQL and system implementation techniques.
- Enable students to model ER diagrams for any customized application
- Inducting appropriate strategies for optimization of queries.
- Provide knowledge on concurrency techniques
- Demonstrate the organization of Databases

**Course Outcomes (CO):**

After completion of the course, students will be able to
- Design a database for a real-world information system
- Define transactions that preserve the integrity of the database
- Generate tables for a database
- Organize the data to prevent redundancy
- Pose queries to retrieve the information from the database.

| UNIT - I | **Introduction, Introduction to Relational Model** | 9Hrs |
|---|---|---|

**Introduction:** Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators,
**Introduction to Relational Model:** Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations

| UNIT - II | **Introduction to SQL, Advanced SQL** | 9 Hrs |
|---|---|---|

**Introduction to SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL**:** Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.
**Advanced SQL:** Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.

| UNIT - III | **Database Design and the E-R Model, Relational Database Design** | 8Hrs |
|---|---|---|

**Database Design and the E-R Model:** Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.
**Relational Database Design**:
Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms.

| UNIT - IV | **Query Processing, Query optimization** | 8 Hrs |
|---|---|---|

**Query Processing:** Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.
**Query optimization**: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

| UNIT - V | **Transaction Management, Concurrency Control, Recovery System** | 10Hrs |
|---|---|---|

**Transaction Management:**Transactions:   Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.

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|---|
| **Concurrency Control:** Lock-based Protocols, Deadlock Handling, Multiple granularity, Timestamp-based Protocols, and Validation-based Protocols. |
| **Recovery System:** Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations. |
| **Textbooks:** |
| 1. A.Silberschatz, H.F.Korth, S.Sudarshan, "Database System Concepts",6/e, TMH 2019 |
| **Reference Books:** |
| 1. Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA |
| 2. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning. |
| 3.Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke,TMH |
| **Online Learning Resources:** |
| https://onlinecourses.nptel.ac.in/noc21_cs04/preview |

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**Comuper Science & Engineering (Data Science)**

| Course Code | OPERATING SYSTEMS | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A05402T** | **(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and  AI & DS)** | | **3** | **0** | **0** | **3** |
| **Pre-requisite** | **Basics of CO and DBMS** | **Semester** | **IV** | | | |

| **Course Objectives:** |
|---|
| The course is designed to<br>• Understand basic concepts and functions of operating systems<br>• Understand the processes, threads and scheduling algorithms.<br>• Provide good insight on various memory management techniques<br>• Expose the students with different techniques of handling deadlocks<br>• Explore the concept of file-system and its implementation issues<br>• Familiarize with the basics of the Linux operating system<br>• Implement various schemes for achieving system protection and security |

| **Course Outcomes (CO):** |
|---|
| After completion of the course, students will be able to<br><br>• Realize how applications interact with the operating system<br><br>• Analyze the functioning of a kernel in an Operating system.<br><br>• Summarize resource management in operating systems<br><br>• Analyze various scheduling algorithms<br><br>• Examine concurrency mechanism in Operating Systems<br><br>• Apply memory management techniques in the design of operating systems<br><br>• Understand the functionality of the file system<br><br>• Compare and contrast memory management techniques.<br><br>• Understand deadlock prevention and avoidance.<br><br>• Perform administrative tasks on Linux based systems. |

| UNIT - I | **Operating Systems Overview, System Structures** | 8Hrs |
|---|---|---|
| **Operating Systems Overview**: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems<br>**System Structures**: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot. | | |
| UNIT - II | **Process Concept, Multithreaded Programming,Process Scheduling, Inter-process Communication** | 10Hrs |
| **Process Concept**: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems.<br>**Multithreaded Programming**: Multithreading models, Thread libraries, Threading issues, Examples.<br>**Process Scheduling**: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.<br>**Inter-process Communication**: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem. | | |
| UNIT - III | **Memory-Management Strategies, Virtual Memory Management** | Lecture 8Hrs |
| **Memory-Management Strategies**: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples.<br>**Virtual Memory Management**: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples. | | |
| UNIT - IV | **Deadlocks, File Systems** | Lecture 9Hrs |

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**Deadlocks**: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention.

**File Systems**: Files, Directories, File system implementation, management and optimization.

Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

| UNIT - V | **System Protection, System Security** | Lecture 8Hrs |
|---|---|---|

**System Protection**: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.

**System Security**: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification.

Case Studies: Linux, Microsoft Windows.

**Textbooks:**

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008.

(Topics: Inter-process Communication and File systems.)

**Reference Books:**

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

**Online Learning Resources:**

https://nptel.ac.in/courses/106/106/106106144/
http://peterindia.net/OperatingSystems.html

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**Comuper Science & Engineering (Data Science)**

| Course Code | Software Engineering | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A05403T** | **(Common to CSE, IT, CSE( DS), CSE (IoT))** | | **3** | **0** | **0** | **3** |
| **Pre-requisite** | | **Semester** | | **IV** | | |

**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** | 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** | 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** | 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** | 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** | 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:**

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| |
|---|
| 1.  Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.<br>2.  Pressman R, "Software Engineering- Practioner Approach", McGraw Hill. |
| **Reference Books:** |
| 1.  Somerville, "Software Engineering", Pearson 2.<br>2.  Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill.<br>3.  JalotePankaj, "An integrated approach to Software Engineering", Narosa |
| **Online Learning Resources:** |
| https://nptel.ac.in/courses/106/105/106105182/<br>http://peterindia.net/SoftwareDevelopment.html |

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| Course Code | MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to All branches of Engineering) | | L | T | P | C |
|---|---|---|---|---|---|---|
| 20A52301 | | | 3 | 0 | 0 | 3 |
| Pre-requisite | NIL | Semester | | III | | |

**Course Objectives:**
- 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 structure and pricing methods and strategy
- 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

**Course Outcomes (CO):**
- Define the concepts related to Managerial Economics, financial accounting and management.
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
- Apply the Concept of Production cost and revenues for effective Business decision
- Analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Develop the accounting statements and evaluate the financial performance of business entity.

| UNIT - I | **Managerial Economics** |
|---|---|

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 | **Production and Cost Analysis** |
|---|---|

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 | **Business Organizations and Markets** |
|---|---|

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 | **Capital Budgeting** |
|---|---|

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)

| UNIT - V | **Financial Accounting and Analysis** |
|---|---|

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit

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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.

**Textbooks:**
1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

**Reference Books:**
1. Ahuja Hl Managerial economics Schand,3/e,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, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

**Online Learning Resources:**
**https://www.slideshare.net/123ps/managerial-economics-ppt**
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting

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| Course Code | ORGANISATIONAL BEHAVIOUR | | L | T | P | C |
|---|---|---|---|---|---|---|
| 20A52302 | (Common to All branches of Engineering) | | 3 | 0 | 0 | 3 |
| Pre-requisite | NIL | Semester | | III | | |

| | |
|---|---|
| **Course Objectives:** | |

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To Impart knowledge about group dynamics
- To make them understand the importance of change and development

**Course Outcomes (CO):**

- Define the Organizational Behaviour, its nature and scope.
- Understand the nature and concept of Organizational behaviour
- Apply theories of motivation to analyse the performance problems
- Analyse the different theories of leadership
- Evaluate group dynamics
- Develop as powerful leader

| UNIT - I | **Introduction to Organizational Behavior** |
|---|---|

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.

| UNIT - II | **Motivation and Leading** |
|---|---|

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland'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 | **Organizational Culture** |
|---|---|

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 | **Group Dynamics** |
|---|---|

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 | **Organizational Change and Development** |
|---|---|

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

**Textbooks:**

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011
2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017

**Reference Books:**

- McShane, Organizational Behaviour, TMH 2009
- Nelson, Organisational Behaviour, Thomson, 2009.
- Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009.
- Aswathappa, Organisational Behaviour, Himalaya, 2009

**Online Learning Resources:**

httphttps://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**

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| Course Code | Business Environment | | L | T | P | C |
|---|---|---|---|---|---|---|
| 20A52303 | (Common to All branches of Engineering) | | 3 | 0 | 0 | 3 |
| Pre-requisite | NIL | Semester | | III | | |
| | | | | | | |

**Course Objectives:**
- To make the student to understand about the business environment
- To enable them in knowing the importance of fiscal and monitory policy
- To facilitate them in understanding the export policy of the country
- To Impart knowledge about the functioning and role of WTO
- To Encourage the student in knowing the structure of stock markets

**Course Outcomes (CO):**
- Define Business Environment and its Importance.
- Understand various types of business environment.
- Apply the knowledge of Money markets in future investment
- Analyse India's Trade Policy
- Evaluate fiscal and monitory policy
- Develop a personal synthesis and approach for identifying business opportunities

| UNIT - I | **Overview of Business Environment** |
|---|---|

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 | **Fiscal & Monetary Policy** |
|---|---|

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 | **India's Trade Policy** |
|---|---|

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 | **World Trade Organization** |
|---|---|

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 | **Money Markets and Capital Markets** |
|---|---|

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.

**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.HPH2016

**Reference Books:**

**R 20 Regulations**

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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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| Course Code | Database Management Systems Lab | L | T | P | C |
|---|---|---|---|---|---|
| **20A05401P** | **(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and  AI & DS)** | **0** | **0** | **3** | **1.5** |
| **Pre-requisite** | | **Semester** | | **IV** | |

**Course Objectives:**
- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors usingPL/SQL.
- To design and implementation of a database for an organization

**Course Outcomes (CO):**

After completion of the course, students will be able to
- Design database for any real world problem
- Implement PL/SQL programs
- Define SQL queries
- Decide the constraints
- Investigate for data inconsistency

**List of Experiments:**

### Week-1: CREATION OF TABLES

1. Create a table called Employee with the following structure.

| Name | Type |
|---|---|
| Empno | Number |
| Ename | Varchar2(20) |
| Job | Varchar2(20) |
| Mgr | Number |
| Sal | Number |

   a. Add a column commission with domain to the Employee table.
   b. Insert any five records into the table.
   c. Update the column details of job
   d. Rename the column of Employ table using alter command.
   e. Delete the employee whose empno is19.

2. Create department table with the following structure.

| Name | Type |
|---|---|
| Deptno | Number |
| Deptname | Varchar2(20) |
| location | Varchar2(20) |

   a. Add column designation to the department table.
   b. Insert values into thetable.
   c. List the records of emp table grouped bydeptno.
   d. Update the record where deptno is9.
   e. Delete any column data from thetable

3. Create a table called Customertable

| Name | Type |
|---|---|

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| Cust name | Varchar2(20) |
|---|---|
| Cust street | Varchar2(20) |
| Cust city | Varchar2(20) |

    a. Insert records into thetable.
    b. Add salary column to thetable.
    c. Alter the table columndomain.
    d. Drop salary column of the customertable.
    e. Delete the rows of customer table whose ust_city is 'hyd'.
    f. Create a table called branchtable.

| Name | Type |
|---|---|
| Branch name | Varchar2(20) |
| Branch city | Varchar2(20) |
| asserts | Number |

4. Increase the size of data type for asserts to the branch.
    a. Add and drop a column to the branch table.
    b. Insert values to the table.
    c. Update the branch name column
    d. Delete any two columns from the table
5. Create a table called sailor table

| Name | Type |
|---|---|
| Sid | Number |
| Sname | Varchar2(20) |
| rating | Varchar2(20) |

    a. Add column age to the sailor table.
    b. Insert values into the sailor table.
    c. Delete the row with rating>8.
    d. Update the column details of sailor.
    e. Insert null values into the table.
6. Create a table called reserves table

| Name | Type |
|---|---|
| Boat id | Integer |
| sid | Integer |
| day | Integer |
|  |  |

    a. Insert values into the reservestable.
    b. Add column time to the reservestable.
    c. Alter the column day data type todate.
    d. Drop the column time in thetable.
    e. Delete the row of the table with somecondition.

**Week-2: QUERIES USING DDL AND DML**

1. a. Create a user and grant all permissions to theuser.
    b. Insert the any three records in the employee table and use rollback. Check theresult.
    c. Add primary key constraint and not null constraint to the employeetable.
    d. Insert null values to the employee table and verify theresult.
2. a. Create a user and grant all permissions to theuser.

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     b. Insert values in the department table and usecommit.

     c. Add constraints like unique and not null to the departmenttable.

     d. Insert repeated values and null values into thetable.

3.   a. Create a user and grant all permissions to theuser.

     b. Insert values into the table and use commit.

     c. Delete any three records in the department table and use rollback.

     d. Add constraint primary key and foreign key to thetable.

4.   a. Create a user and grant all permissions to theuser.

     b. Insert records in the sailor table and usecommit.

     c. Add save point after insertion of records and verify save point.

     d. Add constraints not null and primary key to the sailortable.

5.   a. Create a user and grant all permissions to theuser.

     b. Use revoke command to remove userpermissions.

     c. Change password of the usercreated.

     d. Add constraint foreign key and notnull.

6.   a. Create a user and grant all permissions to theuser.

     b. Update the table reserves and use savepointandrollback.

     **c.** Add constraint primary key , foreign key and not null to the reserves table

     **d.** Delete constraint not null to the tablecolumn

## Week-3:QUERIES USING AGGREGATE FUNCTIONS

1.   a. By using the group by clause, display the enames who belongs to deptno 10 alongwithaveragesalary.

     b. Display lowest paid employee details under eachdepartment.

     c. Display number of employees working in each department and their departmentnumber.

     d. Using built in functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above.

     e. List all employees which start with either B or C.

     f. Display only these ename of employees where the maximum salary is greater than or equalto 5000.

2.   a. Calculate the average salary for each differentjob.

     b. Show the average salary of each job excludingmanager.

     c. Show the average salary for all departments employing more than threepeople.

     d. Display employees who earn more than thelowest salary in department 30

     e. Show that value returned by sign (n)function.

     f. How many days between day of birth to currentdate

3.   a. Show that two substring as singlestring.

     b. List all employee names, salary and 15% rise insalary.

     c. Display lowest paid emp details under eachmanager

     d. Display the average monthly salary bill for eachdeptno.

     e. Show the average salary for all departments employing more than twopeople.

     f. By using the group by clause, display the eid who belongs to deptno 05 along withaverage salary.

4.   a. Count the number of employees in department20

     b. Find the minimum salary earned byclerk.

     c. Find minimum, maximum, average salary of allemployees.

     d. List the minimum and maximum salaries for each jobtype.

     e. List the employee names in descendingorder.

     f. List the employee id, names in ascending order byempid.

5.   a. Find the sids ,names of sailors who have reserved all boats called"INTERLAKE

     Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors.

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b. Find the sname , bid and reservation date for eachreservation.

c. Find the ages of sailors whose name begin and end with B and has at least 3characters.

d. List in alphabetic order all sailors who have reserved redboat.

e. Find the age of youngest sailor for each ratinglevel.

6. a. List the Vendors who have delivered products within 6 months from orderdate.

 b. Display the Vendor details who have supplied both Assembled and Subparts.

 c. Display the Sub parts by grouping the Vendor type (Local or NonLocal).

 d. Display the Vendor details in ascendingorder.

 e. Display the Sub part which costs more than any of the Assembledparts.

 f. Display the second maximum cost Assembledpart

## Week-4:  PROGRAMS ON PL/SQL

1. a. Write a PL/SQL program to swaptwonumbers.
   b. Write a PL/SQL program to find the largest of threenumbers.
2. a. Write a PL/SQL program to find the total and average of 6 subjects and display thegrade.
   b. Write a PL/SQL program to find the sum of digits in a givennumber.
3. a. Write a PL/SQL program to display the number in reverseorder.
   b. Writea PL/SQLprogramtocheckwhetherthegivennumberisprimeornot.
4. a. Write a PL/SQL program to find the factorial of a givennumber.
   b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius andarea.
5. a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When 'hello' passed to the program it should display 'Hll' removing e and o from the worldHello).
   b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainderin words.

## Week-5: PROCEDURES AND FUNCTIONS

1. Write a function to accept employee number as parameter and return Basic +HRA together as single column.
2. Accept year as parameter and write a Function to return the total net salary spent for a givenyear.
3. Create a function to find the factorial of a given number and hence findNCR.
4. Write a PL/SQL block o pint prime Fibonacci series using localfunctions.
5. Create a procedure to find the lucky number of a given birthdate.
6. Create function to the reverse of givennumber

## Week-6: TRIGGERS

1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and newvalues:

CUSTOMERS table:

| ID | NAME | AGE | ADDRESS | SALARY |
|----|------|-----|---------|--------|
| 1 | Alive | 24 | Khammam | 2000 |
| 2 | Bob | 27 | Kadappa | 3000 |
| 3 | Catri | 25 | Guntur | 4000 |
| 4 | Dena | 28 | Hyderabad | 5000 |
| 5 | Eeshwar | 27 | Kurnool | 6000 |
| 6 | Farooq | 28 | Nellore | 7000 |

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2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database.
   Passenger( Passport_ id INTEGER PRIMARY KEY, Name VARCHAR (50) NotNULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) NotNULL);
   a. Write a Insert Trigger to check the Passport_id is exactly six digits ornot.
   b. Write a trigger on passenger to display messages '1 Record is inserted', '1 record is deleted', '1 record is updated' when insertion, deletion and updation are done on passengerrespectively.

3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETEoccurs.

4. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert orupdate.

5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete _emp and also record user who has deleted the record and date and time ofdelete.

6. Create a transparent audit system for a table CUST_MSTR. The system must keep track of the records that are being deleted orupdated

## Week-7:PROCEDURES

1. Create the procedure for palindrome of givennumber.
2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD isfound.
3. Write the PL/SQL programs to create the procedure for factorial of givennumber.
4. Write the PL/SQL programs to create the procedure to find sum of N naturalnumber.
5. Write the PL/SQL programs to create the procedure to find Fibonacciseries.
6. Write the PL/SQL programs to create the procedure to check the given number is perfect ornot

## Week-8: CURSORS

1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paidemployees.
2. Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item mastertable.
3. Write a PL/SQL block that will display the employee details along with salary usingcursors.
4. To write a Cursor to display the list of employees who are working as a ManagersorAnalyst.
5. To write a Cursor to find employee with given job anddeptno.
6. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the 'employee' table are updated. If none of the employee's salary are updated we getamessage 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in 'employee' table

## Week-9: CASE STUDY: BOOK PUBLISHING COMPANY

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A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications.

A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do thefollowing:

1. Analyze the datarequired.
2. Normalize theattributes.

Create the logical data model using E-R diagrams

## Week-10: CASE STUDY GENERAL HOSPITAL

AGeneralHospitalconsistsofanumberofspecializedwards(suchasMaternity,Pediatric,Oncology, etc.). Each ward hosts a number of patients, who were admitted on the recommendation of their ownGP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following.

1. Analyze the datarequired.
2. Normalize theattributes.

Create the logical data model using E-R diagrams

## Week-11: CASE STUDY: CAR RENTAL COMPANY

A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special creditcard facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do thefollowing:

1. Analyze the datarequired.
2. Normalize theattributes.

Create the logical data model using E-R diagrams

## Week-12: CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM

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A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons.) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programs have compulsory modules. The database is also to contain some information about studentsincludingtheirnumbers,names,addresses,degreestheyreadfor,andtheirpastperformance i.e. modules taken and examination results. For the above case study, do the following:

1. Analyze the datarequired.
2. Normalize theattributes.
3. Create the logical data model i.e., ERdiagrams.
4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys whereverrequired.
5. Insert values into the tables created (Be vigilant about Master- Slavetables).
6. Display the Students who have taken M.Sccourse
7. Display the Module code and Number of Modules taught by eachLecturer.
8. Retrieve the Lecturer names who are not Module Leaders.
9. Display the Department name which offers 'English 'module.
10. Retrieve the Prerequisite Courses offered by every Department (with Departmentnames).
11. Present the Lecturer ID and Name who teaches'Mathematics'.
12. Discover the number of years a Module istaught.
13. List out all the Faculties who work for 'Statistics'Department.
14. List out the number of Modules taught by each ModuleLeader.
15. List out the number of Modules taught by a particularLecturer.
16. Create a view which contains the fields of both Department and Module tables. (Hint- The fields like Module code, title, credit, Department code and itsname).
17. Update the credits of all the prerequisite courses to 5. Delete the Module 'History' from the Moduletable.

References:

1. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008.

Online Learning Resources/Virtual Labs:

http://www.scoopworld.in
http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

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**Comuper Science & Engineering (Data Science)**

| Course Code | OPERATING SYSTEMS LAB | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A05402P** | **(Common to CSE, IT, CSE( DS), CSE (IoT), CSE (AI), CSE (AI & ML) and  AI & DS)** | | **0** | **0** | **3** | **1.5** |
| **Pre-requisite** | **Basics of CO and DBMS** | **Semester** | **IV** | | | |

**Course Objectives:**
- To familiarize students with the architecture of OS.
- To provide necessary skills for developing and debugging CPU Scheduling algorithms.
- To elucidate the process management and scheduling and memory management.
- To explain the working of an OS as a resource manager, file system manager, process manager, memory manager, and page replacement tool.
- To provide insights into system calls, file systems and deadlock handling.

**Course Outcomes (CO):**

After completion of the course, students will be able to
- Trace different CPU Scheduling algorithms (L2).
- Implement Bankers Algorithms to Avoid and prevent the Dead Lock (L3).
- Evaluate Page replacement algorithms (L5).
- Illustrate the file organization techniques (L4).
- Illustrate shared memory process (L4).
- Design new scheduling algorithms (L6)

**List of Experiments:**
1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls
   Fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms
   a) Round Robin b) SJF c) FCFS d) Priority
5. Implement a dynamic priority scheduling algorithm.
6. Assume that there are five jobs with different weights ranging from 1 to 5. Implement round robin algorithm with time slice equivalent to weight.
7. Implement priority scheduling algorithm. While executing, no process should wait for more than 10 seconds. If the waiting time is more than 10 seconds that process has to be executed for at least 1 second before waiting again.
8. Control the number of ports opened by the operating system with
   a) Semaphore b) Monitors.
9. Simulate how parent and child processes use shared memory and address space.
10. Simulate sleeping barber problem.
11. Simulate dining philosopher's problem.
12. Simulate producer-consumer problem using threads.
13. Implement the following memory allocation methods for fixed partition
    a) First fit b) Worst fit c) Best fit
14. Simulate the following page replacement algorithms
    a) FIFO b) LRU c) LFU etc.,
15. Simulate Paging Technique of memory management
16. Simulate Bankers Algorithm for Dead Lock avoidance and prevention
17. Simulate the following file allocation strategies
    a) Sequential b) Indexed c) Linked
18. Simulate all File Organization Techniques
    a) Single level directory b) Two level c) Hierarchical d) DAG

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**References:**

1. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Eighth Edition, John Wiley.
2. "Operating Systems: Internals and Design Principles", Stallings, Sixth Edition–2009, Pearson Education
3. "Modern Operating Systems", Andrew S Tanenbaum, Second Edition, PHI.
4. "Operating Systems", S.Haldar, A.A.Aravind, Pearson Education.
5. "Principles of Operating Systems", B.L.Stuart, Cengage learning, India Edition.2013-2014
6. "Operating Systems", A.S.Godbole, Second Edition, TMH.
7. "An Introduction to Operating Systems", P.C.P. Bhatt, PHI.

**Online Learning Resources/Virtual Labs:**

https://www.cse.iitb.ac.in/~mythili/os/
http://peterindia.net/OperatingSystems.html
https://www.vlab.co.in

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| Course Code | SOFTWARE ENGINEERING LAB | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A05403P** | **(Common to CSE, IT, CSE( DS), CSE (IoT))** | | **0** | **0** | **3** | **1.5** |
| Pre-requisite | | Semester | IV | | | |

| | |
|---|---|

**Course Objectives:**
- To learn and implement the fundamental concepts of Software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams through the appropriate tool.
- To learn to implement various software testing strategies.

**Course Outcomes (CO):**

After completion of the course, students will be able to
- Acquaint with historical and modern software methodologies
- Understand the phases of software projects and practice the activities of each phase
- Practice clean coding
- Take part in project management
- Adopt skills such as distributed version control, unit testing, integration testing, build management, and deployment

**List of Experiments:**

1. Draw the Work Breakdown Structure for the system to be automated
2. Schedule all the activities and sub-activities Using the PERT/CPM charts
3. Define use cases and represent them in use-case document for all the stakeholders of the system to be automated
4. Identify and analyze all the possible risks and its risk mitigation plan for the system to be automated
5. Diagnose any risk using Ishikawa Diagram (Can be called as Fish Bone Diagram or Cause& Effect Diagram)
6. Define Complete Project plan for the system to be automated using Microsoft Project Tool
7. Define the Features, Vision, Business objectives, Business rules and stakeholders in the vision document
8. Define the functional and non-functional requirements of the system to be automated by using Use cases and document in SRS document
9. Define the following traceability matrices :
   1. Use case Vs. Features
   2. Functional requirements Vs. Usecases
10. Estimate the effort using the following methods for the system to be automated:
    1. Function point metric
    2. Usecase point metric
11. Develop a tool which can be used for quantification of all the non-functional requirements
12. Write C/C++/Java/Python program for classifying the various types of coupling.
13. Write a C/C++/Java/Python program for classifying the various types of cohesion.
14. Write a C/C++/Java/Python program for object oriented metrics for design proposed by Chidamber and Kremer. (Popularly called CK metrics)
15. Convert the DFD into appropriate architecture styles.
16. Draw a complete class diagram and object diagrams using Rational tools
17. Define the design activities along with necessary artifacts using Design Document.
18. Reverse Engineer any object-oriented code to an appropriate class and object diagrams.
19. Test a piece of code that executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.
20. Test the percentage of code to be tested by unit test using any code coverage tools
21. Define appropriate metrics for at least 3 quality attributes for any software application of your interest.
22. Define a complete call graph for any C/C++ code. (Note: The student may use any tool that generates call graph for source code)

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| **References:** |
|---|
| 1. Software Engineering? A Practitioner‟ s Approach, Roger S. Pressman, 1996, MGH. <br> 2. Software Engineering by Ian Sommerville, Pearson Edu, 5th edition, 1999 <br> 3. An Integrated Approach to software engineering by Pankaj Jalote , 1991 Narosa |
| **Online Learning Resources/Virtual Labs:** |
| http://vlabs.iitkgp.ac.in/se/ |

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**Comuper Science & Engineering (Data Science)**

| Course Code | Programming with R | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A32401** | | | **1** | **0** | **2** | **2** |
| **Pre-requisite** | **Fundamental Programming** | **Semester** | | **IV** | | |
| | | | | | | |

| **Course Objectives:** |
|---|
| • How to manipulate data within R and to create simple graphs and charts used in introductory statistics. |
| • The given data using different distribution functions in R. |
| • The hypothesis testing and calculate confidence intervals; perform linear regression models for data analysis. |
| • The relevance and importance of the theory in solving practical problems in the real world. |
| **Course Outcomes (CO):** |
| After completion of the course, students will be able to |
| • Install and use R for simple programming tasks. |
| • Extend the functionality of R by using add-on packages |
| • Extract data from files and other sources and perform various data manipulation tasks on them. |
| • Explore statistical functions in R. |
| • Use R Graphics and Tables to visualize results of various statistical operations on data. |
| • Apply the knowledge of R gained to data Analytics for real-life applications. |
| **List of Experiments:** |
| **1: INTRODUCTION TO COMPUTING** |
| a. Installation of R |
| b. The basics of R syntax, workspace |
| c. Matrices and lists |
| d. Subsetting |
| e. System-defined functions; the help system |
| f. Errors and warnings; coherence of the workspace |
| |
| **2: GETTING USED TO R: DESCRIBING DATA** |
| a. Viewing and manipulating Data |
| b. Plotting data |
| c. Reading the data from console, file (.csv) local disk and web |
| d. Working with larger datasets |
| |
| **3: SHAPE OF DATA AND DESCRIBING RELATIONSHIPS** |
| a. Tables, charts and plots. |
| b. Univariate data, measures of central tendency, frequency distributions, variation, and Shape. |
| c. Multivariate data, relationships between a categorical and a continuous variable, |
| d. Relationship between two continuous variables – covariance, correlation coefficients, comparing multiple correlations. |
| e. Visualization methods – categorical and continuous variables, two categorical variables, two continuous variables. |

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**4: PROBABILITY DISTRIBUTIONS**

a. Sampling from distributions – Binomial distribution, normal distribution

b. tTest, zTest, Chi Square test

c. Density functions

d. Data Visualization using ggplot – Box plot, histograms, scatter plotter, line chart, bar chart, heat maps


**5: EXPLORATORY DATA ANALYSIS** Demonstrate the range, summary, mean, variance, median, standard deviation, histogram, box plot, scatter plot using population dataset.


**6: TESTING HYPOTHESES**

a. Null hypothesis significance testing

b. Testing the mean of one sample

c. Testing two means


**7: PREDICTING CONTINUOUS VARIABLES**

a. Linear models

b. Simple linear regression

c. Multiple regression

d. Bias-variance trade-off – cross-validation


**8: CORRELATION**

a. How to calculate the correlation between two variables.

b. How to make scatter plots.

c. Use the scatter plot to investigate the relationship between two variables


**9: TESTS OF HYPOTHESES**

a. Perform tests of hypotheses about the mean when the variance is known.

b. Compute the p-value.

c. Explore the connection between the critical region, the test statistic, and the p-value


**10**: **ESTIMATING A LINEAR RELATIONSHIP** Demonstration on a Statistical Model for a Linear Relationship

b. Least Squares Estimates

c. The R Function lm

d. Scrutinizing the Residuals


**11: APPLY-TYPE FUNCTIONS**

a. Defining user defined classes and operations, m odels and methods in R

b. Customizing the user's environment

c. Conditional statements

d. Loops and iterations


**12: STATISTICAL FUNCTIONS IN R**

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a. Demonstrate Statistical functions in R

b. Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modeling methods.

**References:**

1. SandipRakshit, "Statistics with R Programming", McGraw Hill Education, 2018.

2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning: with Applications in R", Springer Texts in Statistics, 2017.

3. Joseph Schmuller, "Statistical Analysis with R for Dummies", Wiley, 2017.

4. K G Srinivasa, G M Siddesh, ChetanShetty, Sowmya B J, "Statistical Programming in R", Oxford Higher Education, 2017.

**Online Learning Resources/Virtual Labs:**

1. www.oikostat.ch

2. https://learningstatisticswithr.com/

3. https://www.coursera.org/learn/probability-intro#syllabus

4. https://www.isibang.ac.in/~athreya/psweur/

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**Comuper Science & Engineering (Data Science)**

| Course Code | Design Thinking for Innovation | | L | T | P | C |
|---|---|---|---|---|---|---|
| **20A99401** | **(Common to All branches of Engineering)** | | **2** | **1** | **0** | **0** |
| **Pre-requisite** | **NIL** | **Semester** | **IV** | | | |

**Course Objectives:**

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.

**Course Outcomes (CO):**

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

| UNIT - I | Introduction to Design Thinking | 10 Hrs |
|---|---|---|

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.

| UNIT - II | Design Thinking Process | 10 Hrs |
|---|---|---|

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

**Activity:** 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.

| UNIT - III | Innovation | 8 Hrs |
|---|---|---|

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.

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

| UNIT - IV | Product Design | 8 Hrs |
|---|---|---|

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

**Activity:** Importance of modelling, how to set specifications, Explaining their own product design.

| UNIT - V | Design Thinking in Business Processes | 10 Hrs |
|---|---|---|

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.

**Activity:** How to market our own product, About maintenance, Reliability and plan for startup.

**Textbooks:**

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

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| |
|---|
| **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/ <br> https://nptel.ac.in/courses/109/104/109104109/ <br> https://swayam.gov.in/nd1_noc19_mg60/preview |

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**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.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.

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- 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**

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"

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- 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**

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

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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
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

**Comuper Science & Engineering (Data Science)**
40. **Gender ration in schooling lvel- 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
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
     i. Agriculture

*R 20 Regulations*

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

**Comuper Science & Engineering (Data Science)**

    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 secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**
   - 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)**

*R 20 Regulations*

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

### Comuper Science & Engineering (Data Science)

**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. - COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)**
**Course Structure (R20) – III & IV Year**

| S.No. | Course Code | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|
| | | **Semester–V** | | | | |
| 1. | 20A32501T | Data Management Techniques | 3 | 0 | 0 | 3 |
| 2. | 20A05502T | Artificial Intelligence | 3 | 0 | 0 | 3 |
| 3. | 20A32502 | Foundations of Data Analytics | 3 | 0 | 0 | 3 |
| 4. | 20A12701a 20A12501a 20A05302T | **Professional Elective Course – I** Advanced Databases Data Warehousing and Data Mining Object Oriented Programming through Java | 3 | 0 | 0 | 3 |
| 5. | | **Open Elective Course – I** | 3 | 0 | 0 | 3 |
| 6. | 20A32501P | Data Management Techniques Lab | 0 | 0 | 3 | 1.5 |
| 7. | 20A05502P | Artificial Intelligence Lab | 0 | 0 | 3 | 1.5 |
| 8. | 20A32503 | **Skill oriented course – III** Digital and Social Media Marketing | 1 | 0 | 2 | 2 |
| 9. | 20A32504 | Evaluation of Community Service Project | | | | 1.5 |
| | | **Total** | | | | **21.5** |

**Open Elective-I**

| S.No | Course Code | Course Name | Offered by the Dept. |
|---|---|---|---|
| 1 | 20A01505 | Building Technology | CE |
| 2 | 20A02505 | Electric Vehicles | EEE |
| 3 | 20A03505 | 3D Printing Technology | ME |
| 4 | 20A04507 | MATLAB Programming for Engineers | ECE/EEE |
| 5 | 20A04508 | Introduction to Control Systems | ECE/EEE |
| 6 | 20A27505 | Computer Applications in Food Processing | FT |
| 7 | 20A54501 | Optimization Techniques | Mathematics |
| 8 | 20A56501 | Materials Characterization Techniques | Physics |
| 9 | 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

| S.No | Course Code | Course Name | L | T | P | Credits |
|------|-------------|-------------|---|---|---|---------|
| centered: **Semester–VI** |||||||
| **1.** | 20A05602T | Machine Learning | 3 | 0 | 0 | 3 |
| **2.** | 20A05701a | Cloud Computing | 3 | 0 | 0 | 3 |
| **3.** | 20A32601T | Data Visualization | 3 | 0 | 0 | 3 |
| **4.** | 20A32602a<br>20A05603T<br>20A12602a | **Professional Elective Course– II**<br>Predictive Analytics<br>Internet of Things<br>Computer Graphics | 3 | 0 | 0 | 3 |
| **5.** | | **Open Elective Course – II** | 3 | 0 | 0 | 3 |
| **6.** | 20A05602P | Machine Learning Lab | 0 | 0 | 3 | 1.5 |
| **7.** | 20A32601P | Data Visualization lab | 0 | 0 | 3 | 1.5 |
| **8.** | 20A12604 | Cloud Computing lab | 0 | 0 | 3 | 1.5 |
| **9.** | 20A52401 | **Skill oriented course - IV**<br>Soft Skills | 1 | 0 | 2 | 2 |
| **10.** | 20A99601 | **Mandatory Non-credit Course**<br>Intellectual Property Rights & Patents | 2 | 0 | 0 | 0 |
| **Total** |||||| **21.5** |
| centered: Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation |||||||

**Open Elective-II**

| S.No | Course Code | Course Name | Offered by the Dept. |
|------|-------------|-------------|----------------------|
| 1 | 20A01605 | Environmental Economics | CE |
| 2 | 20A02605 | Smart Electric Grid | EEE |
| 3 | 20A03605 | Introduction to Robotics | ME |
| 4 | 20A04605 | Signal Processing | ECE |
| 5 | 20A04606 | Basic VLSI Design | ECE |
| 6 | 20A27605 | Food Refrigeration and Cold Chain Management | FT |
| 7 | 20A54701 | Wavelet Transforms & its applications | Mathematics |
| 8 | 20A56701 | Physics Of Electronic Materials and Devices | Physics |
| 9 | 20A51701 | Chemistry of Polymers and its Applications | Chemistry |

| | | Semester-VII | | | | |
|---|---|---|---|---|---|---|
| **S.No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **Credits** |
| 1. | 20A05705a 20A32701a 20A32702b | **Professional Elective Course– III** Cyber Security User Interface Design Process Mining | 3 | 0 | 0 | 3 |
| 2. | 20A32702a 20A05702c 20A32702b | **Professional Elective Course– IV** Bio Informatics Natural Language Processing Social Network Analysis | 3 | 0 | 0 | 3 |
| 3. | 20A05703b 20A05703c 20A05702b | **Professional Elective Course– V** Block Chain Technology and Applications Deep Learning Cryptography and Network Security | 3 | 0 | 0 | 3 |
| 4. | 20A52701a 20A52701b 20A52701c | **Humanities Elective – II** Entrepreneurship and Incubation Management Science Enterprise Resource Planning | 3 | 0 | 0 | 3 |
| 5. | | **Open Elective Course – III** | 3 | 0 | 0 | 3 |
| 6. | | **Open Elective Course – IV** | 3 | 0 | 0 | 3 |
| 7. | 20A32703 | **Skill oriented course – V** NoSQL using MongoDB | 1 | 0 | 2 | 2 |
| | 20A32704 | Evaluation of Industry Internship | | | | 3 |
| | | | | | **Total** | **23** |

**Open Elective-III**

| S.No. | Course Code | Course Name | Offered by the Dept. |
|---|---|---|---|
| 1 | 20A01704 | Cost Effective Housing Techniques | CE |
| 2 | 20A02704 | IOT Applications in Electrical Engineering | EEE |
| 3 | 20A03704 | Product Design & Development | ME |
| 4 | 20A04704 | Electronic Sensors | ECE |
| 5 | 20A04506 | Principles of Communication Systems | ECE |
| 6 | 20A27704 | Human Nutrition | FT |
| 7 | 20A54702 | Numerical Methods for Engineers | Mathematics |
| 8 | 20A56702 | Sensors And Actuators for Engineering Applications | Physics |
| 9 | 20A51702 | Chemistry of Nanomaterials and Applications | Chemistry |

**Open Elective-IV**

| S.No. | Course Code | Course Name | Offered by the Dept. |
|---|---|---|---|
| 1 | 20A01705 | Health, Safety & Environmental management | CE |
| 2 | 20A02705 | Renewable Energy Systems | EEE |
| 3 | 20A03705 | Introduction to Composite Materials | ME |
| 4 | 20A04705 | Microcontrollers and Applications | ECE |
| 5 | 20A04706 | Principles of Cellular & Mobile Communications | ECE |
| 6 | 20A27705 | Waste and Effluent Management | FT |
| 7 | 20A54703 | Number theory & its Applications | Mathematics |
| 8 | 20A56703 | Smart Materials and Devices | Physics |
| 9 | 20A51703 | Green Chemistry and Catalysis for Sustainable | Chemistry |

| | | Semester-VIII | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Course Code | Course Name | Category | L | T | P | Credits |
| 1. | 20A32801 | Full Internship & Project work | PR | | | | 12 |
| | | | | | | Total | 12 |

## COURSES OFFERED FOR HONOURS DEGREE IN CSE (DATA SCIENCE)

| S.No. | Code | Course Name | Contact Hours per week | | Credits |
|---|---|---|---|---|---|
| | | | L | T | |
| 1 | 20A32H01 | Data Science for Business | 3 | 1 | 4 |
| 2 | 20A32H02 | Software Project Management using Agile | 3 | 1 | 4 |
| 3 | 20A30H03 | Ethics and Privacy in AI | 3 | 1 | 4 |
| 4 | 20A30H04 | Medical Image Data Processing | 3 | 1 | 4 |
| | 20A32H03 | MOOC – I | | | 2 |
| | 20A32H04 | MOOC - II | | | 2 |

| MOOC Course for 2 credits | Big Data Analytics using Spark | 10 weeks (To be considered only for 8 weeks) | https://www.edx.org/course/big-data-analytics-using-spark?source=aw&awc=6798_1657520739_578015a7e5fc85aba86de3f77adff378&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=422873_Edflex |
|---|---|---|---|
| MOOC Courses for a Total of 2 credits | Deep Learning with TensorFlow | 5 weeks | https://www.edx.org/course/deep-learning-with-tensorflow?source=aw&awc=6798_1657521273_57ca8f6c944caac9a0aabd49519739f6&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=422873_Edflex |
| | Data Representation and Visualization in Tableau | 4 weeks | https://www.edx.org/course/data-representation-and-visualization-in-tableau |
| MOOC Course for 2 credits | Data Science: Productivity Tools | 8 weeks | https://www.edx.org/course/data-science-productivity-tools?source=aw&awc=6798_1657522115_2a535463f4ca875a60c8c8eb4e8553b2&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=422873_Edflex |
| MOOC Course for 2 credits | Six Sigma: Analyze, Improve, Control | 8 weeks | https://www.edx.org/course/six-sigma-analyze-improve-control?source=aw&awc=6798_1657522256_dd3daa384fdef3044ce20596cba19261&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=422873_Edflex |
| MOOC Course for 2 credits | Scalable Data Science | 8 weeks | https://onlinecourses.nptel.ac.in/noc22_cs105/preview |
| MOOC Course for 2 credits | Applied Accelerated Artificial Intelligence | 12 weeks (To be considered for 8 weeks) | https://onlinecourses.nptel.ac.in/noc22_cs83/preview |

## LIST OF MINORS OFFERED TO CSE (DATA SCIENCE)

| S.No. | Minor Title | Department offering the Minor |
|-------|-------------|-------------------------------|
| 1. | Construction Technology | Civil Engineering |
| 2. | Environmental Geotechnology | Civil Engineering |
| 3. | Energy Systems | EEE |
| 4. | 3D Printing | ME |
| 5. | Industrial Engineering | ME |
| 6. | Food Science | Food Technology |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem**                                    **L  T  P  C**
                                                               **3   0  0  3**

**(20A32501T) DATA MANAGEMENT TECHNIQUES**

**Pre-requisite**          **DBMS**

**Course Objectives:**
- The objective of the course is to present an introduction to data management techniques with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively.

**Course Outcomes:**
- Describe the fundamental elements of data management
- Implement the tools and techniques of Data handling System.
- Learn the Data modeling, design and operations
- Apply the security and integrity tools in management system
- Improving the Data usability and Findability using metadata

**UNIT I           Data Management, Data Handling Ethics**           Lecture 8Hrs
**Data Management:** Introduction, Essential Concepts, Data Management Frameworks
**Data Handling Ethics:** Introduction, Business Drivers, Essential Concepts: Ethical Principles for Data, Principles Behind Data Privacy Law, Online Data in an Ethical Context, Risks of Unethical Data Handling Practices, Establishing an Ethical Data Culture, Data Ethics and Governance

**UNIT II           Data Governance, Data Architecture**           Lecture 10Hrs
**Data Governance:** Introduction, Activities, Tools and Techniques, Implementation Guidelines: Organization and Culture, Adjustment and Communication, Metrics
**Data Architecture: -**Introduction: Business Drivers, Data Architecture Outcomes and Practices, Essential Concepts. Activities, Tools: Data Modelling Tools, Asset Management Software, Graphical Design Applications., Techniques: LifecycleProjections, Diagramming Clarity, Implementation Guidelines, Data Architecture Governance

**UNIT IIIData Modelling and Design, Data Storage and Operations**           Lecture 8Hrs
**Data Modelling and Design:** Introduction, Activities, BestPractices, Data Model Governance
**Data Storage and Operations:** Introduction, Activities, Tools,Techniques, Implementation Guidelines, Data Storage and Operations Governance

**UNIT IVData Security, Data Integration and Interoperability**           Lecture 9Hrs
**Data Security:** Introduction, Activities, Tools, Techniques, Implementation Guidelines, Data Security Governance, Works Cited / Recommended
**Data Integration and Interoperability:** Introduction, Data Integration Activities, Tools, Techniques: Implementation Guidelines, DII Governance

**UNIT VMetadata Management, Big Data and Data Science, Data**           Lecture 8Hrs
**Management Maturity Assessment**
**Metadata Management:** Introduction, Activities, Tools, Techniques, Implementation Guidelines, Metadata Governance, Works Cited / Recommended.
**Big Data and Data Science:** Introduction, Activities, Tools, Implementation Guidelines, Big Data and Data Science Governance
**Data Management Maturity Assessment: -** Introduction, Activities Tools, Techniques, Guidelines for a DMMA, Maturity Management Governance

**Textbooks:**
1. "DAMA-DMBOK: Data Management body of Knowledge", 2<sup>nd</sup> Edition, Technics Publications, 2017

**Reference Books:**
1. Data Mining: Concepts and Techniques (The Morgan Kaufman series in Data Management Systems),2011
2. Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining (ACM Books) Paperback – 30 June 2016by ChengXiangZhai (Author), Sean Massung (Author).

**Online Learning Resources:**

1)Google Data Analytics Professional Certificate | Coursera

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

## (20A05502T) ARTIFICIAL INTELLIGENCE
### COMMON TO CSE, IT, CSD, CSE (DS), CSE(IOT)

**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 9Hrs
**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 Nature of Environments, The Structure of Agents.

**UNIT II            Solving Problems by searching**                      Lecture 9 Hrs
Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

**UNIT III            Reinforcement Learning & Natural Language Processing**      Lecture 8Hrs
**Reinforcement Learning**: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL
**Natural Language Processing**: Language Models, Text Classification, Information Retrieval, Information Extraction.

**UNIT IV            Natural Language for Communication**                 Lecture 8 Hrs
**Natural Language for Communication**: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition
**Perception**: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

**UNIT V            Robotics**                                           Lecture 10Hrs
**Robotics**: Introduction, Robot Hardware, Robotic Perception, planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains
**Philosophical foundations**: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent 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", 3rd Edition, Pearson 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/

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**(20A32502) FOUNDATIONS OF DATA ANALYTICS**

**Course Objectives:**
- Discuss various jobs related to Data Science
- Understand MapReduce
- Study Bigdata patterns

**Course Outcomes:**
- Analyze data, test claims, and draw valid conclusions using appropriate statistical methodology
- Use various tools related to Big data
- Obtain training to secure a job

**UNIT I          Introduction          Lecture 8Hrs**

What is Analytics, What is Big Data, Characteristics of Big data, Domain specific examples of big data, Analytics flow for big data, Big data stack, Mapping analytics flow to big data stack, case studies: Genome and Weather data analysis, Analytics patterns

**UNIT II          Setting up Big data stack and Big data Patterns          Lecture 8Hrs**

Hortonworks data platform, Cloudera CDH stack, Amazon Elastic MapReduce, Azure HDInsight, Analytics architecture components and Design styles

**UNIT III          MapReduce, NoSQL          Lecture 10Hrs**

MapReduce patterns, Key-Value Databases, Document Databases, Column Family Databases, Graph databases.

**UNIT IV          Serving databases and Web Frameworks, Big Data Jobs          Lecture10 Hrs**

Relational databases, Non-Relational Databases, Python web application framework – Django, Case study: Django application for viewing weather data, The big picture of Bigdata jobs

**UNIT V          Simulation, Monte Carlo integration & Variance reduction          Lecture 8 Hrs**

Seeing yourself in a big data job, looking into big data platform, Big data jobs for business analytics, big data jobs for data scientists, big data jobs for software developers.

**Textbooks:**
1. ArshdeepBahga, Vijay Madisetti, Big Data Science and Analytics: A Hands of Approach, Self Published: www.hands-on-books-series.com.
2. Jason Williamson, Big Data job for Dummies, Willey, 2015

**Reference Books:**
1. Exploratory Data Analysis with R – Roger D. Peng, Lean pub publications, 2015
2. The Art of Data Science- A Guide for anyone Who Works with Data – Roger D. Peng and Elizabeth Matsui, Lean pub Publications, 2014

**Online Learning Resources:**
1. https://www.mastersindatascience.org/learning/what-is-data-analytics/
2. https://www.techtarget.com/searchdatamanagement/definition/data-analytics
3. https://www.lotame.com/what-is-data-analytics/
4. https://www.oracle.com/business-analytics/data-analytics/

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.TechCSE(DS)– III-I Sem**                                                    **L   T   P   C**
                                                                               **3   0   0   3**

### (20A12701a) ADVANCED DATABASES
**(Professional Elective Course– I)**

**Course Objectives:**
- To study the needs of different databases.
- To understand about different data models that can be used for these databases.
- To make the students get familiarized with transaction management of the database

**Course Outcomes:**
- Design, develop and implement a mid-scale relational database for an application domain using a commercial-grade RDBMS.
- Identify and resolve physical database design and implementation issues.
- Use the persistence framework of a chosen language to perform Object Relational Mapping.
- To provide an introductory concept about the way in which data can be stored in geographical information systems etc., to develop in-depth knowledge about web and intelligent database

**UNIT I          Distributed Databases                              Lecture 8Hrs**
Distributed DBMS Concepts and Design – Introduction – Functions and Architecture of DDBMS – Distributed Relational Database Design – Transparency in DDBMS – Distributed Transaction Management – Concurrency control – Deadlock Management – Database recovery – The X/Open Distributed Transaction Processing Model – Replication servers – Distributed Query Optimization - Distribution and Replication in Oracle.

**UNIT II          Object Oriented Databases                         Lecture 8Hrs**
Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.

**UNIT III          Web Databases                                    Lecture 9Hrs**
Web Technology and DBMS – Introduction – The Web – The Web as a Database Application Platform – Scripting languages – Common Gateway Interface – HTTP Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform – Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages

**UNIT IV          Data Warehousing Concepts                        Lecture 9Hrs**
**Data Warehousing Concept:** Introduction to Data Warehousing, Data Warehouse Architecture, Data Warehousing Tools and Technologies, Data Mart, Data Warehousing and Temporal Databases, Data Warehousing Using Oracle
**Data Warehousing Design: Designing** a Data Warehouse Database, Data Warehouse Development Methodologies, Kimball's Business Dimensional Lifecycle, Dimensionality Modeling, The Dimensional Modeling Stage of Kimball's, Data Warehouse Development Issues, Data Warehousing Design Using Oracle

**UNIT V          OLAP&Data Mining                                  Lecture 9Hrs**
**OLAP:** Online Analytical Processing, OLAP Applications, Multidimensional Data Model, OLAP Tools, OLAP Extensions to the SQL Standard, Oracle OLAP
**Data Mining:** Data Mining Techniques, The Data Mining Process, Data Mining Tools, Data Mining and Data Warehousing, Data Mining (ODM)

**Textbooks:**

1. Thomas M. Connolly, Carolyn E. Begg, "Database Systems - A Practical Approach to Design, Implementation, and Management", Third Edition, Pearson Education, 2003.

**Reference Books:**

1. RamezElmasri&ShamkantB.Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2004.

2. M.TamerOzsu , Patrick Ualduriel, "Principles of Distributed Database Systems", Second Edition, PearsonEducation, 2003.

3. C.S.R. Prabhu, "Object Oriented Database Systems", PHI, 2003.

4. Peter Rob and Corlos Coronel, "Database Systems – Design, Implementation and Management", Thompson Learning, Course Technology, 5th Edition, 2003.

**Online Learning Resources:**

1. Advanced Database Queries | edX

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

| B.TechCSE(DS)– III-I Sem | L | T | P | C |
|---|---|---|---|---|
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### (20A12701a) DATA WAREHOUSINGAND MINING
### Common to IT, CSE(DS)

**Course Objectives:**
The course is designed
- To familiarize with mathematical foundations of data mining tools.
- To introduce classical models and algorithms in data warehouses and data mining.
- To investigate the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- To explore data mining techniques in various applications like social, scientific and environmental context.

**Course Outcomes:**
After completion of the course, students will be able to
- Design a Data warehouse system and perform business analysis with OLAP tools
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Design appropriate classification and clustering techniques for data analysis
- Infer knowledge from raw data

**UNIT I    Warehousing and Online Analytical Processing**          Lecture 8Hrs

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

**UNIT II    Data Mining and Data Preprocessing**          Lecture 10Hrs

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Pre-processing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III    Associations and Classification**          Lecture 8Hrs

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

**UNIT IV    Cluster Analysis**          Lecture 9Hrs

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster Analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

**UNIT V    Weka Tool**          Lecture 8Hrs

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

**Textbooks:**
1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, Elsevier, Third Edition, 2013.

2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

**Reference Books:**
1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

**Online Learning Resources:**
1. https://www.coursera.org/courses?query=data%20warehouse
2. https://www.edx.org/learn/data-warehouse

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B.TechCSE(DS)– III-I Sem            **L   T   P   C**
                                               **3   0   0   3**

**(20A05302T) OBJECT ORIENTED PROGRAMMING THROUGH JAVA**
**Common to CSE, IT, CSD, CSE (AI), CSE (AI & ML),CSE(DS), AI& DS)**

**Pre-requisite      Fundamental Programming**

**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 (CO):**
After completion of the course, students will be able to
- 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.
- Develop applets for web applications.
- Build GUIs and handle events generated by user interactions.
- Use the JDBC API to access the database

**UNIT - I          Introduction                                 8Hrs**
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                 9Hrs**
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 (java.io)       9Hrs**
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 (java.util)      8Hrs**
Multithreading: The Java thread model, Creating threads, Thread priorities, Synchronizing threads, Interthread communication.
The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collectionclasses- 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    8Hrs**

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, showmessagedialog, showconfirmdialog, showinputdialog, showoptiondialog, 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 andGajalakshmi, 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

http://peterindia.net/JavaFiles.html

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**B.TechCSE(DS)– III-I Sem**                                                    **L   T   P   C**
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## (20A32501P) DATA MANAGEMENT TECHNIQUES LAB

**Course Objectives:**
- To understand data definition and data manipulation commands.
- To understand functions, procedures and procedural extensions of data bases
- To get familiar with the use of a front-end tool
- To understand design and implementation of typical database applications

**Course Outcomes:**
**Upon completion of the course, the students will be able to:**
- Use typical data definitions and manipulation commands.
- Design applications to test Nested and Join Queries
- Implement simple applications that use Views
- Implement applications that require a Front-end Tool
- Critically analyze the use of Tables, Views, Functions and Procedures

**List of Experiments:**
1.Perform the following database administrator tasks
- Install the database software of your choice
- Plan the database of your organization
- Create and open the database
- Backup the database
- Enroll system users
- Implement the Database design
- Backup the fully functional database
- Tune database performance
- Download and install patches
- Rollout to additional hosts
- Starting up and shutting down a database
- Altering database availability
- Configure database memory manually and automatically
- Monitor errors and alerts
- Monitor performance
- Collect statistics on tables
- Alter the tables
- Creating, altering, dropping indexes
- Create, alter, using and dropping views

1. Experiment with the following
- Common number functions
- Common string functions
- Common data and time functions
- Conversion functions

2. Perform inner join, left join, right join, full join
3. Perform the following
- Data import and export with Oracle, SQL Server, MYSQL
- Create a stored procedure with parameters in Oracle, SQL Server, MYSQL

4. Create a database for the State Government considering different departments and functions of

the state government
- Design the database
- Represent using ER model
- Apply Normalization up to BCNF
- Implement the database using DBMS of your choice
- Design user interfaces for performing different operations. You can do it with the feature of the DBMS or use language like Python and JAVA
- Perform the operations
- Generate appropriate reports using the data and aggregate functions

**References:**
1. Oracle Database Administrators guide, 11g release, 2010
2. Preston Zhang, Practical Guide to Oracle SQK, T-SQL, and MYSQL, CRC Press
3. Use Data Management Tools & Guides - Research Data Management Basics – InfoGuides at George Mason University (gmu.edu)
4. RafatSarosh, MecheleGruhn, SQL Server Interview Questions
5. Peter Rob, Carlos Coronel, Database systems design, implementation and management, Thomson Course technology

**Online Learning Resources/Virtual Labs:**
1. Lab Data Management & Analysis Software | Thermo Fisher Scientific - IN

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**B.TechCSE(DS)– III-I Sem**                                                  **L   T   P   C**
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## (20A05502P) ARTIFICIAL INTELLIGENCE LAB
### COMMON TO CSE,IT,CSD, CSE (DS)

**Course Objectives:**
- To teach the methods of implementing algorithms using artificial intelligence techniques
- To illustrate search algorithms

To demonstrate the building of intelligent agents

**Course Outcomes:**

After completion of the course, students will be able to
- Implement search algorithms
- Solve Artificial intelligence problems
- Design chatbot and virtual assistant

**List of Experiments:**

1. Write a program to implement DFS and BFS
2. Write a Program to find the solution for traveling salesman Problem
3. Write a program to implement Simulated Annealing Algorithm
4. Write a program to find the solution for the wumpus world problem
5. Write a program to implement 8 puzzle problem
6. Write a program to implement Towers of Hanoi problem
7. Write a program to implement A* Algorithm
8. Write a program to implement Hill Climbing Algorithm
9. Build a Chatbot using AWS Lex, Pandora bots.
10. Build a bot that provides all the information related to your college.
11. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
12. The following is a function that counts the number of times a string occurs in another string:

```
# Count the number of times string s1 is found in string s2
Def count substring(s1,s2):
count = 0
  for i in range(0,len(s2)-len(s1)+1):
   if s1 == s2[i:i+len(s1)]:
     count += 1
      return count
   For instance, countsubstring('ab','cabalaba') returns 2.
```

Write a recursive version of the above function. To get the rest of a string (i.e. everything but the first character).

13. Higher order functions. Write a higher-order function count that counts the number of elements in a list that satisfy a given test. For instance: count (lambda x: x>2, [1, 2, 3, 4, 5]) should return 3, as there are three elements in the list larger than 2. Solve this task without using any existing higher-order function.

14. Brute force solution to the Knapsack problem. Write a function that allows you to generate random problem instances for the knapsack program. This function should generate a list of items containing N items that each have a unique name, a random size in the range      1 ....... 5 and a random value in the range 1..... 10.

Next, you should perform performance measurements to see how long the given knapsack solver take to solve different problem sizes. You should perform at least 10 runs with different randomly generated problem instances for the problem sizes 10,12,14,16,18,20 and 22. Use a backpack size of 2:5 x N for each value problem size N. Please note that the method used to generate random numbers can also affect performance, since different distributions of values can make the initial

conditions of the problem slightly more or less demanding.

How much longer time does it take to run this program when we increase the number of items? Does the backpack size affect the answer?
Try running the above tests again with a backpack size of 1 x N and with 4:0 x N.

15. Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitely large).

Write a function layout (N,C,L) that can give a table placement (i.e. a number from 0 : : :C -1) for each guest such that there will be no social mishaps.

For simplicity we assume that you have a unique number 0 ......N-1 for each guest and that the list of restrictions is of the form [(X, Y) ...] denoting guests X, Y that are not allowed to sit together. Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer False.

**References:**
1. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logical approach", Oxford University Press, 2004.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.
4. Artificial Neural Networks, B. Yagna Narayana, PHI
5. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight, TMH.
6. Artificial Intelligence and Expert Systems, Patterson, PHI.

**Online Learning Resources/Virtual Labs:**
https://www.tensorflow.org/
https://pytorch.org/
https://github.com/pytorch
https://keras.io/
https://github.com/keras-team
http://deeplearning.net/software/theano/
https://github.com/Theano/Theano
https://caffe2.ai/
https://github.com/caffe2
https://deeplearning4j.org/Scikit-learn:https://scikit-learn.org/stable/
https://github.com/scikit-learn/scikit-learn
https://www.deeplearning.ai/
https://opencv.org/
https://github.com/qqwweee/keras-yolo3
https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/
https://developer.nvidia.com/cuda-math-library
http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php

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**B.TechCSE(DS)– III-I Sem**                                    **L   T   P   C**
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**(20A32503) DIGITAL AND SOCIAL MEDIA MARKETING**
**(Skill Oriented Course)**
**Pre-requisite Internet Knowledge, Acquittance with some social media Facebook, Twitter**

**Course Objectives:**
- This course takes an in-depth look at the relationship between media and human behavior, and examines how organizations capitalize on social media, and these consumer-to-consumer interactions, to support their marketing efforts.

**Course Outcomes:**
After completion of the course, students will be able to
- Understand what social media is, the various channels through which it operates, and its role in marketing strategy
- Use principles of consumer and social psychology to develop social media content and campaigns that engage consumers
- Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagating ideas, messages, products, and behaviors across social networks
- Measure the impact of a social media campaign in terms of a specific marketing objective

**UNIT I          Introduction, Search Engine optimization          Lecture 9Hrs**
**Marketing Goes Digital:** Introduction, Digital isn't the only option, Non-Marketing digital marketers, Personalization, Viral Marketing, Paid, earned and owned, Content marketing, Influencers, Affiliate marketing, Attribution, Public relations and reputation management, Integrated marketing communications, Gaming, Legal Considerations, Strategic digital marketing, Digital marketing Objectives
**Search Engine optimization:** Introduction, How search engines work, Keyword selection, On-site optimization, Off-site optimization, Strategic search engine optimization, Third-party search engine ranking

**Activity 1:(Search Engine Optimization)**
Perform the following activities in relation to On Page -Search Engine Optimization.

1. Submit your site to Google Search Console: Take a screenshot of successful message.
2. Create XML Map. Submit to Google Search Console: Take a screenshot of successful message.
3. Install Yoast SEO Plug-in. Perform SEO Analysis.  Take screenshot of the report
4. Perform Readability Analysis of the post that you created in Activity 1 Website Review: Part:1.  Question 1 using Yoast SEO. Take a screenshot of the report
5. Use keyword Planner tool. Select 10 Important Keyword for your website. Takescreen shot of this list.

**UNIT II          Website Development          Lecture 8Hrs**
**Website Development:** Introduction, Web presence ownership, management and development, Usability, The basics, Content development, The B2B website, The global web presence

**Activity 2: Buy Domain Name and WebHosting**

You need to buy a domain name and webhosting to build your own websites which is very important

to have hands-on experience with SEO and other digital marketing techniques.

**UNIT III**　　　　　　　**E-commerce**　　　　　　　　　　　Lecture9 Hrs

**E-commerce:** Introduction, Multi-channel retailing, Fulfilment, Comparison shopping engines, e-marketplaces and third-party shopping websites, The e-commerce website

**Advertising online:** Introduction, Programmatic advertising, Objectives and management, Online ad formats, Search advertising, Network advertising, Landing pages

**Activity-3: (Website Review)**

1. Crete a Website of your own
2. Add a new post to your website, a topic should be related to your Website.
3. Add a contact us form in the website (Use Contact Form 7 Plug-in).
4. Create Home page of your Website using Elementor Plug-in.
5. Add Slider to any page of your website
6. Create top Menu of your website

**UNIT IV**　　　　　　　**Email marketing**　　　　　　　　　Lecture8 Hrs

**Email marketing:** Introduction, Email as a medium for direct marketing, Email as a medium for marketing messages, Email newsletters

**Activity 4: Email Marketing**

All these questions are with respect to MailChimp

1. Create a new Audience. Add 10 Dummy Subscribers to the audience list using any of the following methods
   1. Manual
   2. Copy Paste from the file
   3. CSV or tab-delimited text file
2. Make sure your list includes, First Name, Last name, Phone (Dummy), Tag, Address and Gender. Please also mention which method you have used. Take a screenshot of the list. Upload to your website. Send the URL of Page.
3. Create a signup form using "Form Builder Option". Objective should be collecting the emails for your Digital Marketing Training Institute. Share the URL of Signup form
4. Create an embedded form. Embed this form in any page of your website. Share the link of the page. Objective should be collecting the emails only.
5. Suppose you are offering Training on Digital Marketing. Create a 1 Column - Full Width Template by using at least five Blocks in the template. Share the URL of that template
6. Select "Art Newsletter" and customize it a newsletter from digital marketing training institute. You may include the text/ message as per your wish.

**Activity 5: Email Marketing**

All these questions are with respect to Mail Chimp

1. Take the audience list. Create Two segments based on gender. Take the screenshot of each segment and Upload to your website. Send the URL of Page.
2. Create a group based on interest in your audience. It should be visible in Signup form. Take the screenshot and Upload to your website. Send the URL of Page.
3. Create a dummy campaign using mail chimp to promote Digital marketing services. Share the URLs of the Campaign. Use may use any template as per your wish.
4. Create a dummy 'plain text campaign' on any subject. Take a screenshot of Desktop and Mobile preview. Upload to your website. Send the URL of Page.

5. Create a pop-up form for your website. Share the URL of your website.

**UNIT V**                **Marketing on Social media**                Lecture 9Hrs
**Marketing on social media:** Introduction, Blogging, Consumer reviews and ratings, Social networking, Social sharing, Social media service and support, Strategic marketing on social media, Measure and monitor

**Activity 6: Social Media Marketing**

Assume a product. You want to advertise it. Prepare the advertisement and do the marketing on Face book.

**Activity 7:  Twitter and LinkedIn**
Experiment with Twitter and LinkedIn

**Activity 8: YouTube**

All the students put together create a YouTube Chanel. Upload videos. Optimize it.

**Activity 9: Logo, Banner, Video**

Prepare logo, banner, and Video for assumed product/organization

**Activity 10: WhatsApp**

Prepare a publicity video and market it on WhatsApp

**Textbooks:**
1.Alan Charlesworth, "Digital Marketing: A Practical Approach", 3rd Edition,2018

**Reference Books:**
1. Digital and Social Media Marketing: Emerging Applications and Theoretical Development,Nripendra P. Rana 2019
2. Digital Marketing Paperback – 6 August 2020by Seema Gupta
**Online Learning Resources:**
   1. Advanced Certificate in Digital Marketing and Communication | MICA, upGrad

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**B.TechCSE(DS)– III-II Sem**                                        **L  T  P  C**
                                                                      **3  0  0  3**

**(20A05602T) MACHINE LEARNING**
**Common to CSE, IT,CSD,CSE(AI),CSE(AI&ML),CSE(DS),AI&DS,CSE(IOT)**

**Course Objectives:**
The course is introduced for students to
- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

**Course Outcomes (CO):**
After completion of the course, students will be able to
- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Design application using machine learning techniques

UNIT – I  **Introduction to Machine Learning &Preparing to Model**        Lecture 9Hrs
Introduction: What is Human Learning?  Types of Human Learning, what is Machine Learning?Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning
Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT – II  **Modelling and Evaluation &Basics of Feature Engineering**        Lecture 9Hrs
Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model
Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection

UNIT – III  **Bayesian Concept Learning & Supervised Learning: Classification**  Lecture 10Hrs
Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network
Supervised Learning: Classification: Introduction**,** Example of Supervised Learning**,** Classification Model**,** Classification Learning Steps**,** Common Classification Algorithms-*k*-Nearest Neighbour(*k*NN), Decision tree, Random forest model, Support vector machines

UNIT – IV  **Supervised Learning: Regression**                                Lecture 10Hrs
Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT – V  **Unsupervised Learning**Lecture 9Hrs
Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods,
*K*-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN
Finding Pattern using Association Rule- Definition of common terms, Association rule, Theapriori algorithm for association rule learning, Build the aprioriprinciple rules

**Textbooks:**

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

**Reference Books:**
1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
1. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

**Online Learning Resources:**
- Andrew Ng, "Machine Learning Yearning"
- https://www.deeplearning.ai/machine-learning- yearning/
- Shai Shalev-Shwartz , Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms" , Cambridge University Press https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

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| B.TechCSE(DS)– III-II Sem | L | T | P | C |
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### (20A05701a) CLOUD COMPUTING
### Common to CSE,IT, CSD, CSE(AI), CSE(AI&ML), CSE(DS), AI&DS

**Course Objectives:**
- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.

**Course Outcomes (CO):**
After completion of the course, students will be able to
- Ability to create cloud computing environment
- Ability to design applications for Cloud environment
- Design &amp; develop backup strategies for cloud data based on features.
- Use and Examine different cloud computing services.
- Apply different cloud programming model as per need.

| UNIT - I | **Basics of Cloud computing** | Lecture 8Hrs |
|---|---|---|

**Introduction to cloud computing:** Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications
**Cloud concepts and Technologies:** Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.
**Cloud Services and Platforms:** Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

| UNIT - II | **Hadoop and Python** | Lecture 9Hrs |
|---|---|---|

**Hadoop MapReduce:** Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.
**Cloud Application Design**: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.
**Python Basics:** Introduction, Installing Python, Python data Types &amp; Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes.

| UNIT - III | **Python for Cloud computing** | Lecture 8Hrs |
|---|---|---|

**Python for Cloud:** Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Frame work, Designing a RESTful web API.
**Cloud Application Development in Python**: Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App.

| UNIT - IV | **Big data, multimedia and Tuning** | Lecture 8Hrs |
|---|---|---|

**Big Data Analytics:** Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.
**Multimedia Cloud:** Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App.
**Cloud Application Benchmarking and Tuning:** Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study.

| UNIT - V | **Applications and Issues in Cloud** | Lecture 9 Hrs |
|---|---|---|

**Cloud Security:** Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.
**Cloud for Industry, Healthcare &Education:** Cloud Computing for Healthcare, Cloud

computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.

**Migrating into a Cloud:** Introduction, Broad Approaches to migrating into the cloud, the seven–step model of migration into a cloud.

**Organizational readiness and Change Management in The Cloud Age:** Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self – assessment.

**Legal Issues in Cloud Computing**: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and data location, commercial and business considerations, Special Topics.

**Textbooks:**

1. Cloud computing A hands-on Approach‖ By ArshdeepBahga, Vijay Madisetti, Universities Press, 2016

2. Cloud Computing Principles and Paradigms: By Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2016

**Reference Books:**

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, SThamaraiSelvi, TMH
2. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O 'Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press.

**Online Learning Resources:**

Cloud computing - Course (nptel.ac.in)

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**B.TechCSE(DS)– III-II Sem**                                                     **L  T  P  C**
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## (20A32601T) DATA VISUALIZATION

**Course Objectives:**
- Discuss the importance of Data Visualization
- Demonstrate story telling
- Explain the environment of Tableau

**Course Outcomes:**
After completion of the course, students will be able to
- Effectively present the data
- Draw insights from the data
- Use Tableau

**UNIT I**                                                                        Lecture 9 Hrs

Introduction, the importance of Context, Choosing and effective visual

**UNIT II**                                                                       Lecture 9 Hrs

Clutter is your enemy, Focus your audience's attention, Lessons in Storytelling

**UNIT III**                                                                      Lecture 10 Hrs

Communicating data: A step in the process, a model of communication, Three types of communication problems, six principles of communicating data.
Introduction to Tableau: Using Tableau, Tableau products, Connecting to data.
How much and How many: Communicating how much, communicating how many
Ratios and Rates: Ratios, Rates

**UNIT IV**                                                                       Lecture 10 Hrs

Proportions and Percentages: Part to whole, current to historical, actual to target.
Mean and Median
Variation and Uncertainty: Respecting variation, Variation over time-Control charts, Understanding uncertainty

**UNIT V**                                                                        Lecture 8 Hrs

Multiple Quantities: Scatterplots, Stacked Bars, Regression and Trend Lines, The Quadrant Chart
Changes over time: The origin of time charts, the line chart, the dual axis line chart, the connected scatterplot, the date filed type and seasonality, the timeline, the slopegraph
Maps and Location: One special map, circle maps, filled maps, dual encoded maps.

**Textbooks:**
1. Cole NussbaumerKnaflic, Storytelling with data, Wiley
2. Ben Jones, Communicating Data with Tableau, O'Reilly

**Reference Books:**
1. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Reilly.
2. Andy Kirk, Data Visualization: A Successful Design Process, PAKT.
3. Scott Murray, Interactive Data Visualization for Web, O'Reilly.

**Online Learning Resources:**
1. Data Analysis and Visualization Foundations | Coursera
2. Data Visualization | Coursera

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B.TechCSE(DS)– III-II Sem                                          L   T   P   C
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**(20A32602a) PREDICTIVE ANALYTICS**
**(Professional Elective Course-II)**

**Course Objectives:**
- Discuss the concept Predictive Analytics
- Illustrate the uses and applications of Predictive Analytics
- Demonstrate building of Predictive Analytics models

**Course Outcomes:**
- Visualize and explore data to better understand relationships among variables
- Understand how ensemble models improve predictions
- Organize the predictive modelling task and data flow
- Apply predictive models to generate predictions for new data
- Choose and implement appropriate performance measures for predictive models

**UNIT I**                                                        Lecture 10 Hrs
**Overview of Predictive Analytics:** What Is Analytics? What Is Predictive Analytics? Business Intelligence Predictive Analytics vs. Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining, Who Uses Predictive Analytics? , Challenges in Using Predictive Analytics, What Educational Background Is Needed to Become a Predictive Modeler?
**Setting Up the Problem:** Predictive Analytics Processing Steps: CRISP-DM, Business Understanding, Defining Data for Predictive Modelling, Defining the Target Variable, Defining Measures of Success for Predictive Models, Doing Predictive Modelling Out of Order, Case study-Recovering Lapsed Donors, Fraud Detection

**UNIT II**                                                       Lecture 8 Hrs
**Data Understanding:** What the Data Looks Like, Single Variable Summaries, Data Visualization in One Dimension, Histograms, Multiple Variable Summaries, Data Visualization, Two or Higher Dimensions, The Value of Statistical Significance, Pulling It All Together into a Data Audit.
**Data Preparation:** Variable Cleaning, Feature Creation.

**UNIT III**                                                      Lecture 9 Hrs
**Itemsets and Association Rules:** Terminology, Parameter Settings, How the Data Is Organized, Measures of Interesting Rules, Deploying Association Rules, Problems with Association Rules, Building Classification Rules from Association Rules.
**Descriptive Modelling:** Data Preparation Issues with Descriptive Modelling, Principal Component Analysis, Clustering Algorithms.
**Interpreting Descriptive Models:** Standard Cluster Model Interpretation.

**UNIT IV**                                                       Lecture 9 Hrs
**Predictive Modelling:** Decision Trees, Logistic Regression, Neural Networks, K-Nearest Neighbour, Naïve Bayes, Regression Models, Linear Regression, Other Regression Algorithms.
**Assessing Predictive Models:** Batch Approach to Model Assessment, Assessing Regression Models.

**UNIT V**                                                        Lecture 10 Hrs
**Model Ensembles:** Motivation for Ensembles, Bagging, Boosting, Improvements to Bagging and Boosting, Model Ensembles and Occam's Razor, Interpreting Model Ensembles.
**Text Mining:** Motivation for Text Mining, A Predictive Modelling Approach to Text Mining, structured vs. Unstructured Data, Why Text Mining Is Hard, Data Preparation Steps, Text Mining Features, Modelling with Text Mining Features, Regular Expressions.
**Model Deployment:** General Deployment Considerations.
**Case Studies:** Survey Analysis Case Study, Help Desk Case Study.

**Textbooks:**
1.  Dean Abbott, Applied Predictive Analytics, Published by Jhon Wiley &Sons, Inc,2014.

**Reference Books:**
1.  Eric Siegel, Predictive Analytics, Published by Jhon Wiley & Sons, inc,2013.
2.  Data Analytics using Python Kindle Editionby Bharti Motwani, 2020.

**Online Learning Resources:**
1.  Predictive Analytics: Introduction to Business Forecasting | Udemy

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**B.TechCSE(DS)– III-II Sem**                                      **L   T   P   C**
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**(20A05603T) INTERNET OF THINGS**
**Common to CSE, IT, CSD, CSE(AI), CSE(DS),AI&DS**
**PROFESSIONAL ELECTIVE COURSE - II**

**Course Objectives:**
- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

**Course Outcomes:**
After completion of the course, students will be able to
- Understand general concepts of Internet of Things.
- Apply design concept to IoT solutions
- Analyze various M2M and IoT architectures
- Evaluate design issues in IoT applications
- Create IoT solutions using sensors, actuators and Devices

**UNIT I       Introduction to IoT**                                    Lecture 8Hrs
Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

**UNIT II Prototyping IoT Objects using Microprocessor/Microcontroller**       Lecture 9Hrs
Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

**UNIT III      IoT Architecture and Protocols**                         Lecture 8Hrs
Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

**UNIT IV     Device Discovery and Cloud Services for IoT**              Lecture 8Hrs
Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

**UNIT V    UAV IoT**                                                    Lecture 10Hrs
Introduction toUnmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

**Textbooks:**
1. Vijay Madisetti and ArshdeepBahga, " Internet of Things ( A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles,  K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

**Reference Books:**
1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, " From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

**Online Learning Resources:**
1. https://www.arduino.cc/
2. https://www.raspberrypi.org/
3. https://nptel.ac.in/courses/106105166/5
4. https://nptel.ac.in/courses/108108098/4

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B.TechCSE(DS)– III-II Sem

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### (20A12602a) COMPUTER GRAPHICS
### (Professional Elective-II)

**Course Objectives:**

- To familiarize with the use of the components of a graphics system.
- To learn how to draw the line, circle etc., from preliminary element (pixel).
- To learn the basic principles of 3-dimensional computer graphics.
- To provide an understanding of how to scan convert the basic geometrical primitives and how to transform the shapes to fit them as per the picture definition.
- To provide an understanding of mapping from a world coordinate to device coordinates, clipping, and projections.
- To be able to apply computer graphics concepts in the development of computer games, information visualization, and in business applications.

**Course Outcomes:**

After completion of the course, students will be able to

- Explain the basic concepts used in computer graphics.
- Inspect various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
- Assess the importance of viewing and projections.
- Define the fundamentals of animation, virtual reality and its related technologies.
- Analyze the typical graphics pipeline.

**UNIT IOverview of computer graphics system**                    Lecture 8Hrs

Overview of Computer Graphics System – Video display devices – Raster Scan and randomscan system – Input devices – Hard copy devices.

**UNIT IIOutput primitives and attributes**                    Lecture 9Hrs

Drawing line, circle and ellipse generating algorithms – Scan line algorithm – CharacterGeneration – attributes of lines, curves and characters – Antialiasing.

**UNIT IIITwo-dimensional graphics Transformations and viewing**          Lecture 9Hrs

Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines and Clipping of polygons.

**UNIT IVThree-dimensional graphics and viewing**                    Lecture 8Hrs

Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces,Splines, Bezier curves and surfaces – Geometric and Modelling transformations – Viewing -Parallel and perspective projections.

**UNIT VRemoval of hidden surfaces**                    Lecture 8Hrs

Visible Surface Detection Methods – Computer Animation.

**Textbooks:**

1. Hearn, D. and Pauline Baker,M., Computer Graphics (C-Version),2$^{nd}$ Edition, Pearson Education.

**Reference Books:**

1. Neuman, W.M., and Sproull, R.F., Principles of Interactive Computer Graphics, McGraw Hill., 1979.
2. Roger, D.F., Procedural elements for Computer Graphics, Mc Graw Hill, 1985.

3.  Asthana, R.G.S and Sinha, N.K., Computer Graphics, New Age Int. Pub., 1996.
4.  Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Computer Graphics, PearsonEducation, 2001.

**Online Learning Resources:**

1.  http://math.hws.edu/eck/cs424/downloads/graphicsbook-linked.pdf
2.  https://nptel.ac.in/courses/106/106/106106090/

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**B.TechCSE(DS)– III-II Sem**                                          **L   T   P   C**
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**(20A05602P) MACHINE LEARNING LAB**
**Common to CSE, CSD,CSE(AI),CSE(AI&ML),CSE(DS),AI&DS**

**Course Objectives:**
- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

**Course Outcomes (CO):**
After completion of the course, students will be able to
- Understand the Mathematical and statistical prospectives of machine learning algorithms through python programming
- Appreciate the importance of visualization in the data analytics solution.
- Derive insights using Machine learning algorithms

**List of Experiments:**
**Note:**
    a.  The programs can be implemented in either JAVA or Python.
    b.  For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
    c.  Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

1.  Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2.  For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3.  Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4.  Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5.  Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6.  Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7.  Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8.  Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9.  Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

**Projects**
1. Predicting the Sale price of a house using Linear regression
2. Spam classification using Naïve Bayes algorithm
3. Predict car sale prices using Artificial Neural Networks
4. Predict Stock market trends using LSTM
5. Detecting faces from images

**References:**
1. Python Machine Learning Workbook for beginners, AI Publishing, 2020.

**Online Learning Resources/Virtual Labs:**
1) Machine Learning A-Z (Python & R in Data Science Course) | Udemy
2) Machine Learning | Coursera

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**B.TechCSE(DS)– III-II Sem**                                    **L   T   P   C**
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## (20A32601P) DATA VISUALIZATION LAB

**Course Objectives:**
- Discuss concepts and principles of data visualization particularly related to decision making.
- Investigate technologies and practices for visualizing data as part of a data management and analytics system.
- Apply user interface design principles and practices to develop interactive data visualizations.
- Design effective dashboard for decision making at various levels.
- Conduct research on relevant data visualization topics.

**Course Outcomes:**
At the end of the course students will be able to:
- Understand and describe the main concepts of data visualization
- Publish the created visualizations to Tableau Server and Tableau Public
- How to recognize good (and bad) data visualizations, how to interpret a data visualization, and Using shapes, colors, text and layout appropriately
- Identifying stories and insights in data, preparing data for visualization, and create several different charts using Tableau.

**List of Experiments**:
1. Connecting to the data
2. Formatting and insertion of data
3. Creating worksheets, navigating the sheets, applying filters, aggregating the data
4. Organize the data into dashboards
5. Create story
6. Develop interactive plots in Python
7. Create Time series Data Visualization in Python
8. Visualization of Semi-Structured data
9. Create Sales Growth Dashboard – for the tracking of sales teams progress
10. Design Social media Dashboard – find how well your sponsored social activating are performing, monitor your PPC campaigns
11. Develop Healthcare Data Dashboard – Allows hospital administrators to manage and identify patient hazards from a single screen.

**References:**
1. Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016
2. Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010

**Online Learning Resources/Virtual Labs:**
1. Data Visualization with Tableau | Coursera

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**B.TechCSE(DS)– III-II Sem**

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### (20A12604P) CLOUD COMPUTING LAB
### Common to IT, CSE(AI), CSE(AI&ML), CSE(DS), AI&DS

**Course Objectives:**
- Demonstrate application development using Cloud
- Explain features of Hadoop

**Course Outcomes (CO):**

On completion of this course, the students will be able to:
- Configure various virtualization tools such as Virtual Box, VMware workstation.
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Manipulate large data sets in a parallel environment.

**List of Experiments:**
1. Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows operating systems.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount
9. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
10. Develop a Guestbook Application using Google App Engine
11. Develop a Serverless Web App using AWS
12. Design a Content Recommendation system using AWS
13. Design a Cloud based smart traffic management system
14. Design Cloud based attendance management system
15. Design E-learning cloud-based system
16. Using Amazon Lex build a Chatbot

**References:**
1. https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html.
2. http://code.google.com/appengine/downloads.html
3. http://code.google.com/appengine/downloads.html

**Online Learning Resources/Virtual Labs:**
1. Google Cloud Computing Foundations Course - Course (nptel.ac.in)

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**B.TechCSE(DS)– III-II Sem**

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## (20A52401) SOFT SKILLS

**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:**

By the end of the program students should be able to
- 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**          **10Hrs**

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**              **10Hrs**

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**          **10Hrs**

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**          **10Hrs**

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 | 10Hrs |
|---|---|---|

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
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

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**B.TechCSE(DS)– III-II Sem**

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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.TechCSE(DS)– IV-I Sem**                                    **L   T   P   C**
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### (20A05705a) CYBER SECURITY
### Common to IT, CSE(DS), CSE(IOT)
### (Professional Elective course - III)

**Course Objectives:**

The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cyber crime.

**Course Outcomes:**

After completion of the course, students will be able to

- Classify the cyber crimes 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**                        Lecture 8Hrs

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**          Lecture 9Hrs

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**          Lecture 9Hrs

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 an Measures in Mobile Computing Era, Laptops.

**UNIT IV          Tools and Methods Used in Cybercrime**          Lecture 8Hrs

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**          Lecture 8Hrs

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.DavidIrwin.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.TechCSE (DS)– IV-I Sem**                                   **L   T   P   C**
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### (20A32701a) USER INTERFACE DESIGN
**(Professional Elective Course– III)**

**Course Objectives:**
- Understand what user experience (UX) means and how it matters
- Understand how to approach UX and usability
- Understand how to approach UI design

**Course Outcomes:**
After completion of the course, students will be able to
- Understand Importance and Characteristics of User interface design
- Understand User Interface Design process AND Business functions
- Apply System menus, navigation schemes and windows characteristics
- Understand screen-based controls and device-based controls
- Design the prototypes and test plans of user interface

**UNIT I**                                                         Lecture 8Hrs
**The Importance of User Interface:** Defining the User Interface, The Importance Of
Good Design, The Benefits of Good Design, A Brief History of The Human-Computer
Interface-Introduction of The Graphical User Interface, The Blossoming of The World
Wide Web, A Brief History of Screen Design
**Characteristics of Graphical and Web User Interfaces:** The Graphical User Interface, The Web
User Interface, Principles of User Interface Design.

**UNIT II**                                                      Lecture 9Hrs
**The User Interface Design Process:** Obstacles and Pitfalls in the Development Path, Usability, The
Design Team
**Know Your User or Client**: Understanding How People Interact with Computers,
Important Human Characteristics in Design, Perception, Memory, Sensory Storage, Visual Acuity,
Human Considerations in Design-The User's Knowledge and Experience, The User's Tasks and
Needs, The User's Psychological Characteristics, The User's Physical Characteristics, Human
Interaction Speeds.

**UNIT III**                                                    Lecture 8Hrs
**Understand the Business Function:** Business Definition and Requirements Analysis, Determining
Basic Business Functions, Design Standards or Style Guides, System Training and Documentation
Needs.
**Understand the Principles of Good Screen Design:** Human Considerations In
Screen Design, Interface Design Goals, Statistical Graphs

**UNIT IV**                                                    Lecture 8Hrs
**Develop System Menus and Navigation Schemes**: Structures of Menu, Functions Of Menus,
Formatting And Phrasing Of Menus, Navigating Menus, Kinds Of Graphical Menus, Window
Characteristics, Components Of A Window, Types Of Windows, Window Operations, Web Systems.

**UNIT V**                                                    Lecture 9 Hrs
Selecting the Proper Device-Based Controls: Characteristics of Device-Based Controls, Presentation
Controls, Write Clear Text and Messages, Provide Effective Feedback and Guidance and Assistance,
Create Meaningful Graphics, Icons AndImages, Multimedia, Graphics, Organize and Layout
Windows and Pages, The Purpose Of Usability Testing, Developing and Conducting The Test.

**Textbooks:**

1. The Essential Guide to User Interface Design, Second Edition, Wilbert O. Galitz, 2002.

**Reference Books:**

1. User Interface Design, A Software Engineering Perspective, Soren Lauesen.

2. User Interface Design and Evolution, Debbie Stone, Caroline Jarrett, Mark Woodroffe, ShaileyMinocha, 2005

**Online Learning Resources:**

1.   Google UX Design Professional Certificate | Coursera

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**B.Tech CSE (DS)– IV-I Sem**

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**(20A32701b) PROCESS MINING**
**(Professional Elective Course– III)**

**Course Objectives:**
- Discuss the basic concepts of Process mining
- Demonstrate how to apply process mining

**Course Outcomes:**
At the end of the course students will be able to:
- To Learn Transparency Is a Prerequisite for Digital Transformation
- Understand Process Modelling and Analysis
- To learn and apply process discovery techniques
- Applying process mining e
- Analysis of Lasagna and Spaghetti process and future of process mining.

**UNIT I** Lecture 8Hrs
**Introduction:** Process Mining in a Nutshell, Purpose: Identifying the Right Use Cases, Challenges, Pitfalls, and Failures. Process Mining, RPA, BPM, and DTO.

**UNIT II** Lecture 9Hrs
**Process Mining: The Missing Link**- Limitations of Modelling, Process Mining, Analysingan Example Log, Play-In, Play-Out, andReplay, Positioning Process Mining.
**Process Modelling and Analysis:** The Art of Modelling, Process Models, Model-Based Process Analysis.

**UNIT III** Lecture 8Hrs
**Process Discovery:** A Simple Algorithm for Process Discovery, Rediscovering Process Models, Challenges.
**Advanced Process Discovery Techniques:** Characteristics, Heuristic Mining, Genetic Process Mining, Region-Based Mining, Inductive Mining.

**UNIT IV** Lecture 8Hrs
**Process Mining Software:** Process Mining Not Included, Different Types of Process Mining Tools, ProM: An Open-Source Process Mining Platform, Commercial Software.
**Process Mining in the Large:** Big Event Data, Case-Based Decomposition, Activity-Based Decomposition, Process Cubes, Streaming Process Mining

**UNIT V** Lecture 9 Hrs
**Analyzing "Lasagna Processes" –** Characterization, Use Cases, Approach, Applications
**Analyzing "Spaghetti Processes"**- Characterization, Approach, Applications
**Outlook: Future of Process Mining-** Academic View: Development of the Process Mining Discipline. Business View: Towards a Digital Enabled Organization

**Textbooks:**
1. Reinkemeyer, Lars. "Process mining in action." Principles, Use Cases and Outlook, Santa Barbara, 2020.
2. Aalst, Wil van der. "Data science in action." Process mining. Springer, Berlin, Heidelberg, 2016.

**Reference Books:**
1. Ferreira, Diogo R. A primer on process mining: Practical skills with python and graphviz. Cham: Springer International Publishing, 2017.
2. Burattin, Andrea. "Process mining techniques in business environments." volume 207 of Lecture Notes in Business Information Processing. Springer International Publishing, 2015.
3. Huser, Vojtech. "Process mining: Discovery, conformance and enhancement of business processes." 2012.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

| B.TechCSE (DS)– IV-I Sem | L | T | P | C |
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**(20A32702a) BIO INFORMATICS**
**(Professional Elective Course– IV)**

**Course Objectives:**
- Discuss basic knowledge on various techniques and areas of applications in bioinformatics.
- Explore common problem in bioinformatics, alignment techniques, ethical issues, public data sources, and evolutionary modelling.
- Discover the practical use of tools for specific bioinformatic areas.

**Course Outcomes:**
- To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.
- Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics.
- Explain about the methods to characterise and manage the different types of Biological data
- Classify different types of Biological Databases.
- Introduction to the basics of sequence alignment and analysis.
- Summarize biological macromolecular structures and structure prediction methods.

**UNIT I** Lecture 8Hrs
**Bioinformatics and The Internet:** Internet Basics, Connecting to The Internet, Electronic Mail, File Transfer Protocol, The World Wide Web.
**The NCBI Data Model:** Introduction, PUBs: Publicationsorperish, SEQ-Ids: What's In A Name? BIOSEQs: Sequences, BIOSEQ-SETs: Collections Of Sequences, SEQ-ANNOT: Annotating The Sequence, SEQ-DESCR: Describing The Sequence, Using The Model .

**UNIT II** Lecture 9Hrs
**The Gen Bank sequence database:** Introduction, Primary and Secondary Databases, Formatvs. Content: Computersvs. Humans, The database. The Gen Bank Flat file: A Dissection.
**SUBMITTING DNA SEQUENCES TO THE DATABASES:** Introduction, Why, Where, and What to Submit? DNA/RNA, Population, Phylogenetic, and Mutation Studies, Protein-Only Submissions,How to Submit on the World Wide Web,How to Submit with Sequin, Updates, Consequences of the Data Model, EST/STS/GSS/HTG/SNP and Genome Centres, Concluding Remarks, Contact Points for Submission of Sequence Data to DDBJ/EMBL/GenBank.

**UNIT III** Lecture 8Hrs
**STRUCTURE DATABASES:** Introduction to Structures, PDB: Protein Data Bank at the Research Collaboratory for Structural Bioinformatics (RCSB), MMDB: Molecular Modelling Database at NCBI, Structure File Formats, Visualizing Structural Information, Database Structure Viewers, Advanced Structure Modelling, Structure Similarity Searching, ProblemSet
**GENOMIC MAPPING AND MAPPING DATABASE:** Interplay of Mapping and Sequencing, Genomic Map Elements, Types of Maps, Complexities and Pitfalls of Mapping, Data Repositories, Mapping Projects and Associated Resources, Practical Uses of Mapping Resources, Problem Set.
Lecture 8Hrs
**UNIT IV**
**INFORMATION RETRIEVAL FROM BIOLOGICAL DATABASES**: Integrated Information Retrieval: The Entrez System,LocusLink,Sequence Databases Beyond NCBI, Medical Databases, Problem Set
**SEQUENCE ALIGNMENT AND DATABASE SEARCHING:** Introduction, The Evolutionary Basis of Sequence Alignment, The Modular Nature of Proteins, Optimal Alignment Methods,

Substitution Scores and Gap Penalties, Statistical Significance of Alignments, Database Similarity Searching, FASTA,BLAST, Database Searching Artifacts, Position-Specific Scoring Matrices Spliced Alignments.

**UNIT V**                                                                                                   Lecture 9 Hrs
**PHYLOGENETIC ANALYSIS:**   Fundamental Elements of Phylogenetic Models,Tree Interpretation—The Importance of Identifying Paralogs and Orthologs, Phylogenetic Data Analysis: The Four Steps, Alignment: Building the Data Model , Alignment: Extraction of a Phylogenetic Data Set, Determining the Substitution  model, Tree-Building Methods, Distance, Parsimony, and Maximum Likelihood: What's the Difference?,Tree Evaluation,Phylogenetics Software,  Internet-Accessible  Phylogenetic  Analysis  Software,Some  Simple  Practical Considerations.

**COMPARATIVE GENOME ANALYSIS:** Progress in Genome Sequencing, Genome Analysis and Annotation, Application of Comparative Genomics—Reconstruction of Metabolic Pathways, Avoiding Common Problems in Genome Annotation.

**LARGE-SCALE GENOME ANALYSIS:** Introduction, Technologies for Large-Scale Gene Expression, Computational Tools for Expression Analysis, Hierarchical Clustering, Prospects for the Future

**Textbooks:**
1. D. Baxevanis and F. Oulette, (2002) "Bioinformatics: A practical guide to the analysis of genes and proteins", Wiley Indian Edition
2. Cynthia Gibas and Per Jambeck (2001), "Developing Bioinformatics Computer Skills". O'Reilly press, Shorff Publishers and Distributors Pvt. Ltd., Mumbai.
3. Bryan  Bergeron  MD  (2003),  "Bioinformatics  Computing".  Prentice  Hall  India  (Economy Edition)
4. Stuart Brown (2000) "Bioinformatics – A biologists guide to Biocomputing and Internet". Eaton Publishing

**Reference Books:**
1. T. K. Attwood & D. J. Parry-Smith (2001), "Introduction to Bioinformatics", Pearson Education Ltd, Low Price Edition.
2. Bioinformatics: Sequence and Genome Analysis. D. W. Mount (2001) Cold Spring Harbor Laboratory Press.
3. Arthur M. Lesk (2002) "Introduction to Bioinformatis" Oxford University Press

**Online Learning Resources:**
1.   Bioinformatics | Coursera
2.   Learn Bioinformatics with Online Courses, Classes, & Lessons | edX

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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## (20A05702c) NATURAL LANGUAGE PROCESSING
### (Professional Elective Course– IV)

**Course Objectives:**
- Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
- Discuss approaches to syntax and semantics in NLP.
- Examine current methods for statistical approaches to machine translation.
- Teach machine learning techniques used in NLP.

**Course Outcomes:**
After completion of the course, students will be able to
- Understand the various NLP Applications and Organization of Natural language, able to learn and implement realistic applications using Python.
- Apply the various Parsing techniques, Bayes Rule, Shannon game, Entropy and Cross Entropy.
- Understand the fundamentals of CFG and parsers and mechanisms in ATN's.
- Apply Semantic Interpretation and Language Modelling.
- Apply the concept of Machine Translation and multilingual Information Retrieval systems and Automatic Summarization.

**UNIT I Introduction to Natural language**                                    Lecture 8Hrs
The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

**UNIT II Grammars and Parsing**                                    Lecture 9Hrs
Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayees Rule, Shannon game, Entropy and Cross Entropy.

**UNIT III Grammars for Natural Language**                                    Lecture 8Hrs
Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

**UNIT IV**                                    Lecture 8Hrs
**Semantic Interpretation**
Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory.
**Language Modelling**
Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.

**UNIT V**                                    Lecture9 Hrs
**Machine Translation**
Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

**Multilingual Information Retrieval**
Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

**Multilingual Automatic Summarization**
Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

**Textbooks:**
1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, AksharBharathi, Vineetchaitanya, Prentice–Hall of India.

**Reference Books:**
1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

**Online Learning Resources:**
https://nptel.ac.in/courses/106/105/106105158/
http://www.nptelvideos.in/2012/11/natural-language-processing.html

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**B.Tech (CSE)– IV-I Sem**
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### (20A32702b) SOCIAL NETWORK ANALYSIS
### Professional Elective Course– IV

**Course Objectives:**
- Discuss the characteristics of different social networks
- Demonstrate the functioning of different social networks

**Course Outcomes:**
After completion of the course, students will be able to
- Explore the functionality of different social networks
- Analyze social networks

**UNIT I**                                                  Lecture 8Hrs
Hacking on Twitter data, Micro formats: Semantic Markup and common sense collide

**UNIT II**                                               Lecture 9Hrs
Mailboxes: Oldies but Goodies, Titter: Friends, Followers and Set wise operations

**UNIT III**                                             Lecture 8Hrs
Twitter: The Tweet, the Whole Tweet, and Nothing but the Tweet

**UNIT IV**                                            Lecture 8Hrs
LinkedIn: Clustering your professional network for Fun (and profit)

**UNIT V**                                             Lecture 9 Hrs
Face book: The All-in-one Wonder

**Textbooks:**
Matthew A. Russel, Mining the Social Web, O'Reilly, 2013

**Reference Books:**
1. Social Network Analysis: A Introduction with an Extensive Implementation to a Large Scale Online Network using Pajek, SeifedineKadry, Mohammed Taie, 2014.
2. An Introduction to Social Network Data Analytics, Charu C. Aggarwal, IBM T. J. Watson Research Center.

**Online Learning Resources:**
1. Social Network Analysis | Coursera

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**B.TechCSE(DS)– IV-I Sem**                                          **L  T  P  C**
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**(20A05703b) BLOCKCHAIN TECHNOLOGY AND APPLICATIONS**
**(Professional Elective Course– V)**

**Course Objectives:**
- Understand how blockchain systems (mainly Bitcoin and Ethereum) work and to securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their own projects.

**Course Outcomes:**
After completion of the course, students will be able to
- Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
- Identify the risks involved in building Blockchain applications.
- Review of legal implications using smart contracts.
- Choose the present landscape of Blockchain implementations and Understand Cryptocurrency markets.
- Examine how to profit from trading cryptocurrencies.

**UNIT I        Introduction**                                      Lecture 8Hrs
Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain. Evolution of Blockchain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.

**UNIT II Block chain Concepts**                                   Lecture 9Hrs
Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

**UNIT III Architecting Blockchain solutions**                     Lecture 9Hrs
Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.

**UNIT IV Ethereum Block chain Implementation**                    Lecture 8Hrs
Ethereum Blockchain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, MyEtherWallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, OpenZeppelin Contracts

**UNIT V Hyperledger Blockchain Implementation**                   Lecture 8Hrs
Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation,

Invoking Chaincode Functions Using Client Application.

Advanced Concepts in Blockchain: Introduction, Inter Planetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

**Textbooks:**
1. Ambadas, Arshad SarfarzAriff, Sham "Blockchain for Enterprise Application Developers", Wiley
1. Andreas M. Antonpoulos, "Mastering Bitcoin: Programming the Open Blockchain" , O'Reilly

**Reference Books:**
1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly

**Online Learning Resources:**
1. https://github.com/blockchainedindia/resources
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0 401.htm
4. https://nptel.ac.in/courses/106105184
5. https://onlinecourses.nptel.ac.in/noc22_cs44/preview

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B.TechCSE(DS)– IV-I Sem
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### (20A05703c) DEEP LEARNING
### (Professional Elective Course– V)

**Course Objectives:**
- Demonstrate the major technology trends driving Deep Learning
- Build, train, and apply fully connected deep neural networks
- Implement efficient (vectorized) neural networks
- Analyse the key parameters and hyper parameters in a neural network's architecture

**Course Outcomes:**

After completion of the course, students will be able to
- Demonstrate the mathematical foundation of neural network
- Describe the machine learning basics
- Differentiate architecture of deep neural network
- Build a convolutional neural network
- Build and train RNN and LSTMs

**UNIT I**                                        Lecture 8Hrs

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, MarginalProbability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

**UNIT II**                                        Lecture 9Hrs

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

**UNIT III**                                      Lecture 8Hrs

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

**UNIT IV**                                        Lecture 9Hrs

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

                                       Lecture 8Hrs

**UNIT V**

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

**Textbooks:**
1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press,2016.
2. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition,2017.

**Reference Books:**
1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly,DouweOsinga, O'Reilly, Shroff Publishers,2019.

**Online Learning Resources:**
1.https://keras.io/datasets/
2.http://deeplearning.net/tutorial/deeplearning.pdf
3.https://arxiv.org/pdf/1404.7828v4.pdf
4.https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5.https://www.deeplearningbook.org
6.https://nptel.ac.in/courses/106105215

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**B.TechCSE(DS)– IV-I Sem**          **L  T  P  C**
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**(20A05702b) CRYPTOGRAPHY & NETWORK SECURITY**
**(Professional Elective Course – V)**

**Course Objectives:**

This course aims at training students to master the:

- The concepts of classical encryption techniques and concepts of finite fields and number theory
- Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes, and message digests, and public key algorithms
- Design issues and working principles of various authentication protocols, PKI standards
- Various secure communication standards including Kerberos, IPsec, TLS and email
- Concepts of cryptographic utilities and authentication mechanisms to design secure applications

**Course Outcomes**:

- After completion of the course, students will be able to
- Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory
- Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
- Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
- Apply different digital signature algorithms to achieve authentication and create secure applications
- Apply network security basics, analyse different attacks on networks and evaluate the performance of firewalls and security protocols like TLS, IPSec, and PGP
- Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

**UNIT I**                                                    Lecture 9Hrs

Computer and Network Security Concepts : Computer Security Concepts, The OSI Security Architecture, Security Attacks ,Security Services , Security Mechanisms ,A Model for Network Security, Classical Encryption Techniques : Symmetric Cipher Model ,Substitution Techniques ,Transposition Techniques ,Steganography, Block Ciphers : Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard :AES Structure, AES Transformation Functions

**UNIT II**                                                    Lecture 9Hrs

Number Theory:

The Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms, Finite Fields: Finite Fields of the Form GF(p), Finite Fields of the Form $GF(2^n)$. Public Key Cryptography: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.

**UNIT III**                                                   Lecture 9Hrs

Cryptographic Hash Functions: Application of Cryptographic Hash Functions,Requirements& Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures: NIST Digital Signature Algorithm, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure

**UNIT IV** Lecture 9Hrs

User Authentication: Remote User Authentication Principles, Kerberos. Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

**UNIT V** Lecture 8Hrs

Transport Level Security: Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell(SSH)

Firewalls: Firewall Characteristics and Access Policy, Types of Firewalls, Firewall Location and Configurations.

**Textbooks:**
1. Cryptography and Network Security- William Stallings, Pearson Education, 7thEdition.
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition.

**Reference Books:**
1. Cryptography and Network Security- Behrouz A Forouzan, DebdeepMukhopadhyaya, Mc-GrawHill, 3rd Edition,2015.
2. Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

**Online Learning Resources:**
1. https://nptel.ac.in/courses/106/105/106105031/lecture
   Dr.DebdeepMukhopadhyayIITKharagpur [VideoLecture]
2. https://nptel.ac.in/courses/106/105/106105162/lecture
   Dr.SouravMukhopadhyay IIT Kharagpur [VideoLecture]
3. https://www.mitel.com/articles/web-communication-cryptography-and-network-securityweb articles by Mitel Power Connections

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**B.Tech CSE (DS)– 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)
2. Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013

**References:**
1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwana‖ "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.pd
4. http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50

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**B.Tech CSE (DS)– IV-I Sem**

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### (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.

**UNITI    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.

**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**
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 &Weihrich, "Essentials of Management", 6th 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", 9th edition, PHI, 2005

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**B.Tech CSE(DS)– IV-I Sem**                                      **L   T   P   C**
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**(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

**UNITI**

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),

**UNITII**

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

**UNITIII**

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)

**UNITIV**

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,

**UNITV**

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

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**B.Tech CSE(DS)– IV-I Sem**                                                        **L   T   P   C**
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**(20A32703) NO SQL USING MONGO DB**
**Skill Oriented Course - V**

Pre-requisite      DBMS, Basic knowledge of DataScience

**Course Objectives:**
- This course elucidates concepts related to Mongodb.
- The students will get hands- on experience in working with NoSQL and Mongodb.

**Course Outcomes (CO):**

After completion of the course, students will be able to
- Understand the working of NoSQL, Mongodb, its features
- Explain and compare different types of Data
- Demonstrate the detailed architecture and performance tune of Document-oriented databases.
- Explain performance tune of Key-Value Pair NoSQL databases.
- Apply NoSQL development tools on MongoDB

**UNIT - I**
Introduction, Getting Started- Documents, Collections, Databases, Getting and Starting MongoDB, Introduction to MongoDB Shell, Data Types, Using the MongoDB Shell
Creating, Updating, and Deleting Documents: Inserting and Saving Documents, Updating Documents, Setting a write concern

**UNIT - II**
Indexing: Introduction to Indexing, Using explain () and hint(), When Not to use Index,Types of Indexes, Index Administration
Special Index and Collection Types: Capped Collections, Time-To-Live Indexes, Full-Text Indexes, Geospatial Indexing, Storing Files with GridFS

**UNIT - III**
Aggregation: The Aggregation Framework, Pipeline Operations, MapReduce, Aggregation Commands
Application Design: Normalization versus Denormalization, Optimizations for Data Manipulation, Planning Out Databases and Collections, Managing Consistency, Migrating, Schemas, When Not to use MongoDB
Setting Up a Replica Set: Introduction to Replication, A One-minute Test Setup, configuring a ReplicaSet, changing your ReplicaSet Configuration, How to design a Set, Member Configuration Options

**UNIT - IV**
Administration: Starting Members in Standalone Mode, Replica Set Configuration, Manipulating Member State, Monitoring Replication, Master-Slave
Sharding Administration: Seeing the Current State, Tracking Network Connections, Server Administration, Balancing Data
Data Administration: Setting Up Authentication, Creating and Deleting Indexes, Preheating Data, Compacting Data, Moving Collections, Pre-allocating Data Files

**UNIT - V**
Starting and Stopping MongoDB: Starting from the Command Line, Stopping MongoDB, Security, Logging
Monitoring MongoDB: Monitoring Memory Usage, Calculating the Working Set, Tracking Performance, Monitoring Replication
Making Backups: Backing Up a server, Backing Up a ReplicaSet, Backing Up a Sharded Cluster, Cresting Incremental Backups with mongoopolog
Designing the System, Virtualization, Configuring System Settings, Configuring your network, System Housekeeping

**Textbooks:**
1. "MongoDB: The Definitive Guide", SECOND EDITION by Kristina Chodorow, Published by O'Reilly Media, Inc.
2. "The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing", by EelcoPlugge, Peter Membrey and Tim Hawkins, Apress

**Reference Books:**
1. MongoDB Complete Guide: Develop Strong Understanding of Administering MongoDB, CRUD Operations, MongoDB Commands,2021

**Online Learning Resources:**
What Is NoSQL? NoSQL Databases Explained | MongoDB

**List of Experiments**
1. Install MongoDB
2. Install MongDB Shell and Practice
3. Connect to a MobgoDB Deployment
4. Perform CRUD operations
5. Run Aggregation pipeline
6. Perform Client side Field level encryption
7. Write scripts to modify data and perform some administrative operations

**Projects**
Build a Content Management System using MongoDB
Build a File sharing application similar to Dropbox and Google drive using MongoDB

# OPEN ELECTIVES

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## (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 protectionof buildings-general principles of design of openings-various types of fire protection measures to be considered while panning 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 2nd Edition 2015
2. Building construction by Punmia.B.C, Jain.A.K and Jain.A.K Laxmi Publications 11th 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

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## (20A02505) ELECTRIC VEHICLES
### (Open Elective-I)

**Course Objectives:**
- To get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- To get exposed to EV system configuration and parameters
- To know about electro mobility and environmental issues of  EVs
- To understand about basic EV propulsion and dynamics
- To understand about fuel cell technologies for EV and HVEs
- To know about basic battery charging and control strategies used in electric vehicles

**Course Outcomes:**
- Understand and differentiate between conventional and latest trends in Electric Vehicles
- Analyze various EV resources, EV dynamics and Battery charging
- Apply basic concepts of EV to design complete EV system
- Design EV system with various fundamental concepts

**UNIT I    INTRODUCTION TO EV SYSTEMS AND PARAMETERS**
Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

**UNIT II    EV AND ENERGY SOURCES**
Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

**UNIT III    EV PROPULSION AND DYNAMICS**
Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

**UNIT IV    FUEL CELLS**
Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.
Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples

**UNIT V    BATTERY CHARGING AND CONTROL**

**Battery charging:** Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.
**Control:** Introduction, modelling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

**Textbooks:**
1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

**Reference Books:**
1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.

**Online Learning Resources:**
1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

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**B.Tech III-I Sem**                                      **L  T  P  C**
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### (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 Applicationsof 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), Ballastic 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/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4

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### (20A04507) MATLAB PROGRAMMING FOR ENGINEERS

**Course Objectives:**
To provide fundamental knowledge of programming language for solving problems.
**Course Outcomes**: On completion of the course, students will be able to
- Generate arrays and matrices for numerical problems solving.
- Represent data and solution in graphical display.
- Write scripts and functions to easily execute series of tasks in problem solving.
- Use arrays, matrices and functions in Engineering applications
- Design GUI for basic mathematical applications.

**UNIT I**
Introduction: Basics of MATLAB, MATLAB windows, Advantages of MATLAB, on-line help, file types. MATLAB Basics: Variables and Constants –Vectors and Matrices- Arrays - manipulation-Built-in MATLAB Functions. Creating and printing simple plots, Creating, Saving and Executing a Script File, Creating and Executing a function file. Programming Basics: Data Types-Operators – Hierarchy of operations, Relational and logical operators, if-end structure, if-else-end structure, if-elseif-else-end structure, switch-case statement, for-end loop, while-end loop, break and continue commands.

**UNIT II**
Scripts and Functions Script Files, Function Files, Debugging methods in MATLAB. Graphics: Basic 2D plots: Printing labels- grid and axes box- Entering text in a box- Axis control-Style options Multiple plots-subplots-specialized 2D plots: stem-, bar, hist, pi, stairs, loglog, semilog,polar,comet 3D plots: Mesh,Contour,Surf,Stem3,ezplot.

**UNIT III**
Numerical Methods Using MATLAB Numerical Differentiation, Numerical integration- Newton-Cotes integration formulae, Multi-step application of Trapezoidal rule, Simpson's 1/3 Rule for Numerical Integration. MATLAB functions for integration. Linear Equations- Linear algebra in MATLAB, solving a linear system, Gauss Elimination, Finding eigen values and eigen vectors, Matrix factorizations, Advanced topics.

**UNIT IV**
Nonlinear Equations System of Non-linear equations, Solving System of Equations Using MATLAB function fsolve, Interpolation Lagrange Interpolation, Two dimensional Interpolation, Straight line fit using Least Square Method, Curve fitting using built-in functions ployval and polyfit, cubic fit using least square method. Finding roots of a polynomial - roots function, Newton-Raphson Method.

**UNIT V**
Solution of Ordinary differential Equations (ODEs)-The 4th order Runge-kutta Method, ODE Solvers in MATLAB, Solving First –order equations using ODE23 and ODE45. Structures and Graphical user interface (GUI): Advanced data Objects, how a GUI works, Creating and displaying a GUI. GUI components, Dialog Boxes.

**Learning Resources:**
1. Getting started with MATLAB "A quick introduction for scientist and engineers by Rudra Pratap, Oxford publications.
2. Advanced Guide to MATLAB-Practical Examples in Science and Engineering by S.N.Alam, S.Islam, S.K. Patel-I.K. International Publishing House Pvt. Ltd.

3. Stephen J. Chapman-"MATLAB Programming for Engineers"- 5th Edition- Cengage Learning- 2015. Getting started with MATLAB (Version 9) The Math works.
4. An Introduction to MATLAB® Programming and Numerical Methods for Engineers 1st Edition by Timmy Siauw Alexandre Bayen, Elsevier-18th April 2014.
5. https://nptel.ac.in/courses/103106118/2
6. https://www.udemy.com/numerical-methods

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### (20A04508) INTRODUCTION TO CONTROL SYSTEMS

**Course Objectives:**
- To learn the concepts of linear Systems theory and its analysis.

**Course Outcomes:**
- Understand different system representation, block diagram reduction and Mason's rule.
- Determine Time response analysis of LTI systems and steady state error.
- Plot open loop and closed loop frequency responses of systems
- Understand Stability concept.
- Perform State variable analysis.

**UNIT I        MATHEMATICAL MODELS OF PHYSICAL SYSTEMS**
Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction– Signal flow graphs.

**UNIT II        TIME RESPONSE ANALYSIS & ROOT LOCUS TECHNIQUE**
Standard test signals – Steady state error & error constants – Time Response of I and II order system – Root locus – Rules for sketching root loci.

**UNIT III        FREQUENCY RESPONSE ANALYSIS**
Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

**UNIT IV        STABILITY CONCEPTS & ANALYSIS**
Concept of stability – Necessary condition – RH criterion – Relative stability – Nyquist stability criterion – Stability from Bode plot – Relative stability from Nyquist & Bode – Closed loop frequency response.

**UNIT V        STATE VARIABLE ANALYSIS**
Concept of state – State Variable & State Model – State models for linear & continuous time systems – Solution of state & output equation – controllability & observability.

**Textbooks:**
1. Benjamin C. Kuo, Automatic Control Systems, PHI Learning Private Ltd, 2010.
2. J. Nagrath and M. Gopal, Control Systems Engineering, Tata McGraw-Hill Education Private Limited, Reprint, 2010.

**References:**
1. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, Pearson Education, Third Impression, 2009.
2. S. Palani, Control System Engineering, Tata McGraw-Hill Education Private Limited, First Reprint, 2010.

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## (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 I**V
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**
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**(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://slideplayer.com/slide/7790901/
https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf

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**B.Tech III-I Sem**                                                                        **L   T   P   C**
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## (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 2nd Edition, 3 Volumes-Kaufmann E N -John Wiley (Bp)

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**B.Tech III-I Sem**                                                      **L   T   P   C**
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## (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 batterie**s.**

**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 7th 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 2nd Edition, Harlow: Longman.(1996),
4. Natural Resource and Environmental Economics by Roger Perman, Michael Common, Yue Ma and James Mc Gilvray 3rd Edition, Pearson Education.(2003),

**Online Learning Resources:**
https://nptel.ac.in/courses/109107171

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**B.Tech III-II Sem**                                                              **L  T  P  C**
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### (20A02605) SMART ELECTRIC GRID
### (Open Elective Course-II)

**Course Objectives:**
- Understand recent trends in grids, smart grid architecture and technologies
- Analyze smart substations
- Apply the concepts to design smart transmission systems
- Apply the concepts to design smart distribution systems

**Course Outcomes:**
- Understand trends in Smart grids, needs and roles of Smart substations
- Design and Analyze Smart Transmission systems
- Design and Analyze Smart Distribution systems
- Analyze SCADA and DSCADA systems in practical working environment

**UNIT I          INTRODUCTION TO SMART GRID**
Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid

**UNIT II          SMART GRID TECHNOLOGIES**
Characteristics of Smart grid, Micro grids, Definitions, Drives, benefits, types of Micro grid, building blocks, Renewable energy resources, needs in smart grid, integration impact, integration standards, Load frequency control, reactive power control, case studies and test beds

**UNIT III          SMART SUBSTATIONS**
Protection, Monitoring and control devices, sensors, SCADA, Master stations, Remote terminal unit, interoperability and IEC 61850, Process level, Bay level, Station level, Benefits, role of substations in smart grid, Volt/VAR control equipment inside substation

**UNIT IV          SMART TRANSMISSION SYSTEMS**
Energy Management systems, History, current technology, EMS for the smart grid, Synchro Phasor Measurement Units (PMUs), Wide Area Monitoring Systems (WAMS), protection & Control (WAMPC), needs in smart grid, Role of WAMPC smart grid, Drivers and benefits, Role of transmission systems in smart grid

**UNIT V          SMART DISTRIBUTION SYSTEMS**
DMS, DSCADA, trends in DSCADA and control, current and advanced DMSs, Voltage fluctuations, effect of voltage on customer load, Drivers, objectives and benefits, voltage-VAR control, VAR control equipment on distribution feeders, implementation and optimization, FDIR - Fault Detection Isolation and Service restoration (FDIR),faults, objectives and benefits, equipment, implementation

**Textbooks:**
1. Stuart Borlase, Smart Grids - Infrastructure, Technology and Solutions, CRC Press, 1e, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley–IEEE Press, 2e, 2013.

**Reference Books:**
1. A.G. Phadke and J.S. Thorp, Synchronized Phasor Measurements and their Applications, Springer Edition, 2e, 2017.
2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2e, 2012.

**Online Learning Resources:**
1. https://onlinecourses.nptel.ac.in/noc22_ee82/preview

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B.Tech IV-I Sem
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### (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. Schillin, 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

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**B.Tech IV-I Sem**                                                                                      **L  T  P  C**
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## (20A04605) SIGNAL PROCESSING
### (Open Elective Course –II)

**Course objectives:**
- Understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- Ability to represent continuous time signals (both periodic and non-periodic) in the time domain, sdomain and the frequency domain
- Understand the properties of analog filters, and have the ability to design Butterworth filters
- Understand and apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time (without loss of information)
- Able to represent the discrete time signal in the frequency domain
- Able to design FIR and IIR filters to meet given specifications

**Course Outcomes**:
- Understand and explain continuous time and discrete time signals and systems, in time and frequency domain
- Apply the concepts of signals and systems to obtain the desired parameter/ representation
- Analyse the given system and classify the system/arrive at a suitable conclusion
- Design analog/digital filters to meet given specifications
- Design and implement the analog filter using components/ suitable simulation tools
- Design and implement the digital filter using suitable simulation tools, and record the input and output of the filter for the given audio signal

**UNIT I**
Signal Definition, Signal Classification, System definition, System classification, for both continuous time and discrete time. Definition of LTI systems

**UNIT II**
Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems

**UNIT III**
Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications

**UNIT IV**
Sampling Theorem- Statement and proof, converting the analog signal to a digital signal. Practical sampling. The Discrete Fourier Transform, Properties of DFT. Comparing the frequency response of analog and digital systems.

**UNIT V**
Definition of FIR and IIR filters. Frequency response of ideal digital filters
Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, and the frequency sampling technique to meet given specifications Comparing the designed filter with the desired filter frequency response

**Textbooks:**
1. 'Signals and Systems', by Simon Haykin and Barry Van Veen, Wiley.
**References:**
1. 'Theory and Application of Digital Signal Processing', Rabiner and Gold
2. 'Signals and Systems', Schaum's Outline series
3. 'Digital Signal Processing', Schaum's Outline series

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**B.Tech III-II Sem**                                                                      **L  T  P  C**
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### (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, transconductance.

**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: λ - 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, RegularityDefinition & 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

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**B.Tech III-II Sem**                                                                      **L   T   P   C**
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**(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, convicted 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 Laroiya, S. C. "Practical Refrigeration and Air Conditioning". Wiley Estern Ltd., New Delhi 1991

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**B.Tech III-II Sem**

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**(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 ad 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. Raghuveer Rao, "Wavelet Transforms", Pearson Education, Asia.

Online Learning Resources:
https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915

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**B.Tech  III-II Sem**                                              **L   T   P   C**
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### (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://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech III-II Sem**

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## (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 cellulosics

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 cellulosics: 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

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B.Tech IV-I Sem                                                                                       L   T   P   C
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### (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**
- a) **Housing Scenario :**Introducing - Status of urban housing - Status of Rural Housing
- b) **Housing Finance**: Introducing - Existing finance  system in India - Government role as facilitator - Status at Rural Housing Finance - Impedimently in housing finance and related issues
- c) **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
- d) **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  prefatroices - Adopting of total prefactcation of mass housing in India- General remarks on pre cast rooting/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

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**B.Tech IV-I Sem**                                                  **L  T  P  C**
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## (20A02704) IoT APPLICATIONS IN ELECTRICAL ENGINEERING
### (Open Elective Course – III)

**Course Objectives:**
- Understand basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- Analyze motion less and motion detectors in IoT applications
- Understand about Analyze applications of IoT in smart grid
- Apply the concept of Internet of Energy for various applications

**Course Outcomes:**
- Understand the concept of IoT in Electrical Engineering
- Analyze various types of motionless sensors and various types of motion detectors
- Apply various applications of IoT in smart grid
- Design future working environment with Energy internet

**UNIT I          SENSORS**

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

**UNIT II          OCCUPANCY AND MOTION DETECTORS**

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

**UNIT III          MEMS**

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

**UNIT IV          IoT FOR SMART GRID**

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

**UNIT V          INTERNET of ENERGY (IoE)**

Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid

**Textbooks:**
1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

**Reference Books:**
1. Raj Kumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

**Online Learning Resources:**
1. https://onlinecourses.nptel.ac.in/noc22_cs96/preview
2. https://nptel.ac.in/courses/108108123
3. https://nptel.ac.in/courses/108108179

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### (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 factorsin 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/

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## (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

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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 VCommunication 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", 3rd 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", 4th Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam "Digital and Analog Communication Systems", Wiley India Edition, 2008.

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## (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

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### (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/

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**(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$^{nd}$ 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

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### (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 nanotecnology, 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.

**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, MaGraw-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.

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**B.Tech IV-I Sem**                                                              **L   T   P   C**
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### (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 TerjeAven 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

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### (20A02705) RENEWABLE ENERGY SYSTEMS
### (Open Elective Course – IV)

**Course Objectives:**
- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

**Course Outcomes:**
- Understand various alternate sources of energy for different suitable application requirements
- Understand the concepts of solar energy generation strategies and wind energy system
- Analyze Solar and Wind energy systems
- Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass and fuel cells

**UNIT I        SOLAR ENERGY**
Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

**UNIT II        PV ENERGY SYSTEMS**
Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

**UNIT III        WIND ENERGY**
Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

**UNIT IV        GEOTHERMAL ENERGY**
Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

**UNIT V        MISCELLANEOUS ENERGY TECHNOLOGIES**
**Ocean Energy**: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.
**Bio mass Energy**: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration
**Fuel cell**: Principle of working of various types of fuel cells and their working, performance and limitations.

**Textbooks:**
1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
2. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

**Reference Books:**

1. S. P. Sukhatme, "Solar Energy",$3^{rd}$ Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
2. B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",$3^{rd}$ Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.

**Online Learning Resources:**

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

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**B.Tech  IV-I Sem**                                                                    **L   T   P   C**
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**(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 – Auto clave 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 pyrolsis –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 carbonfibre 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

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## (20A04705) MICROCONTROLLERS & APPLICATIONS
### (Open Elective Course –IV)

**Course Objectives:**

- 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.

**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

**UNIT 1** 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.

**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.

**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.

**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.

**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.

**Textbooks:**

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.

**References:**

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.

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**B.Tech IV- I Sem**                                                 **L   T   P   C**
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**(20A04706) PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS**

**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.

**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).

**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.

**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.

**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.

**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.

**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.

**Textbooks:**
1. William C. Y. Lee, "Mobile Cellular Telecommunications", 2nd Edition, McGraw-Hill International, 1995.
2. Theodore S. Rappaport, "Wireless Communications – Principles and Practice", 2nd Edition, PHI, 2004.

**References:**
1. Aditya K. Jagannatham "Principles of Modern Wireless Communications Systems – Theory and Practice", McGraw-Hill International, 2015.

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**B.Tech IV-I Sem**                                                  **L  T  P  C**
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### (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 waste water and effluent treatment

**UNIT I**
Wastewater Treatment an Overview: Terminology – Regulations – Health and Environment Concerns in waste water 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-Grow-Hill International editions2001,.
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" 3rd Edition Mc Graw Hill 2008

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**B.Tech IV-I Sem**                                          **L  T  P  C**
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**(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 p hi-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

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### (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-precipitaiton. 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, Champman 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, 2nd 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

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## (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, 4th 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 AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:Green Nanoscience, wiley-VCH, 2013.

# HONOURS

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**(20A32H01) DATA SCIENCE FOR BUSINESS**

**Pre-requisite**          **Data Science**

**Course Objectives:**
- Expose with the basic rudiments of business intelligence system
- Expose with different data analysis tools and techniques

**Course Outcomes:**

At the end of the course the students will be able to
- Understand the fundamentals of business intelligence.
- Applying link to data mining with business intelligence.
- Apply various modelling techniques.
- Understand the data analysis and knowledge delivery stages.
- Apply business intelligence methods to various situations and decide on appropriate technique.

**UNIT I**                                                                            Lecture 8 Hrs

Introduction – Business problems and Data Science Solutions, Introduction to Predictive modeling: From Correlation to Supervised Segmentation

**UNIT II**                                                                          Lecture 8 Hrs

Fitting the Data- Fitting a Model to Data, Overfitting and its Avoidance

**UNIT III**                                                                         Lecture 9Hrs

Similarity, Neighbors, and Clusters, Decision Analytic Thinking: What is a Good model

**UNIT IV**                                                                        Lecture 8 Hrs

Representing and Mining text, Decision Analytic Thinking II: Toward Analytic Engineering

**UNIT V**                                                                         Lecture 9 Hrs

Other Data Science Tasks and Techniques, Data Science and Business Strategy

**Textbooks:**

1. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly, 2013.

**Reference Books:**

1. Efraim Turban, Ramesh Sharda, DursunDelen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2013.
2. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete ProjectLifecycle of Decision Making", Addison Wesley, 2003.
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for DecisionMaking", Wiley Publications, 2009.
4. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager'sGuide", Second Edition, 2012.

**Online Learning Resources:**

1. Edx: IBM Data Warehousing and BI Analytics

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**B.TechCSE(DS)**                                                                 **L   T   P   C**
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## (20A32H02) SOFTWARE PROJECT MANAGEMENT USING AGILE

**Pre-requisite**          **Software Engineering Fundamentals**

**Course Objectives:**
- Teach how to manage a Project
- Discuss Agile method of handling projects

**Course Outcomes:**
After completion of the course, students will be able to
- Apply Agile methodology for software development
- Critically analyze quality of software
- Estimate the software cost

**UNIT I**            Introduction, The Agile Business Case            Lecture 8Hrs
History, Background, and the Manifesto, Traditional Lifecycle, Agile Lifecycle, Scaling for Enterprise Agile, Four Agile Methodologies

The Agile Business Case: The Business Case, Business Value Models, Project Balance Sheet, Building the Business Case by Levels

**UNIT II**           Quality in the Agile Space            Lecture 9Hrs
Quality Values and Principles, Thought Leaders and Agile Quality, Sampling for Quality Validation, Agile in the Waterfall: First Principles and Requisite Conditions, The Black Box, Interfaces, and Connectivity, Governing

**UNIT III**          Scope and Requirements            Lecture 9Hrs
Developing the Scope and Requirements: Agile Scope, Envisioning, Requirements, Planning at a Distance
Planning and Scheduling: Planning in the Enterprise Context, Scheduling, Other Plans in the Enterprise Agile Project

**UNIT IV**          Estimating Cost and Schedule            Lecture 8Hrs
The Nature of Estimates, Drivers on Cost and Schedule, Building Estimates
Teams Are Everything: The Social Unit, Principle and Values Guide Teams, Teams Are Building Blocks, Some Teams Work; Others Do Not, Matrix Management in the Agile Space

**UNIT V**           Governance, Managing Value            Lecture 8Hrs
Governance Is Built on Quality Principles, Governance Verifies Compliance
Managing Value: Defining and Accounting for Value, Burn-down Charts and Value Scorecards
**Textbooks:**
  1. John C. Goodpasture, PMP, "Project Management the Agile Way", Second Edition, J. Ross Publishing 2016.
**Reference Books:**
  1. Kalpesh Ashar, Agile Essentials you always wanted to know, Vibrant publishers, 2020
  2. Jutta Eckstein, Agile Software development in the large: Diving into the Deep, Jutta Eckstein Publisher, 2022
**Online Learning Resources:**
  1. Coursera: Agile Project Management offered by Google

  2. Coursera: Alex Cowan, Agile Development Specialization

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**B.TechCSE(DS)**                                                        **L   T   P   C**
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**(20A30H03) ETHICS AND PRIVACY IN AI**

**Pre-requisite**          **Artificial Intelligence**

**Course Objectives:**

The course is designed to

- To understand the need for ensuring ethics in AI
- To understand ethical issues with the development of AI agents
- To apply the ethical considerations in different AI applications
- To evaluate the relation of ethics with nature
- To overcome the risk for Human rights and other fundamental values

**Course Outcomes:**

After completion of the course, students will be able to

- Understand the ethical issues in the development of AI agents
- Learn the ethical considerations of AI with perspectives on ethical values
- Apply the ethical policies in AI based applications and Robot development
- To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights.
- This study will help to overcome the evil genesis in the concepts of AI.

**UNIT I Introduction, What Do We Need to Understand About Ethics?**          Lecture  8 Hrs

Introduction: Artificial Intelligence and Ethics, Why Ethics in AI? Why Now? Current Initiatives in AI and Ethics, Codes of Ethics in Context: Other Approaches to Ethical Questions in AI

What Do We Need to Understand About Ethics?: A Preliminary Plea: Ethics Is Not About' Banning' Things, Normative Ethical Theories, Ethics and Empirical Evidence, So Why Do We Even Need Ethics?, So, With What Sort of Issues Is Ethics Concerned?, Who(orWhat) Is The Proper Object of Moral Concerns, and How Widely Should Our Concerns Extend?, Four Domains of Ethics: Self, Friend, Stranger, World, What Counts as Adequate Justification and Argument in Ethics?, Moral Relativism, Moral Justification and AI, A Distributed Morality?, MoralAgents, Moral Motivation, AI, Codes of Ethics and the Law

**UNIT II Does AI Raise Any Distinctive Ethical Questions? Codes of Professional Ethics** Lecture 10 Hrs

DoesAIRaiseAnyDistinctiveEthicalQuestions? Methodology: Focusing in on Ethical Questions, Many Ethical Issues in AI Are Shared with Other Rapidly Developing Technology, Ethical Questions Arise from AI's Typical Use to Enhance, Supplement, or Replace the Work of Humans, We Also Need to Consider the Methods of Production of AI, Hype in AI and Implications for Methodology in Ethics

Codes of Professional Ethics: Introduction: The Varieties of Ethical Codes, Professional Codes of Ethics Tend to Have Certain Commonalities, Codes of Ethics and Institutional Backing, The Context of Codes of Ethics, Can Codes of Ethics Make the Situation Worse? Yes

**UNIT IIIHow AI Challenges Professional Ethics, Developing Codes of Ethics**   Lecture  8

**Amidst Fast Technological Change** Hrs

How AI Challenges Professional Ethics: AI Professional Organisations and Companies, and the Nature of Its Development and Production, Gradients of Professional Power and Vulnerability in AI, A Third Layer of Complexity in Codes of Professional Ethics for AI: The Behaviour of Machines, The Authority of Any Resulting Codes.

Developing Codes of Ethics Amidst Fast Technological Change: Social, Cultural and Technological Change and Ethics, Social, Cultural, Economic and Technological Change: The Example of AI and Employment, Regulating for Whom? The Global Reach of AI, Universalism, and Relativism, Diversity in Participation as Part of the Solution.

**UNIT IVSomeCharacteristicPitfallsinConsideringtheEthicsofAI,andWhattoDoAboutThem, Some Suggestions for How to Proceed** Lecture 9 Hrs

Some Characteristic Pitfalls in Considering the Ethics of AI, and

What to Do About Them: The Idealisation of Human and of Machine Agency, Building Ethics into AI and the Idealisation of Moral Agency, Replacing and Enhancing Human Agency, Boundaries and AI, Addressing the Increased Gradient of Vulnerability, Common Language, Miscommunication and the Search for Clarity.

Some Suggestions for How to Proceed: Organisations and Codes, Procedures for Drawing Up and Implementing Codes, The Content of Codes, Thinking About Ethical Issuesin Developing and Implementing Codes of Ethics, Asilomar AI Principles

**UNIT V An Introduction to Privacy Aspects of Information and Communication Technologies, Data Mining in Large Databases** Lecture 8 Hrs

Introduction, Privacy and the Internet, Privacy in Databases, Privacy in Ubiquitous Computing.

Data Mining in Large Databases — Strategies for Managing the Trade-Off Between Societal Benefit and Individual Privacy: Introduction, Examples of data-collecting institutions and data users, Strategies for controlling privacy, Measures of the utility of published data sets and outputs.

**Textbooks:**

1. Paula Boddington," Towards a Code of Ethics for Artificial Intelligence", Springer.
2. AgustiSolanas& Antoni Martínez-Ballesté "Advances in Artificial Intelligence for Privacy Protection and Security" World Scientific

**Reference Books:**

1. "Oxford Handbook of Ethics of AI", Markus D. Dubber frank pasqualesunit Das, oxford university press.

**Online Learning Resources:**

1. Coursera: Ethics of Artificial Intelligence
2. Coursera: Artificial Intelligence Privacy and Convenience

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### (20A30H04) MEDICAL IMAGE DATA PROCESSING

**Pre-requisite**          Computer Graphics Fundamentals

**Course Objectives:**
- Understand the significance of image process in medical industry
- Teach the process of extracting correct information in medical images

**Course Outcomes:**

The course is designed to
- Analyze medical images
- Apply image processing techniques to medical images

**UNIT I**          Basics of Medical Image Sources          Lecture 8 Hrs

Radiology, The Electromagnetic Spectrum, Basic X-Ray Physics, Attenuation and Imaging, Computed Tomography, Magnetic Resonance Tomography, Ultrasound, Nuclear Medicine and Molecular Imaging, Other Imaging Techniques, Radiation Protection and Dosimetry

Image Processing in Clinical Practice: Application Examples, Image Databases, Intensity Operations, Filter Operations, Segmentation, Spatial Transforms, Rendering and Surface Models, Registration, CT Reconstruction

**UNIT II**          Image Representation          Lecture 10 Hrs

Pixels and Voxels, Gray Scale and Color Representation, Image File Formats, Dicom, Other Formats – Analyze 7.5, NIFTI And Interfile, Image Quality and The Signal-To-Noise Ratio, Practical Lessons Operations in Intensity Space: The Intensity Transform Function and The

Dynamic Range, Windowing, Histograms and Histogram Operations, Dithering and Depth, Practical Lessons

**UNIT III**          Filtering and Transformations, Segmentation          Lecture 8 Hrs

The Filtering Operation, The Fourier Transform, Other Transforms, Practical Lessons

Segmentation: The Segmentation Problem, ROI Definition and Centroids, Thresholding, Region Growing, More Sophisticated Segmentation Methods, Morphological Operations, Evaluation of Segmentation Results

**UNIT IV**          Spatial Transforms          Lecture 9 Hrs

Discretization – Resolution and Artifacts, Interpolation and Volume Regularization, Translation and Rotation, Reformatting, Tracking and Image-Guided Therapy

Rendering and Surface Models: Visualization, Orthogonal and Perspective Projection, and The Viewpoint, Raycasting, Surface–Based Rendering

**UNIT V**          Registration, CT Reconstruction          Lecture 8 Hrs

Fusing Information, Registration Paradigms, Merit Functions, Optimization Strategies, Some General Comments, Camera Calibration, Registration to Physical Space, Evaluation of Registration Results

CT Reconstruction: Introduction, Radon Transform, Algebraic Reconstruction, Some Remarks on Fourier Transform and Filtering, Filtered Back projection

**Textbooks:**

1. Wolfgang Birkfellner, "Applied Medical Image Processing", Second Edition, CRC Press.

**Reference Books:**

1. Sinha G.R., Medical Image Processing Concepts and Application, PHI, 2014
**2.** Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university press, 2010

**Online Learning Resources:** Coursera: Pranav Rajpurkar, AI for Medical Diagnosis