ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE

## SEMESTER-I (I-I)

| S. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| THEORY | | | | | | |
| 1 | 23SH1T03 | Chemistry | 3 | 0 | 0 | 3 |
| 2 | 23SH1T04 | Linear Algebra and Calculus | 3 | 0 | 0 | 3 |
| 3 | 23ME1T01 | Engineering Graphics | 3 | 0 | 0 | 3 |
| 4 | 23EE1T01 | Basic Electrical and Electronics Engineering | 2 | 0 | 2 | 3 |
| 5 | 23IT1T01 | Introduction to Programming | 3 | 0 | 0 | 3 |
| PRACTICAL | | | | | | |
| 6 | 23SH1L03 | Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 7 | 23EE1L01 | Electrical and Electronics Engineering Workshop | 0 | 0 | 3 | 1.5 |
| 8 | 23IT1L01 | Computer Programming Lab | 0 | 0 | 3 | 1.5 |
| 9 | 23IT1L02 | IT Workshop | 0 | 0 | 2 | 1 |
| 10 | 23PC1P01 | Health and Wellness, Yoga and Sports | 0 | 0 | 1 | 0.5 |
| | | | | | **Total Credits** | **21** |

## SEMESTER-II (I-II)

| S. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| THEORY | | | | | | |
| 1 | 23SH2T01 | Communicative English | 2 | 0 | 0 | 2 |
| 2 | 23EE2T03 | Electrical circuit Analysis-I | 3 | 0 | 0 | 3 |
| 3 | 23SH2T02 | Engineering Physics | 3 | 0 | 0 | 3 |
| 4 | 23SH2T05 | Differential equations and Vector Calculus | 3 | 0 | 0 | 3 |
| 5 | 20ME2T02 | Basic Civil & Mechanical Engineering | 3 | 0 | 0 | 3 |
| PRACTICAL | | | | | | |
| 6 | 23ME2L01 | Engineering Workshop | 0 | 0 | 3 | 1.5 |
| 7 | 23SH2L01 | Communicative English Lab | 0 | 0 | 2 | 1 |
| 8 | 23SH2L02 | Engineering Physics Lab | 0 | 0 | 2 | 1 |
| 9 | 23EE2L03 | Electrical Circuits – I Lab | 0 | 0 | 3 | 1.5 |
| 10 | 23PC2P01 | NCC / NSS / Scouts & Guides / Community service | 0 | 0 | 1 | 0.5 |
| | | | | | **Total Credits** | **19.5** |

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE
**(SEMESTER-III II-I)**

| S.No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| THEORY | | | | | | |
| 1 | 23SH3T01 | Complex Variables & Numerical Methods | 3 | 0 | 0 | 3 |
| 2 | 23EC3T05 | Analog Electronics | 3 | 0 | 0 | 3 |
| 3 | 23EE3T01 | Electromagnetic Field Theory | 3 | 0 | 0 | 3 |
| 4 | 23EE3T02 | Electrical Circuit Analysis-II | 3 | 0 | 0 | 3 |
| 5 | 23EE3T03 | Electrical Machines-I | 3 | 0 | 0 | 3 |
| 6 | 23GE3M01 | Human Values | 2 | 0 | 0 | --- |
| PRACTICAL | | | | | | |
| 8 | 23EE3L01 | Electrical Circuits -II and Simulation Lab | 0 | 0 | 3 | 1.5 |
| 9 | 23EE3L02 | Electrical Machines-I Lab | 0 | 0 | 3 | 1.5 |
| 10 | 23EE3S01 | Introduction to MATLAB | 0 | 1 | 2 | 2 |
| | | | | | **Total Credits** | **20** |

**SEMESTER-IV (II-II)**

| S.No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| THEORY | | | | | | |
| 1 | 23MC4T03 | Principles of Economics & Management | 2 | 0 | 0 | 2 |
| 2 | 23IT4T05 | Data Structures | 3 | 0 | 0 | 3 |
| 3 | 23EC4T05 | Digital Electronics | 3 | 0 | 0 | 3 |
| 4 | 23EE4T01 | Electrical Machines-II | 3 | 0 | 0 | 3 |
| 5 | 23EE4T02 | Control Systems | 3 | 0 | 0 | 3 |
| 6 | 23SH4M01 | Environmental Science | 2 | 0 | 0 | --- |
| PRACTICAL | | | | | | |
| 6 | 23EE4L01 | Electrical Machines Lab-II | 0 | 0 | 3 | 1.5 |
| 7 | 23EC4L03 | Analog & Digital Electronics Lab | 0 | 0 | 3 | 1.5 |
| 8 | 23SH4M02 | Design Thinking & Innovation | 1 | 0 | 2 | 1 |
| 9 | 23IT4S01 | Data Structures Lab | 0 | 1 | 2 | 2 |
| | | | | | **Total Credits** | **20** |

| **Programme: EEE** | | | | | **I B.Tech I SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23SH1T03** | **CHEMISTRY** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**At the end of the Course, Student will be able to:**

CO 1: Introduce the Basic concept of structure and bonding of Molecules

CO 2: Understand the principle of Band theory and application of conductors and semiconductors.

CO3: Compare the materials of construction for battery and Electrochemical Sensors.

CO 4: Explain the preparation, properties, and applications of thermoplastics & thermosetting & Elastomers conducting polymers.

CO 5: Explain the principles of spectrometry, HPLC in separation of solid and liquid mixtures.

**UNIT–I: Structure and Bonding Models:**

Fundamentals of Quantum mechanics (De broglie & Heisenberg principles), Schrodinger Wave equation (Derivation not required), significance of Ψ and Ψ2.

**Molecular Orbital theory** – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO. π-molecular orbital of butadiene and benzene, calculation of bond order.

**UNIT–II: Modern Engineering materials:**

**Semiconductors** – Introduction, basic concept (Band theory & classification), applications (rectifier & transistor).

**Super conductors** – Introduction, basic concept (Classification) applications.

**Super capacitors**: Introduction, Basic Concept (Classification), Applications.

**Nano materials**: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and applications of Graphine nanoparticles.

**UNIT–III: Electrochemistry and Applications:**

**Electrochemical cell**, Nernst equation (Derivation not required), Electro Chemical Series and Significance, 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 –lithium-ion batteries- working of the batteries including cell reactions;

**Fuel cells**- hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

**UNIT–IV: Polymer Chemistry:**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms (free radical & zeigler-natta) of polymer formation.

**Plastics** –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon,

Bakelite, Nylon-6,6, carbon fibres.

**Elastomers**–Buna-S, Buna-N–preparation, properties and applications.

**Conducting polymers** – classification, polyacetylene– mechanism of conduction and applications.

**Bio-Degradable polymers** - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

**UNIT–V: Instrumental Methods and Applications:**

**Electromagnetic spectrum**. Absorption of radiation: Beer-Lambert's law.

**UV-Visible Spectroscopy**- electronic transition, Instrumentation.

**IR spectroscopies**- fundamental modes and selection rules, Instrumentation.

**Chromatography**-Basic Principle, Classification, HPLC: Principle, Instrumentation and Applications.

**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. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008

3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition.

| **Programme: EEE** | | | | | **I B.Tech I SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23SH1T04** | **LINEAR ALGEBRA AND CALCULUS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Develop and use of matrix algebra techniques that are needed by engineers for practical applications

CO2 : Utilize mean value theorems to real life problems

CO3 : Familiarize with functions of several variables which is useful in optimization

CO4 : Learn important tools of calculus in higher dimensions

CO5 : Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

**SYLLABUS**

**UNIT-I : Matrices**

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of non-singular matrices by Gauss-Jordan method, System of linear equations: Consistency and Inconsistency of System of Homogeneous and Non-Homogeneous equations using ranks and solving by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

**UNIT-II : Eigenvalues, Eigenvectors and Orthogonal Transformation**

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

**UNIT-III : Calculus**

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

**UNIT-IV : Partial differentiation and Applications (Multi variable calculus)**

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule,Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

**UNIT-V : Multiple Integrals (Multi variable Calculus)**

Double integrals, triple integrals, change of order of integration, change of variables to polar,

cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**TEXT BOOKS:**

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition

**REFERENCE BOOKS:**

1.Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2.Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3.Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4.Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th edition
5.Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)

| **Programme: EEE** | | | | | **I B.Tech I SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23ME1T01** | **ENGINEERING GRAPHICS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections

CO2 : Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views

CO3 : Understand and draw projection of solids in various positions in first quadrant

CO4 : Explain principles behind development of surfaces

CO5 : Prepare isometric and perspective sections of simple solids

**SYLLABUS**

**UNIT-I :**

**Introduction:** Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

**Curves:** construction of ellipse, parabola and hyperbola by general method only, Cycloids, Involutes, Normal and tangent to Curves.

**UNIT-II :**

**Orthographic Projections**: Reference plane, importance of reference lines or Plane,

**Projections of a point** situated in any one of the four quadrants.

**Projections of Straight Lines:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes.

**UNIT-III :**

**Projections of Planes:** regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

**Projections of Solids:** Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

**UNIT-IV :**

**Sections of Solids:** Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

**Development of Surfaces:** Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

**Conversion of Views**: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.
**Computer graphics**: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

**TEXT BOOKS:**

1.N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016

**REFERENCE BOOKS:**

1.Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2.Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3.Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

| **Programme: EEE** | | | | | **I B.Tech I SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23EE1T01** | **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Describe fundamental laws, operating principles of motors/generators, MC/MI instruments (L2).

CO2 : Demonstrate the working of electrical machines, measuring instruments and power generation stations (L2).

CO3 : Apply mathematical tools and fundamental concepts to derive various equations related to electrical circuits and machines (L3).

CO4 : Calculate electrical load and electricity bill of residential and commercial buildings (L4)

**SYLLABUS**

**PART A: BASIC ELECTRICAL ENGINEERING**

**UNIT-I : DC & AC Circuits**

**DC Circuits:** Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

**AC Circuits:** A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

**UNIT-II : Machines and Measuring Instruments**

**Machines:** Construction, principle and operation of (i) DC Motor, (ii) DC Generator, – Magnetization characteristics of DC shunt generator (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines (vi)Stepper motor

**Measuring Instruments:** Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge, Energy meter

**UNIT-III : Energy Resources, Electricity Bill & Safety Measures**

**Energy Resources:** Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, **Thermal,** Nuclear, Solar & Wind power generation, Batteries & its types.

**Electricity bill:** Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of – unit used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

**Equipment Safety Measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety

Precautions to avoid shock.

**TEXTBOOKS:**

1.Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition.
2.Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti,Dhanpat Rai & Co, 2013
3.Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

**REFERENCE BOOKS**:

1.Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, FourthEdition
2.Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3.Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press,2017
4.Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018,Second Edition.

**Web Resources:**

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

**Course Objectives:**

• To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

**After successful completion of this course, students should be able to**

CO1 : Explain fundamentals of Semi-Conductor Devices
CO2 : Understand Basic Electronics circuit operation and Instruments
CO3 : Explain Digital Electronics

**UNIT-I : SEMICONDUCTOR DEVICES**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN JunctionDiode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier

**UNIT-II : BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION**

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

**UNIT-III : DIGITAL ELECTRONICS**

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

**TEXTBOOKS:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

**REFERENCE BOOKS**:

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

| **Programme: EEE** | | | | | **I B.Tech I SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23IT1T01** | **INTRODUCTION TO PROGRAMMING** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2 : Analyse a problem and develop an algorithm to solve it
CO3 : Implement various algorithms using the C programming language.
CO4 : Understand more advanced features of C language
CO5 : Develop problem-solving skills and the ability to debug and optimize the code

**SYLLABUS**

**UNIT-I : Introduction to Programming and Problem Solving**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms

**: Control Structures**

**UNIT-II**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue

**UNIT-III : Arrays and Strings**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings

**UNIT-IV : Pointers & User Defined Data types**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

**UNIT-V : Functions & File Handling**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling.

Note: The syllabus is designed with C Language as the fundamental language of implementation

**TEXT BOOKS:**

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

**REFERENCE BOOKS:**

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

| Programme: EEE | | I B.Tech I Semester | | | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23SH1L03** | **CHEMISTRY LAB** | **0** | **0** | **3** | **1.5** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Determine the cell constant and conductance of solutions.
CO2 : Prepare advanced polymer Bakelite materials.
CO3 : Determination of redox potentials.
CO4 : Analysis of water quality.
CO5 : Calculate strength of acid in Pb-Acid battery.

**List of Experiments**

**Any 10 of the following experiments are to be conducted:**

1. Measurement of 10Dq by spectrophotometric method.
2. Conductometric titration of strong acid vs. strong base.
3. Conductometric titration of weak acid vs. strong base.
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery.
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law.
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry.
13. Estimation of HCl using standard Na2CO3 solution.
14. Estimation of total Hardness of water using standard EDTA solution
15. Estimation of $P^H$ of the given water sample & soil using PH meter.

**REFERENCE:**

1. "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar.

| Programme: EEE | | | | | I B.Tech I Semester |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23EE1L01** | **Electrical and Electronics Engineering Workshop** | **0** | **0** | **3** | **1.5** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Measure voltage, current and power in an electrical circuit. (L3)
CO2 : Measure of Resistance using Wheat stone bridge (L4)
CO3 : Discover critical field resistance and critical speed of DC shunt generators. (L4)
CO4 : Investigate the effect of reactive power and power factor in electrical loads. (L5)

**Activities:**

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   (Provide some exercises so that hardware tools and instruments are learned to be used by the students.)
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter,LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter. (Provide some exercises so that measuring instruments are learned to be used by thestudents.)
3. Components: Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
4. Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. Compare values of components like resistors, inductors, capacitors etc with the measured values by using Instruments

SYLLABUS

## PART A: ELECTRICAL ENGINEERING LAB

**List of Experiments**

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

**Reference Books:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill,First Edition.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013.
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, Third Edition.

**Note:** Minimum Six Experiments to be performed.

## PART B: ELECTRONICS ENGINEERING LAB

**Course Objectives:**

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

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

CO1: Identify & testing of various electronic components.
CO2: Understand the usage of electronic measuring instruments.
CO3: Plot and discuss the characteristics of various electron devices.
CO4: Explain the operation of a digital circuit.

**List of Experiments:**

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs

**References:**

1.R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2.R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3.R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

**Note:** Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

| Programme: EEE | | I B.Tech I Semester | | | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23IT1L01** | **Computer Programming Lab** | **0** | **0** | **3** | **1.5** |

**Course Objectives:**

The course aims to give students hands – on experience and train them on the concepts of the C-programming language.

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Read, understand, and trace the execution of programs written in C language.

CO2 : Select the right control structure for solving the problem.

CO3 : Develop C programs which utilize memory efficiently using programming constructs like pointers.

CO4 : Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

**UNIT I**

**WEEK 1**

**Objective:** Getting familiar with the programming environment on the computer and writingthe first program.

**Suggested Experiments/Activities:**

**Tutorial 1:** Problem-solving using Computers.

**Lab1:** Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

**WEEK 2**

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

**Suggested Experiments /Activities:**

**Tutorial 2:** Problem-solving using Algorithms and Flow charts.

**Lab 1:** Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

**WEEK 3**

Objective: Learn how to define variables with the desired data-type, initialize them withappropriate

values and how arithmetic operators can be used with variables and constants.

**Suggested Experiments/Activities:**
**Tutorial 3:** Variable types and type conversions:
**Lab 3:** Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

**UNIT II**

**WEEK 4**
**Objective**: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works

**Suggested Experiments/Activities:**

**Tutorial4:** Operators and the precedence and as associativity:
**Lab4:** Simple computational problems using the operator' precedence and associativity

i) Evaluate the following expressions.
   a. A+B*C+(D*E) + F*G
   b. A/B*C-B+A*D/3
   c. A+++B---A
   d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

**WEEK 5**
**Objective**: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

**Suggested Experiments/Activities**:
**Tutorial 5:** Branching and logical expressions:
**Lab 5**: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

**WEEK 6**

**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when eachof these statements is more appropriate to use.

**Suggested Experiments/Activities**:

**Tutorial 6:** Loops, while and for loops

**Lab 6:** Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

**UNIT III**

**WEEK 7:**

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

**Suggested Experiments/Activities:**

**Tutorial 7:** 1 D Arrays: searching.

**Lab 7:**1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

**WEEK 8:**

**Objective**: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays

**Suggested Experiments/Activities:**

**Tutorial 8**: 2 D arrays, sorting and Strings.

**Lab 8:** Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

**UNIT IV**

**WEEK 9:**

**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C.

**WEEK 10:**

**Objective:** Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures.

**Suggested Experiments/Activities:**

**Tutorial 10:** Bitfields, Self-Referential Structures, Linked lists

**Lab10 :** Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

**UNIT V**

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

**Suggested Experiments/Activities:**

**Tutorial 11:** Functions, call by value, scope and extent,

**Lab 11:** Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

**WEEK 12:**

**Objective**: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions

**Suggested Experiments/Activities:**

**Tutorial 12**: Recursion, the structure of recursive calls

**Lab 12**: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
**v)** Write a recursive function to find the sum of series**.**

**WEEK 13:**

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers.

**Suggested Experiments/Activities**:

**Tutorial 13**: Call by reference, dangling pointers

**Lab 13**: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**WEEK14**:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

**Suggested Experiments/Activities:**

**Tutorial 14:** File handling

**Lab 14:** File operations

i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

**Textbooks:**

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

**Reference Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

| Programme: EEE | | I B.Tech I Semester | | | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23IT1L02** | **IT WORKSHOP** | **0** | **0** | **2** | **1** |

**Course Objectives:**

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Perform Hardware troubleshooting.
CO2 : Understand Hardware components and inter dependencies.
CO3 : Safeguard computer systems from viruses/worms
CO4 : Document/ Presentation preparation.
CO5 : Perform calculations using spreadsheets

**PC Hardware & Software Installation**

**Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

**Task 3:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

**Task 4:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

**Task 5:** Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

**Internet & World Wide Web**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

**Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

**Task 3**: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms

**LaTeX and WORD**

**Task 1 –** Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

**Task 2:** Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

**Task 3:** Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

**EXCEL**

**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text.

**Task 2:** Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

**LOOKUP/VLOOKUP**

**Task 3:** Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

**POWER POINT**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

**Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts

**Task 3:** Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides

**AI TOOLS – ChatGPT**

**Task 1:** Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

**Task 2**: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

**Task 3:** Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

**Reference Books:**

1.Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2.The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3.Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4.PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5.LaTeX Companion, Leslie Lamport, PHI/Pearson.
6.IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7.IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition.

| Programme: EEE | | | | | I B.Tech I Semester |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23PC1P01** | **HEALTH AND WELLNESS, YOGA AND SPORTS** | **0** | **0** | **1** | **0.5** |

**Course Objectives:**

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the importance of yoga and sports for Physical fitness and sound health.
CO2 : Demonstrate an understanding of health-related fitness components
CO3 : Compare and contrast various activities that help enhance their health
CO4 : Assess current personal fitness levels.
CO5 : Develop Positive Personality

**UNIT I**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

**Activities:**

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

**UNIT II**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice

**Activities:**

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

**UNIT III**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games

**Activities:**

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.

Practicing general and specific warm up, aerobics

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

**Reference Books:**

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2002
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014.

**General Guidelines:**

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

| **Programme: EEE** | | | | | **I B.Tech II SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23SH2T01** | **COMMUNICATIVE ENGLISH** | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the context, topic, and pieces of specific information from social or Transactional dialogues

CO2 : Apply grammatical structures to formulate sentences and correct word forms

CO3 : Analyze discourse markers to speak clearly on a specific topic in informal discussions

CO4 : Evaluate reading / listening texts and to write summaries based on global comprehension of these texts.

CO5 : Create a coherent paragraph, essay, and resume.

**SYLLABUS**

**UNIT-I**

**Lesson: HUMAN VALUES:** Gift of Magi **(Short Story)**

**Listening:** Identifying the topic, the context and specific pieces of information by listeningto short audio texts and answering a series of questions.

**Speaking:** Asking and answering general questions on familiar topics such as home,family, work, studies and interests; introducing oneself and others.

**Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.

**Writing:** Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

**Grammar:** Parts of Speech, Basic Sentence Structures-forming questions

**Vocabulary:** Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

**UNIT-II**

**Lesson**: NATURE: The Brook by Alfred Tennyson (Poem)

**Listening**: Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.

**Speaking**: Discussion in pairs/small groups on specific topics followed by short structuretalks.

**Reading**: Identifying sequence of ideas; recognizing verbal techniques that help to linkthe ideas in a paragraph together.

**Writing**: Structure of a paragraph - Paragraph writing (specific topics) Grammar: Cohesive devices -

linkers, use of articles and zero article; prepositions;
**Vocabulary**: Homonyms, Homophones, Homographs.

**UNIT-III**
**Lesson: BIOGRAPHY: Elon Musk**
**Listening:** Listening for global comprehension and summarizing what is listened to.
**Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed
**Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
**Writing:** Summarizing, Note-making, paraphrasing
**Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations
**Vocabulary:** Compound words, Collocations
**:**

**UNIT-IV**
**Lesson: INSPIRATION: The Toys of Peace by** Saki
**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
**Writing:** Letter Writing: Official Letters, Resumes
**Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice
**Vocabulary:** Words often confused, Jargons

**UNIT-V :**
**Lesson**: MOTIVATION: The Power of Intrapersonal Communication (An Essay)
**Listening**: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
**Speaking**: Formal oral presentations on topics from academic contexts
**Reading**: Reading comprehension.
**Writing:** Writing structured essays on specific topics.
**Grammar**: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
**Vocabulary**: Technical Jargons.

**TEXT BOOKS:**
1.Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2.Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

**REFERENCE BOOKS:**

1. 1 Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

**Web Resources:**

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

| **Programme: EEE** | | | | | **I B.Tech II SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23EE2T03** | **ELECTRICAL CIRCUIT ANALYSIS-I** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Remembering the basic electrical elements and different fundamental laws.

CO2 : Understand the network reduction techniques, transformations, concept of self- inductance and mutual inductance, phasor diagrams, resonance and network theorems.

CO3 : Apply the concepts to obtain various mathematical and graphical representations

CO4 : Analyse nodal and mesh networks, series and parallel circuits, steady state response, different
circuit topologies (with R, L and C components).

CO5 : Evaluation of Network theorems, electrical, magnetic and single-phase circuits.

**SYLLABUS**

**UNIT-I : INTRODUCTION TO ELECTRICAL CIRCUITS**

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to- delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources, node and mesh analysis.

**UNIT-II : MAGNETIC CIRCUITS**

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention– coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits

**UNIT-III : SINGLE PHASE AC CIRCUITS**

Characteristics of periodic functions, Average value, R.M.S. value, form factor, representation of a sine function, concept of phasor, phasor diagrams, Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit. Nodal and Mesh analysis.

**UNIT-IV : RESONANCE AND LOCUS DIAGRAMS**

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L ,C and frequency variables

**UNIT-V : NETWORK THEOREMS (DC & AC) EXCITATIONS**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem

**TEXT BOOKS:**

1.Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2.Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition.

**REFERENCE BOOKS:**

1.Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O.Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2.Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.
3.Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.
4.Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023,Fourteenth Edition.
5.Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co.,2018, Seventh Revised Edition.

**Web Resources:**

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/117106108

| **Programme: EEE** | | | | | **I B.Tech II SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 23SH2T02 | **ENGINEERING PHYSICS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Explain the need of coherent sources and the conditions for sustained interference
CO2 : Understand the basic concepts of Crystal Structures & X-ray Diffraction Sources.
CO3 : Apply the concept of magnetism to magnetic devices
CO4 : Analyze the physical significance of wave function.
CO5 : Identify the type of semiconductor using Hall effect.

**SYLLABUS**

**UNIT-I : WAVE OPTICS**

**INTERFERENCE**: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

**Diffraction**: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

**Polarization**: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

**UNIT-II : Crystallography and X-ray diffraction**

**Crystallography**: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

**X-ray diffraction**: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

**UNIT-III : Dielectrics and Magnetic Materials**

**Dielectric Materials**: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss.

**Magnetic Materials**: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

**UNIT-IV : Quantum Mechanics and Free electron Theory**

**Quantum Mechanics**: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

**Free Electron Theory**: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy.

**UNIT-V : SEMICONDUCTORS**

Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

**TEXT BOOKS:**

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

**REFERENCE BOOKS:**

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010.
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

**Web Resources:**

1.https://www.loc.gov/rr/scitech/selected-internet/physics.html

| **Programme: EEE** | | | | | **I B.Tech II SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| **23SH2T05** | **DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS** | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Solve the differential equations related to various engineering fields
CO2 : Identify solution methods for partial differential equations that model physical processes
CO3 : Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO4 : Estimate self and mutual inductances and the energy stored in the magnetic field
CO5 : Estimate the work done against a field, circulation and flux using vector calculus.

**SYLLABUS**

**UNIT-I : Differential equations of first order and first degree**

Introduction -Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Orthogonal Trajectories-Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

**UNIT-II : Linear differential equations of higher order (Constant Coefficients)**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

**UNIT-III : Partial Differential Equations**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

**UNIT-IV : Vector differentiation**

Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.

**UNIT-V : Time Varying Fields**

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, Scalar and Vector del operators applied to vector point functions-Divergence and Curl vector identities – Laplacian operator.

**TEXT BOOKS:**

1."Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10thEdition

**REFERENCE BOOKS:**

1.Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2.Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3.Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018,5th Edition.
4.Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5.Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017.

| **Programme: EEE** | | | | | **I B.Tech II SEM** |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME2T02 | **BASIC CIVIL & MECHANICAL ENGINEERING** | 3 | 0 | 0 | 3 |

**Course Objectives:**

- Get familiarized with the scope and importance of Civil Engineering sub-divisions
- Introduce the preliminary concepts of surveying
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

**After successful completion of this course, students should be able to**

CO1 : Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2 : Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3 : Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

CO4 : Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated

CO5 : Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

**SYLLABUS**

**PART A: BASIC CIVIL ENGINEERING**

**UNIT-I : Basics of Civil Engineering**

Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete-Steel. Introduction to Prefabricated construction Techniques.

**UNIT-II : Surveying**

Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

**UNIT-III : Transportation Engineering, Water Resources and Environmental Engineering**

**Transportation Engineering**: Importance of Transportation in Nation's economic development-Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

**Water Resources and Environmental Engineering**: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

**TEXT BOOKS:**

1.Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt.Ltd. Fourth Edition
2.Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers.2022. First Edition.
3.Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition

**REFERENCE BOOKS:**

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. FifthEdition.
2.Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, KhannaPublishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012

## PART B: BASIC MECHANICAL ENGINEERING

**Course Objectives:** The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

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

CO1: Understand the different manufacturing processes.
CO2: Explain the basics of thermal engineering and its applications.
CO3: Describe the working of different mechanical power transmission systems and power plants.
CO4: Describe the basics of robotics and its applications.

**UNIT-I**

**Introduction to Mechanical Engineering:** Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Engineering Materials -** Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

**UNIT-II**

**Manufacturing Processes:** Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

**Thermal Engineering** – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

**UNIT-III :**

**Power plants** – working principle of Steam, Diesel, Hydro, Nuclear power plants.

**Mechanical Power Transmission** - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

**Introduction to Robotics** - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

**TEXT BOOKS:**

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India)Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengagelearning India Pvt. Ltd.

**REFERENCE BOOKS:**

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
2. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
3. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering,Tata McGraw Hill publications (India) Pvt. Ltd.

| Programme: EEE | | | | | I B.Tech II Semester |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23ME2L01** | **ENGINEERING WORKSHOP** | **0** | **0** | **3** | **1.5** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Identify workshop tools and their operational capabilities.

CO2 : Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding

CO3 : Apply fitting operations in various applications

CO4 : Apply basic electrical engineering knowledge for House Wiring Practice.

**SYLLABUS**

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **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
3. **Sheet Metal Working/Tin smithy**: Familiarity with different types of tools used in sheet metalworking, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **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
5. **Electrical Wiring**: Familiarity 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
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

**TEXT BOOKS:**

1.Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019.
Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2.A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

**REFERENCE BOOKS:**

1.Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2.Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3.Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

| Programme: EEE | | | | | I B.Tech II Semester |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23SH2L01** | **COMMUNICATIVE ENGLISH LAB** | **0** | **0** | **2** | **1** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

CO2 : Apply communication skills through various language learning activities.

CO3 : Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4 : Evaluate and exhibit professionalism in participating in debates and group discussions.

CO5 : Create effective Course Objectives.

**List of Topics:**

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

**Suggested Software:**

- Walden Infotech
- Young India Films

**REFERENCE BOOKS:**

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed), Kindle, 2013.

**Web Resources:**

**Spoken English:**

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

**Voice & Accent:**

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

| Programme: EEE | | | | | I B.Tech II Semester |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23SH2L02** | **ENGINEERING PHYSICS LAB** | **0** | **0** | **2** | **1** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : **Memorize** the conditions for sustained Interference and Diffraction
CO2 : **Understand** the basic concepts of LASER
CO3 : Identify the properties of various materials.
CO4 : Apply the concept of dielectrics on the materials.
CO5 : Analyze the acoustic properties of sound.

**List of Experiments**

1.Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2.Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3.Verification of Brewster's law
4.Determination of dielectric constant using charging and discharging method.
5.Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6.Determination of wavelength of Laser light using diffraction grating.
7.Estimation of Planck's constant using photoelectric effect.
8.Determination of the resistivity of semiconductors by four probe methods.
9.Determination of energy gap of a semiconductor using p-n junction diode.
10.Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11.Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12.Determination of temperature coefficients of a thermistor.
13.Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14.Determination of magnetic susceptibility by Kundt's tube
15.Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16.Sonometer: Verification of laws of stretched string.
17.Determination of young's modulus for the given material of wooden scale by Non uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment**.**

Note: Any 10 of the following experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

**REFERENCE:**

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017

**WEB RESOURCES:**

- www.vlab.co.in
- https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

| Programme: EEE | | | | | I B.Tech II Semester |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23EE2L03** | **ELECTRICAL CIRCUITS – I LAB** | **0** | **0** | **3** | **1.5** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams.

CO2 : Apply various theorems to compare practical results obtained with theoretical calculations.

CO3 : Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil.

CO4 : Analyse different circuit characteristics with the help of fundamental laws and various configurations.

CO5 : Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.

**List of Experiments**

**Any 10 of the following experiments are to be conducted:**

1. Verification of node and mesh analysis.
2. Verification of network reduction techniques.
3. Determination of cold and hot resistance of an electric lamp
4. Determination of Parameters of a choke coil.
5. Determination of self, mutual inductances, and coefficient of coupling
6. Series and parallel resonance
7. Locus diagrams of R-L (L Variable) , R-C (C Variable), RLC (frequency variable) series circuits
8. Verification of Thevenin's Theorem
9. Verification of Norton's Theorem
10. Verification of Maximum power transfer theorem
11. Verification of Compensation theorem
12. Verification of Reciprocity and Millman's Theorems

**REFERENCE BOOKS:**

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, TataMc Graw Hill Education, 2005, sixth edition.
2.Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019

| Programme: EEE | | | | | I B.Tech II Semester |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| **23PC2P01** | **NCC / NSS / SCOUTS & GUIDES / COMMUNITY SERVICE** | **0** | **0** | **1** | **0.5** |

**COURSE OBJECTIVES:**

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the importance of discipline, character and service motto.
CO2 : Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3 : Explore human relationships by analyzing social problems.
CO4 : Determine to extend their help for the fellow beings and downtrodden people.
CO5 : Develop leadership skills and civic responsibilities.

**UNIT I Orientation**

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance**.**

**Activities:**

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
**iv)** Conducting talent show in singing patriotic songs-paintings- any other contribution**.**

**UNIT II Nature & Care**

**Activities:**

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues**.**

**UNIT III Community Service**

**Activities:**

Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.

i) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
ii) Conducting consumer Awareness. Explaining various legal provisions etc.
iii) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
iv) Any other programmes in collaboration with local charities, NGOs etc.

**REFERENCE BOOKS:**

**1.** Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service scheme* Vol;.I, Vidya Kutir Publication, 2021 ( ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

**General Guidelines:**

**1.** Institutes must assign slots in the Timetable for the activities.
**2.** Institutes are required to provide instructor to mentor the students.

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

# KKR & KSR

# INSTITUTE OF TECHNOLOGY AND SCIENCES

# (AUTONOMOUS)

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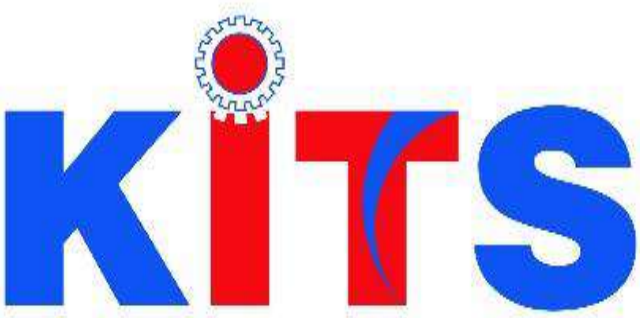
Vinjanampadu, Vatticherukuru Mandal, Guntur, Andhra Pradesh 522017




## BACHELOR OF TECHNOLOGY (B. Tech)

## DEPARTMENT OF CIVIL ENGINEERING

## COURSE STRUCTURE & SYLLABUS HANDOUT

## R-20 REGULATION

## (CHOICE BASED CREDIT SYSTEM)

(Applicable from the batch admitted in AY: 2020-2021)

## SEMESTER-I

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH1T05 | Engineering Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH1T06 | Differential Equations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS1T01 | Problem Solving and Programming Using C | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME1T01 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | 20EE1T02 | Basics of Electrical and Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20SH1L05 | Engineering Chemistry Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CS1L01 | Problem Solving and Programming Using C Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS1L02 | IT Workshop | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **19.5** | **195** | **455** | **650** |

**Theory: BSC-2, ESC-3 Practical: BSC-1, ESC-2**

## SEMESTER-II

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH2T01 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH2T03 | Engineering Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20SH2T07 | Linear Algebra and Vector Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME2W01 | Engineering Workshop | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | 20ME2T01 | Engineering Mechanics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE2M01 | Environmental Science | 2 | 0 | 0 | 0 | --- | --- | --- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20SH2L01 | Communicative English Skills Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20SH2L03 | Engineering Physics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CE2L01 | Computer Aided Drawing Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **19.5** | **195** | **455** | **650** |

**Theory: BSC-2, HSMC-1, And ESC-2 Practical: BSC-1, HSMC-1, And ESC-1**

## SEMESTER-III

| S.No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH3T02 | Numerical Methods & Statistics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CE3T01 | Strength of Materials-1 | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CE3T02 | Surveying | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CE3T03 | Building Materials & Construction Planning | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CE3T04 | Fluid Mechanics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE3M02 | Professional Ethics & Human Values | 2 | 0 | 0 | 0 | --- | --- | --- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CE3L01 | Strength of Materials Laboratory | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CE3L02 | Surveying Laboratory-I | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CE3L03 | Building Drawing Practice Laboratory | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| **10** | **20CE3S01** | **Skill Oriented Course** | 1 | 0 | 2 | 2 | --- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |

**THEORY: BSC-1, PCC-4 PRACTICAL: PCC LAB-3**

## SEMESTER-IV

| S.No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CE4T01 | Structural Analysis-I | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CE4T02 | Strength of Materials-II | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CE4T03 | Concrete Technology | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CE4T04 | Transportation Engineering-1 | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CE4T05 | Hydraulics & Hydraulic Machinery | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20CE4L01 | Fluid Mechanics & Hydraulic Machinery Laboratory | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CE4L02 | Surveying Laboratory-II | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CE4L03 | Concrete Technology Laboratory | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CE4S01 | Skill Oriented Course | 1 | 0 | 2 | 2 | --- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |

**THEORY: ESC-1, BSC-1,PCC-2, HSC-1 PRACTICAL: PCC LAB-3**

**SEMESTER-V**

| S.No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CE5T01 | Design of Reinforced concrete structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CE5T02 | Hydrology& Irrigation Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CE5T03 | Engineering Geology & GIS | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CE5T04 | Advanced Structural Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20OE5T01 | Non-conventional Energy sources(EEE) | 2 | 0 | 2 | 3 | 30 | 70 | 100 |
| 6 | 20GE5M01 | Constitution of India | 2 | 0 | 0 | 0 | --- | --- | --- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CE5L01 | Tranportation Engineering Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CE5L02 | Engineering Geology Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CE3S03 | Skill Advanced Course –RIVET Architecture | 1 | 0 | 2 | 2 | 15 | 35 | 50 |
| 10 | 20CE5I01 | Summer Internship | 0 | 0 | 0 | 1.5 | -- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **180** | **520** | **700** |

**THEORY: PCC-3, PEC-1, OEC-1, MC-1, PRACTICAL: PCC LAB-2**

## Professional Elective Course - 1

| Subject Code | Subject |
|---|---|
| 20CE5T04 | Advanced Structural Analysis |
| 20CE5T04 | Bridge Engineering |
| 20CE5T04 | Finite Element Analysis |

## Open Elective Course – 1

| Subject Code | Offered by Dept. | Subject | Offered for Dept. |
|---|---|---|---|
| 20OE5T01 | BS&H | Entrepreneurship Development | All |
| | EEE | Non-conventional Energy sources/Green Engineering systems | CE |
| | ME | Robotics | CE |
| | ECE | Principles of communication | CE |
| | CSE | Computer Graphics | CE |
| | IT | Principle of software Engineering | CE |

**SEMESTER-VI**

| S.No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CE6T01 | Design of Steel structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CE6T02 | Geo Technical Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CE6T03 | Environmental Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CE6T04 | Pre-fabricated structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20OE6T02 | Database Management(IT) | 2 | 0 | 2 | 3 | 30 | 70 | 100 |
| 6 | 20GE6M04 | Intellictual Property Rights & Patents | 2 | 0 | 0 | 0 | --- | --- | --- |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20CE6L01 | STAAD Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CE6L02 | Geo Technical Engineering Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CE6L03 | Environmental Engineering Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CE6S04 | Soft Skills Course | 1 | 0 | 2 | 2 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |

**THEORY: PCC-3, PEC-1, OEC-1, MC-1** **PRACTICAL: PCC LAB-3**

## Professional Elective Course - 2

| Subject Code | Subject |
|---|---|
| 20CE6T04 | Pre-fabricated structures |
| | Earthquake resistant design of Buildings |
| | Advanced reinforced concrete design |

## Open Elective Course – 2

| Subject Code | Offered by Dept. | Subject | Offered for Dept. |
|---|---|---|---|
| 20OE6T02 | BS&H | Business Environment | All |
| | EEE | Electrical safety Management | CE |
| | ME | Automation in Manufacturing | CE |
| | ECE | Embedded systems/4G and 5G wireless system | CE |
| | CSE | Block chain Technology | CE |
| | IT | Database Management | CE |

**SEMESTER-VII**

| S.No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CE7T01 | Traffic Engineering & Management | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CE7T02 | Construction Management & Cost Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CE7T03 | Foundation Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20OE7T01 | MEMS(ECE) | 2 | 0 | 2 | 3 | 30 | 70 | 100 |
| 5 | 20OE7T02 | Optimization techniques(ME) | 2 | 0 | 2 | 3 | 30 | 70 | 100 |
| 6 | 20HSE7T01 | Principles of Economics & Managemenmt | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CE7S05 | Skill Advanced course-Primaveera | 1 | 0 | 2 | 2 | 15 | 35 | 50 |
| 8 | 20CE7I02 | Summer Internship | 0 | 0 | 0 | 3 | --- | 100 | 100 |
| **Total Credits** | | | | | | **23** | **180** | **570** | **750** |

**THEORY: PEC-3, OEC-2, HSE-1**

## Professional Elective Course - 3

| Subject Code | Subject |
|---|---|
| 20CE7T01 | Traffic Engineering & Management |
| | Urban Transportation Planning |
| | Intelligent Transportation System |

## Professional Elective Course - 4

| Subject Code | Subject |
|---|---|
| 20CE7T02 | Construction Management & Cost Analysis |
| | Building Construction Practice |
| | Construction Equipment and Automation |

## Professional Elective Course - 5

| Subject Code | Subject |
|---|---|
| 20CE7T03 | Foundation Engineering |
| | Environmental GeoTechnology |
| | Off shore Engineering |

## Open Elective Course – 3

| Subject Code | Offered by Dept. | Subject | Offered for Dept. |
|---|---|---|---|
| 20OE7T01 | MBA | Digital Marketing | All |
| | ME | Industrial Management sciences | CE |
| | ECE | Mechatronics/MEMS | CE |
| | CSE | AI & Techniques | CE |
| | IT | JAVA programming | CE |

## Open Elective Course – 4

| Subject Code | Offered by Dept. | Subject | Offered for Dept. |
|---|---|---|---|
| 20OE7T02 | MBA | Human Resourse development and OB | All |
| | EEE | Electrical E nergy conservation and auditing | CE |
| | ME | Optimization techniques | CE |
| | ECE | Design of IOT systems | CE |
| | CSE | Bib data Analysis/Computer Networks | CE |
| | IT | Machine learning | CE |

**SEMESTER-VIII**

| S.No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CE8P01 | Project-Project work,seminar and internship in Industry | 0 | 0 | 0 | **12** | -- | **300** | **300** |

# SEMESTER-V

| **Programme**: **Civil Engineering** | | | | | **Semester**: V |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5T01 | DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES | **3** | **0** | **0** | **3** |
| **Subject Category** : PCC | | | | | |

**Course Outcomes:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C311.1 | Will be able to Design Beam using working stress , Limit state method | Evaluate |
| C311.2 | Will be able to Design Slabs | Evaluate |
| C311.3 | Will be able to Design members for Deflection and Cracking | Evaluate |
| C311.4 | Will be able to Design Columns | Evaluate |
| C311.5 | Will be able to Design Footings | Evaluate |

## UNIT –I

### Design Methods

**Working stress method**: Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance - balanced, under-reinforced and over-reinforced sections. Design of singly and doubly reinforced beams, IS Code Provisions.

**Limit State Design**: Basic statistical principles –Characteristic strength – Characteristic loads - Partial load and safety factors – stress-strain curves for HYSD bars and MS bars. Assumptions – stress block parameters – Moment of Resistance.

**All units i.e. from unit II to unit V are to be taught in Limit State Design.**

## UNIT –II

**Design for Flexure and Shear: D**esign of singly reinforced beams- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beams- Minimum depth - Minimum and

Maximum Flexural Tension Reinforcement - Design of Flanged Sections (T & L)- Effective width of flange - Analysis and Design Problems.

**Design for Shear and Torsion: A**nalysis and design of sections for shear and torsion – bond, anchorage and development length, I.S. code provisions. Design examples in simply supported andcontinuous beams, detailing.

**UNIT – III**

**Slabs and Serviceability:** Classification of slabs, design of one - way slabs, one waycontinuous slab using IS Coefficients (Conventional) –Design of two - way slabs – simply supported slabs and slabs with various edge conditions using IS Coefficients. Design of Stair case

**Limit state of serviceability:** Deflection of Determinate Beams, Simply Supported Slabs, cracking and IS code provisions for beams and slabs.

**UNIT – 1V**

**Design of Compression members**: Effective length, Braced and un-braced columns – IS Code provisions, Design of short columns under axial loads, uniaxial bending and biaxial bending (Demonstration using SP 16)

**UNIT –V**

**Footings: T**ypes of footings – Design of isolated footings – pedestal, square and rectangular and footings subjected to axial loads, uni-axial and Bi-Axial bending moment.

## Text Books:

1. Limit State Design, A. K.Jain, Nem Chand Brothers
2. Reinforced Concrete Structures, N. Krishna Raju & R. N. Pranesh, New Age Publications.
3. Structural Design and Drawing byN.Krishna Raju, Universities Press

## References:

1. R C C Design, B.C Punmia, A. K. Jain and A. K Jain. LakshmiPublications
2. Reinforced Concrete Structures, S. Unnikrishna Pillai &Devdas Menon, Tata c.Graw

Hill, NewDelhi.

3. Design of Reinforced concrete Structures, N.Subrahmanian, Oxford University Press.
4. Limit state design of reinforced concrete structures by P C Varghese, PHI Learning pvt. Ltd.

| **Programme**: **Civil Engineering** | | | | **Semester**: 2 | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5T02 | HYDROLOGY & IRRIGATION ENGINEERING | **3** | **0** | **0** | **3** |
| **Subject Category** : PCC | | | | | |

**Course Outcomes:**

| Course Code | Course Outcome | Blooms Taxonomy |
|---|---|---|
| C312.1 | To understand major hydrologic components and apply key concepts to several practical areas of engineering hydrology and related design aspects | Understand |
| C312.2 | To estimate flood magnitude and carry out flood routing | Evaluate |
| C312.3 | To estimate irrigation water requirements | Evaluate |
| C312.4 | To design irrigation canal structures plan and design diversion head works | Analyze |
| C312.5 | To analyse stability of gravity and earth dams , design ogee spillways and energy dissipation works | Analyze |

## UNIT-I

**Introduction:** Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

**Precipitation**: Types and forms, measurement, raingauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Abstractions from Precipitation,

**Runoff**: Catchment characteristics, Factors affecting runoff, Components of hydrograph, effective rainfall hyetograph and direct runoff hydrograph.

**UNIT-II**

**Floods:**Causes and effects, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management, Hydrologic routing, channel and reservoir routing.

**Ground Water:** Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells.

**UNIT-III**

**Irrigation:** Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty.

**Canal Structures:** Falls: Types and location, design principles of Sarda type fall and straight glacis fall. Regulators: Head and cross regulators, design principles Cross Drainage Works: Types, selection, design principles of aqueduct.

**UNIT-IV**

**Diversion Head Works:** Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations.

**Dams:** Types of dams, selection of type of dam, selection of site for a dam.

**Gravity dams:** Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam.

**UNIT-V**

**Earth Dams**: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters, stability analysis.

**Spillways:** Types, design principles of Ogee spillways, types of spillways crest gates.

.

**Text Books:**

1. Engineering Hydrology, Jayarami Reddy, P., Laxmi Publications Pvt. Ltd., (2013), NewDelhi

2. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publications (P)Ltd.

3. Sharma , S.K (2016) " Irrigation Engineering", S.chand publisher New Delhi.

**References:**

1. Engineering Hydrology Subramanya, K, Tata McGraw-Hill Education PvtLtd, (2013),New Delhi.

2. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna Publishers.

3. Chow , V.T.Maidment,D.K and Mays L.W(2011). "Applied hydrology",Tata McGraw Hills Education Pvt ltd, New Delhi. 4. Mays L.W, Wiley India Pvt. Ltd,(2013). "Water Resources Engineering" Wiley India Pvt.Ltd

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5T03 | ENGINEERING GEOLOGY & GIS | **3** | **0** | **0** | **3** |
| **Subject Category** : PCC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C313.1 | Identify and classify the geological minerals | Knowledge |
| C313.2 | Measure the strengths of various rocks & Prepare ,analyses, interpret the engineering geological maps and analyse the ground conditions through geo physical surveys | Analysis |

| | | |
|---|---|---|
| C313.3 | Classify and measure the earthquake prone areas to practice the hazard zonation | Understand |
| C313.4 | Understand the principles of spatial analysis | Knowledge |
| C313.5 | Appreciate application of RS and GIS to Civil engineering | Evaluate |
| C313.6 | Introduce the basic principles of GIS techniques. | Understand |

## UNIT-I

### WEATHERING & PHYSICAL GEOLOGY

**Introduction-** Branches of geology, Weathering – Types of weathering, Formation of Rivers, River piracy – Various stages of a river. Importance of Geology in Civil Engineering with case studies. Action of Wind, Formation of Sand dunes, Formation of Soils, Different types of soils and their classification.

## UNIT-II

### MINERALOGY & PETROLOGY :

Definition of mineral,Physical properties of minerals,classification of minarals, isomorphism, polymorphism, pseuodomorphism, – properties of: Calcite, Feldspar, Quartz, Olivine, Augite, Hornblende, Muscovite, Biotite, Barites, Bauxite, Garnet, Talc, Hamatite, Magnetite, Chlorite, Galena, & Graphite. Difference between Rock and Mineral. Geological classification of rocks. structures, textures,forms, of igneous,sedimentary&metamorphic rocks, Physical properties of Granite,basalt,gabbro,charnockite,sandstone,limestone,shale,marble,quartzite,Khondolite,charnockite.

## UNIT-III

### STRUCTURAL GEOLOGY & EARTHQUAKES

Strike, Dip, folds – various types – Faults – Various types – Unconformities – Joints. GROUND WATER: Wells – Deep well, shallow well, Springs – Different types. Classification of seismic waves, Mercalli & Richter scales, causes and effects, Seismic belts, Seismic zones of India, precautions while constructing engineering structures. Land Slides: Causes, effects, methods of mitigating impact of landslides.

## UNIT-IV

### GEOGRAPHIC INFORMATION SYSTEM

Geographic Information System: Introduction, GIS categories, Components of GIS, Fundamental operations of GIS. Types of data representation- Data collection data input and output. Mannual Digitizing and Scanning.GIS Data File Management; Layer based GIS, Feature based GIS mapping. Data storage – Raster, Vector and Attribute data storage, Overview of the Data Manipulation and Analysis. Integrated Analysis of the Spatial and Attribute Data. Integration of RS, GIS & GPS.

## UNIT-V

### APPLICATIONS OF GIS IN DAMS & WATER RESOURCES

Selection of site of dam construction, Gravity dams, Arch dams and Earthen dams – Geological considerations for dam construction, Land use/Land cover, Rainfall – Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring. Watershed management for sustainable development and Watershed characteristics

**Text books:**

1. 'Engineering Geology' by N. Chenna Kesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014.
2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
3 Bhatta B (2008), 'Remote sensing and GIS', Oxford University Press
4 Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) 'Remote Sensing and ImageInterpretation', Wiley India Pvt. Ltd., New Delhi

**References:**

1. Krynine & Judd, "Principles of Engineering Geology & Geotechnics", CBS Publishers & Distribution.

2. K.V.G.K. Gokhale, "Principles of Engineering Geology", B.S Publications, 2009.

3. Micheal N Demers, "Fundamental of GIS", 3rd Edition, John Wiley & Sons, 2008.

4. M.Anji Reddy, "Remote Sensing and Geographical Information systems", 3rd Edition, B.S.Publications, 2006.

| **Programme**: **Civil Engineering** | | | | **Semester**: v | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5T04 | ADVANCED STRUCTURAL ANALYSIS | **3** | **-** | **-** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C314.1 | Solve for moment, thrust and shear for different types of arches. cables | Apply |
| C314.2 | Analyze the continuous beams, Frames carrying ultimate loads using plastic analysis | Analyze |
| C314.3 | Analyze structures by moment distribution method for sway and non-sway conditions. | Analyze |
| C314.4 | Analyze structures by kani's method for sway and non-sway conditions. | Analyze |
| C314.5 | Evaluate structures by matrix methods including support Settlements. | Evaluate |

## UNIT-I

**Arches**: Normal thrust, radial shear and bending moment in three hinged and two hinged Parabolic arches. Effects of rib-shortening and temperature change.

**Suspension bridges**: Stresses in loaded cables with supports at the same and different levels.Length of cable.

## UNIT-II

**Plastic Behavior of Structures**：Idealized stress - strain curve for mild steel; Ultimate load carrying capacity of members carrying axial forces; Moment - Curvature relationship for flexural members; Evaluation of fully plastic moment; Shape factor; Collapse load factor; Upper and lower bound theorems; Collapse load analysis of indeterminate beams and single bay, single storied portal frames.

## UNIT-III

Analysis of statically indeterminate frames (single storey, single bay portal frames only), Shear Force & Bending Moment Diagrams, Elastic Curves using **Moment distribution method**

## UNIT-IV

Analysis of statically indeterminate frames (single storey, single bay portal frames only), Shear Force & Bending Moment Diagrams, Elastic Curves using **Kani's method**

## UNIT – V

**Introduction to matrix methods(System Approach) of structural analysis:** Static-indeterminacy, Kinematic indeterminacy, Stiffness and flexibility method for two span Continuous beams only.

**TEXT BOOKS**: .

1. Basic Structural analysis by K.U. Muthu, Azmi Ibrahim, M.Vijayanand, Maganti Janardhana.
2. V. N. Vazirani& M. M. Ratwani, Structural Analysis, Vol. II , Khanna Publishers,Delhi.
3. Matrix analysis of framed structures by Weaver &Ger
4. Basic Structural Analysis by C. S. Reddy, Tata McGraw-Hill.

**REFERENCES:**

1. Statically indeterminate structures – C.K. Wang
2. Indeterminate Structures by R.l. Jindal
3. Indeterminate Structural Analysis by J.S. Kinney.
4. Structural Analysis – A matrix approach by G. S. Pandit & S. P. Gupta; Tata Mc. Graw – Hill Publishing Co. Ltd., New Delhi
5. Limit Analysis of Structures by Manicka Selvam, DhanpatRai Publications, 2012.

| **Programme**: **Civil Engineering** | | | | **Semester**: v | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5T04 | BRIDGE ENGINEERING | **3** | **-** | **-** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOMES | BLOOMS TAXONOMY |
|---|---|---|
| C314.1 | Understand basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality. | Apply |
| C314.2 | Understand the load-carrying capacity of various types of bridges, upon learning the structural responses to different kinds of loads. | Apply |
| C314.3 | Design bridge economically by learning all the methods | Analyse |
| C314.4 | Analyse abutment walls and shape of piers used under various weather conditions. | Analyse |
| C314.5 | Evaluate the importance of bearings and helps to use latest bearings in construction technology. | Evaluate |

## UNIT-I

**Introduction & Investigation for Bridges Components of a Bridge**：Classification; Need for Investigation; Selection of Bridge Site; Preliminary Data to be Collected; Preliminary Drawings; Determination of Design Discharge; Economical Span; Location of Piers and Abutments; Vertical clearance above HFL; Scour depth; Traffic Projection; Choice of Bridge type; Importance of Proper Investigation.

## UNIT-II

**Standard specification for road bridges IRC Bridge code**: width of carriageway: clearances: loads to be considered – dead load: IRC standard live loads: impact effect. Design of Culverts Design of Reinforced concrete slab culvert.

## UNIT-III

**Design of T – Beam Bridge**: Pigeaud's method for computation of slab moments; Courbon's method for computation of moments in girders; Design of simply supported T – beam bridge.

**UNIT-IV**

**Sub Structure for Bridges Pier and abutment caps;** Materials for piers and abutments; Design of pier; Design of abutment; Backfill behind abutment.

**UNIT – V**

**Foundations for Bridges Scour at abutments and piers;** Grip length; Types of foundations; Design of well foundation ;Bearings for Bridges Importance of bearings; Bearings for slab bridges; Bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing

**Text Books** :

1. Design of Bridges by N. Krishna Raju, Publisher: Oxford & IBH Publishing Co Pvt. Ltd.
2. Essentials of Bridge Engineering by Dr. Johnson Victor; Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Design of Bridge Engineering by T.R Jagadeesh, M.A Jayaram, PHI Learning Pvt. Ltd, New Delhi

**References:**

1. Bridge Engineering by Rangwala, Charotar Publishing House Pvt. Ltd.
2. Bridge Engineering by S. Ponnuswamy, (Third Edition 2017) McGraw-Hill Education Pvt. Ltd.
3. Statically indeterminate structures – C.K. Wang.

**Code Books:**

1. IRC:112-2011. Code of Practice. For. Concrete Road Bridges.
2. IRC 5-2015-Standard Specifications And Code Of Practice For Road Bridges
3. IRC: 6-2017. Standard Specifications And Code Of. Practice For Road Bridges.

| **Programme**: **Civil Engineering** | | | | | **Semester**: v |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5T04 | FINITE ELEMENT ANALYSIS | **3** | **-** | **-** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C314.1 | Describe mathematical model for engineering problems | Apply |
| C314.2 | Illustrate finite element formulation for bar, truss problems | Analyse |
| C314.3 | Analyze beam problems by finite element solutions | Analyse |
| C314.4 | Evaluate CST, LST finite elements for stresses. | Evaluate |
| C314.5 | Justify quadrilateral elements for end solutions. | Evaluate |

## UNIT-I

**ELEMENT PROPERTIES:** Basic theory relating to the formulation of the finite element method, element shapes ,nodes , nodal degree of freedom, node numbering, Coordinate system (local and global), Convergence requirements, Compatibility requirement, Geometric Invariance

## UNIT-II

**Finite element analysis of - single bar element:** (One –Dimensional problem) – Shape functions, derivation of stiffness matrix, stress-strain relations– All with reference to bar element and trusses under axial forces. Finite element formulation of truss element: Stiffens matrix-properties –selection of approximate displacement functions‘- solutions of a plane truss –transformation matrix – Galerkins‘s method for 1-D truss-Computation of stress in a truss element.

## UNIT-III

**Finite element formulation of beam elements:** Beam stiffness-assemblage of beam stiffens matrix-example on analysis of beam subjected to concentrated and distributed loading

## UNIT-IV

**Plane stress and plane strain analysis:** Finite element formulation for plane stress and plane strain problems Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces.

**UNIT – V**

**Iso-parametric formulation:** An Iso parametric bar elements-plane bilinear Iso parametric element-quadratic plane element-shape functions evaluations of stiffness matrix.

**Text Books**:

1.Textbook of Finite Element Analysis by P.Seshu.

2. Introduction to Finite Elements in Engineering‖, Tirupathi R. Chandrupatla, Ashok D

3. Finite Element Analysis‖, by S.S.Bhavikatti, New Age International Publishers

**Reference books**:

1. Introduction to the Finite Element method - A Numerical method for engineering analysis by Desai & Abel; CBS Publishers & Distributors., Delhi

2. The finite element method in engineering by S. S.Rao, Butterworth-Heinemann, New Delhi, 1999

## OE-1

| **Programme**: **Civil Engineering** | | | | **Semester**: v | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20GE5M01 | CONSTITUTION OF INDIA | **2** | **0** | **0** | **0** |
| **Subject Category** : MC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOMES | BLOOMS TAXONOMY |
|---|---|---|
| C316.1 | Understand historical background of the constitution making and its importance for building a democratic India. | Understand |
| C316.2 | Understand the functioning of three wings of the government ie., executive, legislative and judiciary. | Understand |

| | | |
|---|---|---|
| C316.3 | Understand the value of the fundamental rights and duties for becoming good citizenof India. | Understand |
| C316.4 | Analyze the decentralization of power between central, state and local self-government. | Analyze |
| C316.5 | Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy. | Apply |

## UNIT I

**Introduction to Indian Constitution**: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

## UNIT II

**Union Government and its Administration Structure of the Indian Union**: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: PowersandFunctions;

## UNIT III

State Government and its Administration Governor - Role and Position - CM and Council ofministers, State Secretariat: Organisation, Structure and Functions

## UNIT IV

**Local Administration** - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Pachayati Raj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level
- Role of Elected and Appointed officials - Importance of grass root democracy

## UNIT V

**Election Commission**: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women.

**References:**

1) Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt.Ltd.

2) SubashKashyap, Indian Constitution, National Book Trust

3) J.A. Siwach, Dynamics of Indian Government & Politics

4) D.C. Gupta, Indian Government and Politics

5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal LawPublication)

6) J.C. Johari, Indian Government andPolitics Hans

7) J. Raj IndianGovernment and Politics

8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law,Prentice – Hall of India Pvt. Ltd.. New Delhi

9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to CivilRight), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

**e-Resources**:

1) nptel.ac.in/courses/109104074/8

2) nptel.ac.in/courses/109104045/

3) nptel.ac.in/courses/101104065/

4) www.hss.iitb.ac.in/en/lecture-details

5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

6) https://www.javatpoint.com/html-tutorial

7) https://www.javatpoint.com/css-tutorial

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5L01 | TRANSPORTATION ENGINEERING LAB | **-** | **-** | **3** | **1.5** |
| **Subject Category** : PCC lAB | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C317.1 | Test aggregates and judge the suitability of materials for the road construction | Apply |
| C317.2 | Test the given bitumen samples and judge their suitability for the road construction | Apply |
| C317.3 | Obtain the optimum bitumen content for Bituminous Concrete | Analyse |
| C317.4 | Determine the traffic volume, speed and capacity. | Apply |
| C317.5 | Draw highway cross sections and intersections. | Analyse |
| C317.6 | Design parking characteristics. | Analyse |

**SYLLABUS:**

**I. ROAD AGGREGATES:**

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test for coarse aggregate
4. Attrition Test
5. Shape tests

**II. BITUMINOUS MATERIALS:**

1. Penetration Test.

2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

**III. BITUMINOUS MIX:**

1. Marshall Stability test.

**IV. TRAFFIC SURVEYS**:

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

**V. DESIGN & DRAWING**

1. Earthwork calculations for road works
2. Drawing of road cross sections
3. Rotary intersection design

**LIST OF EQUIPMENT:**

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

**TEXT BOOKS:**

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.
2. Highway Material Testing & Quality Control by Rao Wiley India pvt. Ltd., Noida, New Delhi.

**REFERENCE BOOKS:**

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE5L02 | ENGINEERING GEOLOGY LAB | **-** | **-** | **3** | **1.5** |
| **Subject Category** : PCC LAB | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C318.1 | Ability to categorize rocks and minerals by their origin and engineering properties. | Apply |
| C318.2 | Ability to apply geological principles to rock masses and discontinuities for use in engineering design e.g. rock slopes, foundation. | Apply |
| C318.3 | Measure strike and dip of the bedding planes | Apply |
| C318.4 | Interpret geological maps | Analyse |
| C318.5 | To inspire the students to think clearly and critically the solution of the civil engineering | Analyse |

**LIST OF EXPERIMENTS:**

1. Fundamentals of Photogrammetry and Photo interpretation – types of photographs; Vertical photographs
2. Study of Survey of India Topographical Maps

3. Interpretation of Contour maps
4. Study of Satellite Imageries
5. Megascopic identification of minerals
6. Identification of Igneous rocks
7. Identification of Sedimentary rocks
8. Identification of Metamorphic rocks
9. Structural Geology-Problem on strike, Dip.
10. Study and Observation of folds, faults and joints.
11. Structural Geology-Completion of outcrops maps, order of superposition.

**Demo & Calculation only:**

12. Seismic Hammer Sounding Method
13. Electrical Resistivity Method (Vertical Electrical Sounding).

**TEXT BOOKS:**

1.'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
2.'Engineering Geology' by N. Chenna Kesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014.

**REFERENCE BOOKS:**

1.Krynine & Judd, "Principles of Engineering Geology & Geotechnics", CBS Publishers & Distribution.
2. K.V.G.K. Gokhale, "Principles of Engineering Geology", B.S Publications, 2009.

## SEMESTER-VI

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6T01 | DESIGN OF STEEL STRUCTURES | **3** | **0** | **0** | **3** |
| **Subject Category** : PCC | | | | | |

**Course Outcomes:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C321.1 | Analysis and design welded connections | Analyse |
| C321.2 | Design simple and compound beams as per | Evaluate |
| C321.3 | Design tension and compression members as per | Evaluate |
| C321.4 | Design built-up column and column base systems | Evaluate |
| C321.5 | Design Plate Girder and Gantry Girder | Evaluate |

## UNIT-I

**WELDED CONNECTIONS:** Introduction, Advantages and disadvantages of welding- Strength of welds- Butt and Fillet welds: Permissible stresses – IS Code requirements. Design of Butt weld and fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints

## UNIT-II

**BEAMS:**Introduction to plastic analysis, Design requirements as per IS Code- Design of simple and compound beams-Curtailment of flange plates, laterally supported and unsupported beams.

## UNIT-III

**TENSION MEMBERS:** General design of members subjected to direct tension and Bending

**Compression members:**Effective length of columns, Slenderness ratio – permissible stresses, Design of compression members composed of a channel and I- sections including strut. Design principles of eccentrically loaded columns and splicing of columns.

**Roof Trusses:** Different types of trusses – Design loads – Load combinations as per IS Code recommendations, structural details –Design of simple roof truss involving the design of purlins, members and joints – tubular trusses.

## UNIT-IV

**Built up columns:** Design of built up compression members made of channel, I sections and angle connectingsystem – Design of lacings and battens.

**Column bases:** Design of slab base and gusset base. Column bases subjected to axial force and moment.

## UNIT-V

**Design of Plate Girder:** Design consideration – I S Code recommendations
Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections.

**Design of Gantry Girder:** impact factors - longitudinal forces, Design of Gantry girders

**Text Books:**

1. Steel Structures Design and Practice, N. Subramanian, Oxford UniversityPress.
2. Limit State Design of steel structures, S. K. Duggal, Tata Mc Graw Hill, NewDelhi

**References:**

1. Structural Design in Steel, SarwarAlamRaz, New Age International Publishers, NewDelhi
2. Structural Design and Drawing byN.Krishna Raju, Universities Press
3. Design of Steel Structures by K.S.Sai Ram, Person India Education Services

**IS Codes:**

1) IS 800:2007, Indian Standard Code for General Construction in Steel, 3rdrevision, Indian Standards Institution, NewDelhi, 2008.
2) IS – 875, Code of practice for design loads (other than earth quake) for buildings and structures (Part-1-Part 5), Bureau of Indian standards.
3) SteelTables.

**These codes and steel tables are permitted to use in the examinations.**

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6T02 | GEOTECHNICAL ENGINEERING | **3** | **0** | **0** | **3** |
| **Subject Category** : PCC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOMES | BLOOMS TAXONOMY |
|---|---|---|
| C322.1 | carry out soil classification and solve three phase system problems | Apply |
| C322.1 | solve any practical problems related to soil stresses estimation, permeability and seepage | Apply |
| C322.1 | estimate the stresses under any system of foundation loads | Analyse |
| C322.1 | solve practical problems related to consolidation settlement and time rate of settlement | Apply |
| C322.1 | Understand the stress distribution in soils | Apply |

## UNIT-I

**Soil Formation,** Minerals in Clays and Sand, Soil Structure, Physical properties of Soil: Void ratio, Porosity, Degree of Saturation, Water Content, Unit Weights, Specific Gravity, Weight – Volume Relationships, Relative density, Consistency Limits and Consistency Indices, Mechanical Analysis and Soil Classification: Sieve Analysis, Stoke's Law, Hydrometer and Pipette Analysis, Textural Classification, Classification based on Size, Unified Soil Classification and Indian Standard Soil Classification Systems, Field Identification of Soils

## UNIT-II

**Soil Hydraulics**: Types of Soil Water, Capillary Rise and Surface Tension, Darcy's Law and its Limitations, Constant Head and Variable Head Permeability Tests, Factors Effecting Coefficient of Permeability, Permeability of Stratified Soils. Total, Neutral and Effective Stresses, Effective Stress Principle, Upward Flow Conditions, Quick Sand Conditions, Critical Hydraulic Gradient.

## UNIT-III

**Stress Distribution in Soils:** Boussinesq's Theory for Determination of Vertical Stress, Assumptions and Validity, Extension to Line, Strip, Rectangular and Circular Loaded Areas, Pressure Bulb and Influence Diagrams, Newmark's Influence Chart – Construction and Use, Westergaard's Theory, 2:1 Load Dispersion Method, Contact Pressure Distribution beneath

Footings.

**UNIT-IV**

**Compaction:** Mechanism of Compaction, Factors Effecting Compaction, Laboratory Compaction Tests, Effect of Compaction on Soil Properties, Field Compaction: Compaction Equipment and Evaluation of Field Compaction.

**Consolidation:** Compression Index, compresibilty of soils- e-p and e-log p curves, Coefficient of Compressibility and Coefficient of Volume Decrease; Spring Analogy for Primary Consolidation; Initial

Compression, Primary Compression and Secondary Compression, Terzaghi's One Dimensional Consolidation Theory .

**UNIT-V**

**Shear Strength of Soils:** Stress at a Point, Mohr Circle of Stress, Mohr-Coulomb Failure Theory, Shear Parameters, Laboratory Shear Tests – Shear Box, Triaxial and Unconfined Compression Tests, Laboratory and Field Vane Shear Tests, Sensitivity of Clays, Types of Shear Tests based on Drainage Conditions, Total Stress Analysis and Effective Stress Analysis, Shear Strength of Sands, Critical Void Ratio and Dilatancy, Liquefaction of Soils, Factors affecting Shear Strength of Clays and Sands,

**Text Books**

1. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers

2. Basic and Applied Soil Mechanics by Gopal Rajan and A.S.R. Rao, New Age International Publishers.

**References:**

3. Geotechnical Engineering by P. Purushothama Raj, Pearson Publishers.

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6T03 | ENVIRONMENTAL ENGINEERING | **3** | **0** | **0** | **3** |
| **Subject Category** : PCC | | | | | |

**Course Objectives:** Upon successful completion of the course, the student will be able to

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C323.1 | **Assess** the quality and quantityof water requirements for acit | Analyse |
| C323.2 | **Design**ofdifferenttreatmentunitsanddistributionsystemsforwatersupply | Evaluate |
| C323.3 | **Analyze**thecharacteristics,collection,conveyanceanddisposalofwastewater | Analyse |
| C323.4 | **Design**ofsewers andvariousunitsina wastewatertreatmentplant | Evaluate |
| C323.5 | **Design**ofsecondaryandbiologicaltreatmentunits | Evaluate |

## UNIT–I

**Water demands-standards-sources**: Aspects of Environmental Engineering – Protected water supply – Need – Water demands – Fluctuations – Design period-Population forecast – Water quality – Drinking water standardsTesting and significance – Quality and Quantity and other considerations of surface and subsurface sources – Yield calculations – Intake works – Storage reservoir capacity – Systems ofwatersupply–Requirements–Detectionofleakages–Selectionofpump–Economicaldiameterofpumpingmain.

## UNIT–II

**Treatment of water and distribution** : Water treatment,conventional treatment flow diagram–Sedimentation types–Principles–Design factors– Coagulation –DesignofClariflocculator –Filtration–Slow,RapidgravityfiltersandPressurefilters–Designprinciples-Disinfection–Theory of Chlorination – Distribution systems– Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipemethod. Valves–Otherappurtenances.

## UNIT–III

**Waste water management**:Introduction:Waste water treatment system–Definitions of terms–Collection and conveyance of sewage – Sewage flow rates – Storm water–Characteristics of sewage –

Cycles of decay–BOD–COD–Ultimate disposal of sewage – self-purification of rivers–sewage farming

**UNIT–IV**

**Design of sewers and primary treatment**: Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewage treatment – Primary treatment:-Screens–Grit chamber–Sedimentation tanks – Design principles . Septic tanks and Imhoff tanks – rural latrines–House plumbing–Appurtenances.

**UNIT–V**

**Secondary biological treatment**: Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Lowcost waste treatment methods – Design of Oxidation ponds – Aerobic and Anaerobic lagoons.Sludge Digestion–Design principles–Disposal.

**Text books:**

1. 1.B.C.PunmiaBC,A.K.JainandA.K.Jain,“WaterSupplyEngineering”,LaxmiPublications.2nd Edition1995, Reprint 2005.
2. B.C.Punmia,A.K.JainandA.K.Jain,“WastewaterEngineering”,LaxmiPublications,2ndEdition1998, Reprint 2014

**References:**

1. S.K.Garg,“WaterSupplyEngineering”,KhannaPublishers,26threvisedEdition,NewDelhi.2 010.
2. S.K. Garg, “Sewage disposal and Air Pollution Enginering”, Khanna Publishers New Delhi. 36thEdition, 2017.
3. H.S.Peavy,D.Rowe,andG.Tchobanoglous,“EnvironmentalEngineering”,McGrawHillPub lishers,New Delhi. 1985.
4. G.S.BirdieandJ.S.Birdie,“WaterSupplyandSanitaryEngineering”DhanpatRaiPublishingC ompanyNew Delhi, 6thEdition, 2002.
5. K.N.Duggal,“ElementsofEnvironmentalEngineering”,S.Chand&CompanyLimited,New Delhi,2007. 6.
P.N.Modi,“SewageTreatmentDisposal&WastewaterEngineering”,StandardBookHouse,2 016.
7. Manualonsewerageandsewagetreatment,CPHEEO,Ministryofurbanaffairsandemploymen t,Govt. ofIndia, New Delhi, 2001

8. WaterandWastewaterEngineering,NPTELvideolecturesand webnotes

| **Programme**: **Civil Engineering** | | | | **Semester**: 2 | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6T04 | PREFABRICATED STRUCTURES | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C324.1 | Understand different methods of prestressing | Apply |
| C324.1 | Estimate effective prestress including short and long term losses | Apply |
| C324.1 | Analyze and design prestressed concrete beams under flexure andshear | Analyse |
| C324.1 | Analyse pre stressed concrete beams for deflections. | Analyse |
| C324.1 | Understand the relevant IS Code provisions for shear, torsion in prestressed concrete | Evaluate |

## UNIT-I

**Introduction &Methods and Systems of prestressing :** Historic development- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of prestressing- Materials- high strength concrete and high tensile steel their characteristics. Pretensioning and Posttensioning methods and systems of prestressing

**Flexure:** Analysis of sections for flexure- beams prestressed with straight, concentric, eccentric, bent and parabolic tendons, Line of Thrust – Pressure Line, Load Balancing Concept.

## UNIT-II

**Losses of Pre-stressing**- Loss of Pre-stress in pre-tensioned and post tensioned members -Elastic shortening, shrinkage, and creep of concrete; Relaxation of steel, slip in anchorage, and frictional losses- Total loss and allowable loss of prestress for design .

## UNIT-III

**Design for Flexure** - Types of failure – Code procedures - Design for flexure using IS Code (IS 1343 - 2012) Cable profile in two span continuous members.Shear and Principal Stresses- Design of Shear reinforcement - Code Provisions- Design for Torsion, Design for Combined bending, shear and torsion.

**UNIT-IV**

**Deflections**: Importance of control of deflections- Factors influencing deflections – Short term deflections of uncracked beams- prediction of long time deflections- IS code requirements.

**UNIT-V**

**Precast concrete beams General introduction**; Non-composite reinforced concrete beams, Precast concrete columns, Built-up Beams.

**Text Books:-**

1. Prestressed Concrete by N.Krishna Raju, 6e Tata Mc Graw Hill Book co.
2. Prestressed Concrete by K.U.Muthu PHI Learning Pvt. Ltd.

**References:**

1. Design of prestress concrete structures by T.Y. Lin and Burns, John Wiley, New York.
2. Precast concrete structures by Kim S.Elliott, Butterworth-Heinemann, 2002.
3. Prestressed Concrete by N. RajagopalanNarosa Publishing House.
4. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi.
5. IS 1343:2012

| **Programme**: **Civil Engineering** | | | | **Semester**: 2 | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6T04 | ADVANCED REINFORCED CONCRETE DESIGN | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Outcomes:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C324.1 | Will be able to Design different types of staircases | Evaluate |
| C324.2 | Will be able to Design Cantilever ad couterfort retaining walls | Evaluate |
| C324.3 | Will be able to Design combined and pile foundations | Evaluate |

| | | |
|---|---|---|
| C324.4 | Will be able to Analyse and Design the Rectangular water tanks as per Is code | Evaluate |
| C324.5 | Will be able to Analyse and Design Flat slab and Grid Floors using IS Code | Evaluate |

**UNIT –I**

**Staircases :**Introduction, types- design of dog-legged staircases,design of open well staircase with quarter span landing, design of stairs with central stringer beam

**UNIT –II**

**Cantilever Retaining walls:**Introduction, Types of retaining walls- Active and Passive earth pressure- Design principles of cantilever retaining walls with horizontal back fill,with horizontal backfill and traffic load ,with sloping backfill Counterfort Retaining walls.Design principles of counterfort retaining walls with horizontal backfill, with horizontal backfill and traffic load, with sloping backfill, Reinforcement detailing and bar bending schedule.

**UNIT – III**

**Combined footings, piles and pile caps:**Combined footings- Rectangular only, Pile Design –Design of bored cast in situ and Precast only, Pile cap- design of 2 pile cap and 3 pile caps only.

**UNIT – 1V**

**Rectangular water tanks:**Introduction- Impermeability requirements- Design requirements, - Permissible stresses in concrete and steel- minimum reinforcement- method of analysis – Approximate method & IS code Method- Design of Rectangular water tanks resting on ground, Design of underground rectangular tanks- design of rectangular overhead tanks.

**UNIT –V**

**Circular and Intz Type water tanks:**Introduction- Design requirements- IS 3370 provisions- Joints in water tanks- Flexible and Rigid joints- Approximate method and IS code method- Design of circular water tanks resting on ground- Design of circular overhead tanks with flat bottom slab- Design of Intz tank- Design of supporting structure.

## Text Books:

1. Pillai and Menon D, "Reinforced concrete Design", 2nd edition, Tata McGraw Hill, 2006.
2. Bhavikatti S.S, " Advance R.C.C. Design ( R.C.C Volume II)", 3rd Edition, New Age International Publishers, 2016.

## References:

1. Varghese P.C, " Advanced Reinforced Concrete Structures", 4th Edition, Prentice hall of India, 2005.

**Code books**:

1. IS: 3370 (part 1), (Part II) and Part (IV).

| **Programme**: **Civil Engineering** | | | | **Semester**: 2 | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6T04 | EARTHQUAKE RESISTANT DESIGN OF BUILDINGS | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Outcomes:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C324.1 | Discuss the equations of motion for undamped free vibrations for SDOF and 2DOF systems | Understand |
| C324.2 | Explain the engineering seismology including causes and effects of earthquakes | Understand |
| C324.3 | Analyse amulti-storeyed structure using Equivalent Static Method and Response Spectrum methods | Analyse |
| C324.4 | Assess various irregularities in buildings | Analyse |
| C324.5 | Apply the provisions of IS:13920 and IS: 4326 to building structures | Apply |

## UNIT-I

**Structural dynamics:**

Introduction – Physical and Mathematical Modelling – Discrete and continuum Modelling. Laws of Equilibrium – Newton's Law of Motion – D'Alembert's Principle and Principle ofvirtual displacement. - Types of Dynamic Loading.

Single Degree of Freedom System (SDOF) – Undamped Free Vibrations – Damped FreeVibrations (concept only).

## UNIT-II

**Engineering seismology:** Introduction- Internal structure of earth – Chemical properties – Physical properties – Continental drift theory – Plate tectonics – Movement of plate Boundaries – Movement ofIndian plate – Faults – Types of faults – Elastic Rebound theory.

Earthquakes – Earthquake terminology – Classification of Earthquakes – Causes and effects of Earthquakes –Earthquake waves

## UNIT-III

**Earthquake resistant design:** Reviews of latest I.S : 1893 (Part 1) provisions for buildings - General principles and design criteria – Assumptions – Design Acceleration spectrum – Horizontal seismic coefficient – Design acceleration – Seismic zones of India – Importance factor – Response reduction factor – Design lateral force – Design imposed loads for Earthquake force calculation –Seismic weight – Analysis by Equivalent Static Method

## UNIT-IV

**Building configurations:** Introduction – Regular and Irregular Buildings.

Plan Irregularities – Torsion Irregularity – Re-entrant corners - Floor slabs having excessive cut-outs or openings- Out of plane offsets in Vertical Elements – Non-parallel Lateral Force system.

Vertical Irregularities – Stiffness Irregularity (soft storey) – Mass Irregularity – Vertical Geometric Irregularity – In-plane discontinuity in Vertical Elements resisting lateral force – strength Irregularity (weak storey) – Floating or stub columns – Irregular Modes of Oscillation in two Principle Plan Directions.

## UNIT-V

**Ductile design and detailing:**Review of Latest IS: 13920 provisions General specifications – Beams – Columns – Shear walls.Special confining reinforcement.Review of Latest IS: 4326 provisions - General principles – Special Construction featuresrelating to separations of structures (above ground only).

**Text Books:**

1.A.K. Jain "Dynamics of Structures with Mat Lab Applications" Pearson India Education Series Pvt.Ltd., Delhi, 2016

2.Pankaj Agarwal & Manish Shrikhande, "Earthquake Resistant Design of Structures", 5th Edition Prentice Hall of India, New Delhi, 2011.

3.S.K.Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, 1st Edition, 2012.

**REFERENCES:**

1.Chopra A.K., "Dynamics of Structures", 5thEdition, Pearson Education, Indian Branch, Delhi, 2007.

2.Mario Paz, "Structural Dynamics - Theory and Computations", 6thEdition, Pearson Education, 2005.

3.IS 456: 2000 Indian Standard Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).

4, IS 1893 (Part 1): 2016, Indian Standard "Criteria for Earthquake Resistant Design of Structures, Part 1, General provisions and Buildings (six revision) Bureau of Indian Standard, New Delhi. (or latest).

5.IS 13920: 2016 Indian Standard "Ductile Design and Detailing of Reinforced Concrete Structures, subjected to Seismic forces - Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).

6.IS 4326: 2013 Indian Standard "Earthquake Resistant Design and Construction of Buildings - Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).

## OE-2

| **Programme**: **Civil Engineering** | | | | **Semester**: 2 | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |

| | | | | | |
|---|---|---|---|---|---|
| 20GE5C03 | INTELLECTUAL PROPERTY RIGHTS AND PATENTS | 2 | 0 | 0 | 0 |
| **Subject Category** : MC | | | | | |

**Course Outcomes:**

| COURSE CODE | COURSE OUTCOMES | BLOOMS TAXONOMY |
|---|---|---|
| C326.1 | Identify different types of intellectual property rights may be prescribed by an output with supporting agencies internationally | Understand |
| C326.2 | Explain the ways to protect literary and artistic works of the authors | Understand |
| C326.3 | Illustrate the process of registering innovative products i.e., Patents | Analyse |
| C326.4 | Analyze the ways to maintain of Trade Marks | Analyse |
| C326.5 | Suggest the ways to protect trade secrets in the organizations Explain different laws available related to cybercrimes. | Apply |

**UNIT – I**

**Introduction to Intellectual property:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT – II**

**Law of Copyrights:** Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**UNIT – III**

**Law of Patents:** Foundation of patent law, patent searching process, ownership rights and transfer. Patent litigation. Dilution of patent rights, patent registration.

**UNIT – IV**

**Trade Marks**:Purpose and function of trademarks, acquisition of trade mark rights, protectable matter (strength and categories of trade marks), selecting, and evaluating trade mark, trade mark registration processes.

**UNIT – V**

**Trade Secrets and Cyber law:** Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation. Introduction to Cyber Law – Information Technology Act 2000 & Cyber Crimes & its types.

**Real time examples must be added to the concepts requires.**

**References:**

1. Intellectual property right, Deborah, E. Bouchoux, Cengage learning.

2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc-Graw Hill Publishing Company Ltd.
3. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4. Cyber Law - Texts & Cases, South-Western's Special Topics Collections.

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6L01 | STAAD LAB | **0** | **0** | **3** | **1.5** |
| **Subject Category** : PCC LAB | | | | | |

**LIST OF EXPERIMENTS**

1. Analysis &Design determinate structures using a software-SIMPLY SUPPORTED BEAM .

2. Analysis &Design of fixed & continuous beams using a software.

3. Analysis & Design of Plane Frames.

4. Analysis &Design of space frames subjected to DL & LL.

5. Analysis &Design of residential building subjected to all loads (DL,LL, WL) .

6. Analysis & Design of Roof Trusses.

7. Design and detailing of built up steel beam.

8. Developing a design programme for foundation using EXCEL Spread Sheet.

9. Detailing ofRCC beam and RCCslab.

10. Detailing of Steel built up compression member.

**Text Books:**

1.Multi-storey precast concrete framed structures by K.S.Elliott and C.K.Jolly, John Wiley & Sons ,2013.

2. Pillai and Menon D, "Reinforced concrete Design", 2nd edition, Tata McGraw Hill, 2006.

3. Bhavikatti S.S, " Advance R.C.C. Design ( R.C.C Volume II)", 3rd Edition, New Age International Publishers, 2016.

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6L02 | GEOTECHNICAL ENGINEERING LAB | **0** | **0** | **3** | **1.5** |
| **Subject Category** : PCC LAB | | | | | |

**LIST OF EXPERIMENTS**

1. Atterberg's Limits.
2. Field density-Core cutter and Sand replacement methods
3. Relative Density of Sand
4. Grain size analysis - Sieve Analysis Hydrometer analysis
5. Permeability of soil - Constant and Variable head tests
6. Compaction test
7. CBR test
8. Consolidation test
9. Unconfined Compression test
10. Triaxial Compression test
11. Direct Shear test.
12. Vane Shear test.
13. Differential free swell (DFS)
14. Measurement of Swell Pressure.

Any eight experiments may be completed.

**LIST OF EQUIPMENT:**

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrinkage limits
3. Field density apparatus for
    a) Core cutter method
    b) Sand replacement method

4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
5. Hydrometer
6. Permeability apparatus for
    a) Constant head test
    b) Variable head test
7. Universal auto compactor for I.S light and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity
11. One dimensional consolation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38 mm dia specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (range of temperature $50^0$ - $150^0$C

**Reference:**

1. IS 2720 – relevant parts

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE6L03 | ENVIRONMENTAL ENGINEERING LABORATORY | **0** | **0** | **3** | **1.5** |
| **Subject Category** : PCC LAB | | | | | |

## LIST OF EXPERIMENTS

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.

2. Determination and estimation of Total Hardness–Calcium &Magnesium.

3. Determination ofAlkalinity/Acidity

4. Determination of Chloride in water and soil

5. Determination and Estimation of total solids, organic solids and inorganic solids and Settleable Solids by Imhoff Cone.

6. Determination of Iron.

7. Determination of Dissolved Oxygen with D.O. Meter &Wrinklers Method and BOD.

8. Determination of N, P, K values in solid waste

9. Physical parameters – Temperature, Color, Odor, Turbidity, Taste.

10. Determination of C.O.D.

11. Determination of Optimum coagulant dose- with and without coagulant aids

12. Determination of Chlorine residue and demand

13. Presumptive Coliformtest.

**NOTE:** Atleast 10 of the experiments enlisted are to be conducted.

**List of Equipments**

1) pH meter

2) Turbiditymeter

3) Conductivitymeter

4) Hot airoven

5) Mufflefurnace

6) Dissolved Oxygenmeter

7) U–V visiblespectrophotometer

8) COD RefluxApparatus

9) Jar TestApparatus

10) BOD Incubator

11) Autoclave

12) Laminar flowchamber

13) Hazen's Apparatus

14) Chlorocsope

**Text Books**

1. Standard Methods for Analysis of Water and Waste Water –APHA

2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, NewDelhi, 2010.

**Reference**

1. Relevant IS Codes.

2. Chemistry for Environmental Engineering by Sawyer and Mc.Carty.

# SEMESTER-VII

**PEC-3**

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T01 | DISASTER MANAGEMENT | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C411.1 | Explain The Aspects Of Disaster Management And Adopt Remedial Measures | Apply |

| | | |
|---|---|---|
| C411.2 | Access The Impact Of Hazards On Structures | Apply |
| C411.3 | Explain The Vulnerability Conditions | Apply |
| C411.4 | Adopt The Rehabilitation Procedures | Apply |
| C411.5 | Fire safety and fire fighting method, fire detectors, and fire extinguishers. | Apply |
| C411.6 | Information Systems & Decision Making Tools | Apply |

**Unit-I**

**Introduction of Natural Hazards and Disaster Management**

**Introduction-** Nature Hazards and Man Made Hazards – Disaster Management cycle – Case study methods of the following, droughts, Earthquakes, landslides, global warming and Disaster mitigating agencies.

**UNIT-II**

**Overview of Disaster Situations in India**

Vulnerability of profile of India and Vulnerability mapping including disaster prone areas, communities, places Disaster preparedness – ways and means, Skills and strategies, rescue, relief reconstruction, Case Studies: Lessons and Experiences from Various Important Disasters in India.

**UNIT-III**

**Flood and Drought Disaster**

Raising flood damage, assessing flood risk, flood hazard assessment, flood impact assessment, flood risk reduction Options, Drought and development, Relief management and prevention, Drought mitigation and management- Integrating technology and people.

**UNIT-IV**

**Landslide and Earthquake Disaster:** Land slide hazards zonation mapping, Geo environmental problems associated with the occurrence of landslides Studies in rock mass classification and land slide management in a part of Garwal-Himalaya, India. The use of electrical resistivity method in the study of landslide, Causes and effects of earth quakes.

**UNIT-V**

**Cyclone & Fire Disaster and Rehabilitation Disaster:**Cyclone occurrence and hazards, Cyclone resistant house for coastal areas, Disaster resistant construction role of Insurance sector, Types of fire,

Fire safety and fire fighting method, fire detectors, and fire extinguishers. Rehabilitation programmes, information systems & decision making tools

**Text books:**

1. Disaster Management, RB Singh (Ed), Rawat Publications, 2000.
2. Disaster Management Future Challenges and Opportunities, jagbirsingh, I.K international publishing house

**References:**

1. Natural Hazards in the urban habitat by lyengar, CBRI, Tata McGraw Hill
2. Natural Disaster management, Jon Ingleton (Ed), Tulor Rose, 1999.
3 . Anthropology of Disaster management, Sachindra Narayan, Gyan Publishing house, 2000.

**URLs and Other E-Learning Resources**

1.http://www.gktoday.in/disaster-management-agencies-of-india/
2.http://www.wcpt.org/disaster-management/Organisations-involved-in-disaster-management
3.http://192.168.0.47/Autonomous%20Learning%20Material%20-%20GEC%20Faculty/

**Digital Learning Materials:**

1. https://youtu.be/qHSHervrpx4
2.https://youtu.be/Ri-ySTqStUk

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T01 | URBAN TRANSPORTAON PLANNING | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C411.1 | Factors underlying traveller choices of mode of travel, route choice and destination | Understand |

| | | |
|---|---|---|
| C411.2 | Choice and how these processes can be represented mathematically. | Apply |
| C411.3 | Knowledge of data required for transportation planning. | Apply |
| C411.4 | The main determinants of travel demand, and how to use statistical packages to study | Analyse |
| C411.5 | Ability to make tradeoffs with multiple factors in project planning and design. | Analyse |
| C411.6 | How engineers and planners interact with local and regional governments, citizens and elected officials to develop and interpret transportation plans. | Analyse |

## UNIT-I

**Introduction and Urban Transportation System Planning-Conceptual Aspects**

Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation, Future Developments. Transport Planning Process, Problem Definition, Solution Generation, Solution Analysis.

## UNIT-II

**Trip Generation Analysis and Mode Choice Modelling:**

Four step Travel Demand forecasting approach, Trip Production Analysis, Zonal models, Category Analysis, Trip Attraction Modelling, Influencing Factors, Earlier Modal Split Models, Trip-End Type Modal Split Model, Trip-Interchange Modal Split Model, Disaggregate Mode-Choice Model, Logit Model of Mode Choice.

## UNIT-III

**Data Collection and Inventories:**

Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship

## UNIT-IV

**Trip Distribution Models**

PA Matrix, OD Matrix, Basis of Trip Distribution, Gravity Model, Calibration of Gravity Model, Singly and Doubly Constrained Gravity Models. Growth Factor Methods of Trip Distribution. Uniform Factor Method, Average Factor Method, Fratar Growth-Factor Method.

**UNIT-V**

**Corridor Identification, Plan Preparation & Evaluation:**Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis.

**Text books:**

1. 'Transportation Engineering - An Introduction' by Khisty C.J., B. Kent Lall, Pearson India Education Services pvt. Ltd.

2. Transportation Engineering and Planning by C S Papacostas and P.D. Prevedours; Pearson India Education Services pvt. Ltd.

**References:**

1. 'Urban Transportation Planning: A decision oriented Approach' by Mayer M and Miller E, McGraw Hill
2. 'Traffic Engineering and Transportation Planning' by Kadiyali.L.R., Khanna Publishers, New Delhi

**URLs and Other E-Learning Resources**

1. https://www.youtube.com/watch?v=YAEyLOCU-8I
2. hits.digimat.in/nptel/courses/video/105106058/L01.html

**Digital Learning Materials:**

1.https://nptel.ac.in/
2. https://www.youtube.com/watch?v=EAEyUOCE-DI

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T01 | INTELLIGENT TRANSPORTATION SYSTEMS | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| **COURSE CODE** | **COURSE OUTCOME** | **BLOOMS TAXONOMY** |
|---|---|---|

| | | |
|---|---|---|
| C411.1 | Understand the sensor and communication technologies. | Understand |
| C411.2 | Apply the various ITS methodologies | Apply |
| C411.3 | Define the significance of ITS under Indian conditions | Analyse |
| C411.4 | Travel and Traffic management | Analyse |
| C411.5 | Advanced Traffic Management Systems (ATMS), (ATIS), (CVO), (ARTS). | Evaluate |
| C411.6 | Overview of ITS implementations in developed countries, | Evaluate |

## UNIT-I

**Introduction to Intelligent Transportation Systems (ITS)**

Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

## UNIT-II

**Telecommunications in ITS:** Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System.

## UNIT-III

**ITS Functional Areas:**Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).

## UNIT-IV

**ITS User Needs and Services:**Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

## UNIT-V

**Automated Highway Systems:** Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

**Text books:**

1. 'Transportation Engineering - An Introduction' by Khisty C.J., B. Kent Lall, Pearson India Education Services pvt. Ltd.

2. Transportation Engineering and Planning by C S Papacostas and P.D. Prevedours; Pearson India Education Services pvt. Ltd.

**References:**

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

2. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.

3. National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).

**URLs and Other E-Learning Resources**

1. https://www.youtube.com/watch?v=NVf9vtazgX8

2https://www.youtube.com/watch?v=Z5VKdLU-y8M

**Digital Learning Materials:**

1. https://www.youtube.com/watch?v=WwUkccNrL4U
2. https://www.civil.iitb.ac.in/tvm/nptel/592_ITS_2/web/web.html

## PEC-4

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T02 | CONSTRUCTION MANAGEMENT & COST ANALYSIS | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C412.1 | Appreciate the importance of construction planning | Apply |

| | | |
|---|---|---|
| C412.2 | Apply the gained knowledge to project management and construction techniques | Apply |
| C412.3 | The student should be able to determine the quantities of different components of buildings. | Evaluate |
| C412.4 | The student should be capable of finalizing the value ofstructures | Evaluate |
| C412.5 | The student should be in a position to find the cost of various buildingcomponents | Evaluate |

**UNIT-I**

**Construction project management**

Project planning- Qualities of a project manager –scheduling techniques ( Bar charts, Milestone charts, Networks)

**UNIT – II**

**Network Analysis**

Developing a Network- CPM and PERT methods

**UNIT – III**

**Project Reviewing**

Updating – Cost Analysis - crashing for optimum cost – crashing for optimum resources – allocation of resources .

**UNIT – IV**

**Specifications of items of construction**

General items of work in Building- Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

**UNIT – V**

**Quantity Estimation**

Detailed Estimation of Buildings using individual wall and center line method

**Text books:**

1) Construction Engineering and Management , Seetharaman , Umesh Publications
2) Estimating and Costing, B.N. Dutta, UBS publishers,2000.

3) Civil Engineering Contracts and Estimates, B. S. Patil, Universities Press (India) Pvt. Ltd., Hyd.

**References:**

1)Estimating and Costing, G.S.Birdie.

2)Construction Planning Equipment and Methods, Peurifoy and Schexnayder , Shapira, Tata Mcgraw hill

3)Construction Project Management Theory and Practice, Kumar NeerajJha (2011), Pearson.

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T02 | Building Construction Practice | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C412.1 | know the different construction techniques and structural systems | Understand |
| C412.2 | Understand various techniques and practices on masonry construction, flooring, and roofing. | Understand |
| C412.3 | Plan the requirements for substructure construction. | Evaluate |
| C412.4 | Know the methods and techniques involved in the construction of various types of super structures | Apply |
| C412.5 | Select, maintain and operate hand and power tools and equipment used in the building construction sites. | Evaluate |

## UNIT I

**Construction techniques :**Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism – floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials – responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Meaning - Building automation - Energy efficient buildings for various zones-Case studies of residential, office buildings and other buildings in each zones.

## UNIT II

**Construction practices :** Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection.

**UNIT III**

**Sub structure construction :** Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation.

**UNIT IV**

**Super structure construction :** Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.

**UNIT V**

**Construction equipment :** Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – types of cranes - Equipment for dredging, trenching, tunneling,

**Text books:**

1.Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C.,

2."Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.

3. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.

4. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

**REFERENCES:**

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.

2. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers New Delhi, 2002.

3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.

4. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi, 1983.

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T02 | CONSTRUCTION EQUIPMENT AND AUTOMATION | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C412.1 | Derive feasibility of specific equipment in different project conditions | Apply |
| C412.2 | Selection of Automation techniques in construction industry | Apply |
| C412.3 | Select suitable Drone technology for surveying and project management | Apply |
| C412.4 | Analyze benefits of robotics versus conventional construction equipment | Analyse |
| C412.5 | Classify application of Virtual Reality, Augmented Reality, BIM in construction industry | Analyse |

## UNIT-1

**Introduction**: Unique features of construction equipment, Need of construction Equipment, past history. Construction Equipment: Capacity, Feasibility, owning and operating cost and Productivity of Different Equipment: Excavators, Pavers, Plastering machines; Pre-stressing jacks and grouting equipment; Cranes and Hoists, Concrete Batching Plants, etc..

## UNIT-11

**Automation in Construction Industry**: Need and Benefit of automation: Automation in Canal lining, Automation in Construction of Highway, Automation in concrete technology.

## UNIT -III

**Drones:** Photogrammetry, Project Monitoring- real time data, aerial mapping, land survey, quantity survey, quality survey, structural health monitoring survey, under water survey.

**UNIT-IV**

**Robotics in Construction**: Introduction, Benefits of robots in construction industry with respect to time, cost, quality, safety. Use of robots for construction activities like Brick laying, Demolition, Material Handling, Structural steel cutting, Rebar tying/bending, Form work mould making, 3D printing- print complex, layered, parts and objects of homes, buildings, bridges and roads 3D Scanner for surveying and project management

**UNIT-V**

**Introduction to Advanced Technologies**: Virtual Reality, Augmented Reality, Building Information Modeling (BIM).

**TEXT BOOKS :**

1) Construction Planning, Methods and Equipment, R.L Peurifoy, McGraw Hill, 2011
2) Construction Project management, Theory & Practice, Kumar Neeraj Jha,., Pearson Education India.
3) BIM and Construction Management: Proven Tools, Methods, and Workflows By Brad Hardin, Dave McCool, John Wiley & Sons
4) Construction equipment and its planning and application Mahesh Varma Metropolitan Book Co

**REFERENCES**

1) Robotics and Automation in Construction, Open access peer- reviewed edited volume
2) Automation in Construction Management: Automated management of Construction Materials Using RFID Technology, Javad Majrouhi Sardroud, Scholars' Press
3) Enhancing BIM Methodology with VR Technology, Open access peer

## PEC-5

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T03 | FOUNDATION ENGINEERING | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C413.1 | Understand the soil exploration methods and samplers used for soil exploration | Understand |
| C413.2 | Understand the need of bearing capacity and types of shallow foundation and learn to design the shallow foundation. | Understand |
| C413.3 | Understand the need and types of pile foundation , cassions and learn to design the pile foundation. | Understand |
| C413.4 | Be able to understand the causes of failure of earth dams and criteria of its control. | Understand |
| C413.5 | Be able to analyze the stability analysis of slopes. | Analyse |

## UNIT-I

**Subsoil Exploration** : Methods of subsoil exploration Direct, semi direct and indirect methods, Soundings by Standard, Dynamic cone and static cone penetration tests, Types of Boring, Types of samples, Criteria for undisturbed samples, Transport and preservation of samples, Borelogs, planning of exploration programmes, report writing

## UNIT-II

**Bearing Capacity:** Safe bearing capacity and allowable bearing pressure, General and local shear failures, Terzaghi's bearing capacity equations its modifications for square, rectangular and circular foundations, Factors affecting bearing capacity of Soil, Effec t of water table on bearing capacity, IS Code method for Bearing capacity of footings, Allowable bearing pressure based on N-values. Bearing capacity from plate load tests.

**Shallow Foundations**: Factors effecting locations of foundation and design considerations of shallow foundations, choice of type of foundations, Foundations on expansive soils.

## UNIT-III

**Settlement Analysis** : Causes of settlement, Computation of settlement, allowable settlement. Measures to reduce settlement

**Pile Foundations** : Types, Construction, load carryig capacity of single pile – Dynamic Formula, Static formula, Pile load tests, Load carrying capacity of pile groups, settlement of pile groups, Negative skin friction, under reamed pile.

**Caissons** : Types of caissons, pneumatic caissons, Different shapes of well foundations, Relative advantages and disadvantages, Different Components of well and their function, Grip length, problems in well sinking and remedial measures.

## UNIT-IV

**Earth Pressure**: Types of Earth pressure, Rankines Active and passive earth pressure, Smooth Vertical wall with horizontal and inclined backfills. Coloumbs wedge theory, Culmans and Rebhanns graphical method for active earth pressure, Retaining walls: Types and Stability Analysis.

## UNIT-V

**Stability Analysis of Slopes** : Infnite and Finite Slopes, Stability Analysis of Infinite Slopes, different factors of safety, Types of Slope Failures – Toe slope and Base failure, , Stability Analysis of Finite slopes – Swedish Circle method, Friction Circle method, Fellineous method for location of Critical Slip Circle, Taylor's stability number.

### Text Books

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao
2. Foundation Analysis and Design – J. E. Bowles.

### References:

1. Soil Mechanics and Foundation Engineering – By K.R. Arora.
2. Foundation Engineering by P.C. Vargheese

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T03 | ENVIRONIMENTAL GEOTECHNOLOGY | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

### Course Objectives:

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C413.1 | Understand Environmental interaction relating to geotechnical problems | Understand |

| | | |
|---|---|---|
| C413.2 | Analyze Factors affecting permeability | Analyse |
| C413.3 | Understand Ground water contamination | Understand |
| C413.4 | Understand Waste modification techniques in waste management | Understand |
| C413.5 | Acknowledge Soil contamination and remediation technology | Analyse |

**UNIT - 1**

Environmental cycles – Soil and water – Environmental interaction relating to geotechnical problems – Effect of pollution on soil – water behaviour.Origin, nature and distribution of soil – Description of individual particle – Soil fabric and structure – Gravitational and surface forces – Intersheet and interlayer bonding in the clay minerals – Basic structural units of clay minerals – Isomorphous substitution – Kaolinite mineral – Montmorillonite mineral – Illite mineral – Electric charges on clay minerals – Ion exchange capacity – Diffused double layer – Adsorbed water – Soil structure – Methods for the identification of minerals.

**UNIT- II**

Effect of drying on Atterberg limits – Shrinkage, swelling and cracking characteristics of soil – Electrochemical characteristics of soil-water system – Sensitivity of soil to environment – Soil-water-air interaction – Activity, sensitivity, causes of sensitivity – Influence of exchangeable cations, pH and organic matter on properties of soils – Permeability of soils – Hydraulic conductivity of different types of soils – Darcy' s law and its validity – Factors affecting permeability

**UNIT- III**

Sources, types and composition of different wastes – Characteristics and classification of hazardous wastes – Generation rates – Potential problems in soils due to contaminants.
Ground water flow – Sources of ground water contamination – Contaminant transport – Pollution of aquifers by mining and liquid wastes – Ground water pollution downstream of landfills – Transport mechanisms.

**UNIT- IV**

CPCB rules and regulations on waste handling and management – Criteria for selection of sites for waste disposal – Disposal techniques -Disposal systems for typical wastes.

Ground modification and waste modification techniques in waste management – Ground modification – Mechanical modification, hydraulic modification, chemical modification.

**UNIT - V**

Liners and covers for waste disposal – rigid and flexible liners – Leachate and gas collection system – Engineered landfills (including basal liner and cover liner systems) – components – design criteria. Hydrological design for ground water pollution control.Soil contamination and remediation technology for both ground and aquifers.

**Text books :**

1. Mitchell J. “Fundamentals of soil behaviour”, John Wiley and Sons., Third Edition, 2005.

2. Robert M. Koerner, “Construction and Geotechnical methods in Foundation Engineering”, McGraw Hill Book Co., 1996.

3.Abdel M. O. Mohamed and Hogan E. Antia, “Developments in Geotechnical Engineering”, Elsevier, 1998.

**References :**

1. Hari D. Sharma and Krishna R. Reddy, “Geoenvironmental Engineering – Site Remediation, Waste Containment, Emerging waste management technologies”, John Wiley and sons, 2004.

2. Daniel D. E. “Geotechnical Practice for Waste Disposal”, Chapman and Hall. 1993.

3. Hsai Yang Fang and John Daniel, “Introduction to Environmental Geotechnology”, CRC press, Taylor and Francis, Second Edition, 2013

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20CE7T03 | **PORT AND HARBOUR ENGINEERING** | **3** | **0** | **0** | **3** |
| **Subject Category** : PEC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C413.1 | Understand wave prediction techniques | Understand |
| C413.2 | Acknowledge Concepts of port and marine terminal design | Apply |
| C413.3 | Understand Port and marine terminal layout | Understand |
| C413.4 | Understand Design procedures for breakwaters | Understand |
| C413.5 | Understand Marine and offshore construction equipment | Understand |

**UNIT– I**

Description and formulation of waves and tides in the ocean, Linear wave theory, wave generation, wave transformation; Shoaling, refraction, diffraction and reflection, wave prediction techniques, Long waves in irregular shaped basins or bays, harbor oscillations.

**UNIT – II**

Growth and regulation of ports. Various components of maritime systems, including shorefront and inlan infrastructure, Docks and Repair facilities, Concepts of port and marine terminal design, cargo handling equipment and intermidal transportation networks.

**UNIT – III**

Port and harbor layout for safe and efficient vessels navigation and cargo loading and unloading. Port buildings. Port and marine terminal layout, navigation channels and dredging, shore infrastructure and utilities, land reclamation , and environmental and economic considerations. Dredging; dredging equipment. Dredging for navigation improvement, pipelines and cables, soil replacement. Potential effects of dredging on environment, environmental factors.

**UNIT– IV**

Functional desing of the various components of ports and marine terminals, including steel, concrete, timber, and stone structures. Design procedures for breakwaters, bulkheads, wharves, dolphins, piers, fender and mooring systems and revetments.

**UNIT – V**

Marine and offshore construction equipment: Basic motions of swaway Barges, crane barges, Offshore derrick barges, semisubmersible barges, Jack-up construction barges, launch barges, pipe laying barges, floating concrete plant. Pile driving equipment.

**Reference Books / Text Books**

1. Port Engineering, by Per Bruun

2.Design and construction of Ports and Marine Structures, by A.D. Qinn, Mc Graw-Hill

3. PHRI (Port and Harbour Research Institute) Japan manual

# OE-3

# 0E-4

| **Programme**: **Civil Engineering** | | | | **Semester**: | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 20HSE7T01 | PRINCIPLES OF ECONOMICS & MANAGEMENT | **3** | **0** | **0** | **3** |
| **Subject Category** : HSMC | | | | | |

**Course Objectives:**

| COURSE CODE | COURSE OUTCOME | BLOOMS TAXONOMY |
|---|---|---|
| C416.1 | To adopts the Managerial Economic concepts for decision making and forward planning. | Apply |
| C416.2 | To assess the functional relationship between Production and factors of production.. | Analyse |
| C416.3 | To outline the different types of business organizations | Understand |
| C416.4 | To familiarize with the concepts of management. | Understand |
| C416.5 | To familiarize with the functions of management | Understand |

## UNIT-I

**INTRODUCTION TO MANAGERIAL ECONOMICS & DEMAND:**Definition, Nature and Scope of Managerial Economics.

**Demand Analysis**: Definition-types of demand - Demand Determinants, Law of Demand and

its exceptions.

**Elasticity of Demand:** Definition, Types, Significance of Elasticity of Demand. Demand Forecasting: definition, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

## UNIT-II

**THEORY OF PRODUCTION AND COST ANALYSIS**:

**Production Function** – Law of Variable Proportion, Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Laws of Returns.

**Cost Analysis**: Types of Cost, Break-even Analysis (BEA)- Determination of Break-Even Point (Simple numerical problems) - Managerial Significance and limitations of BEA.

## UNIT-III

**BUSINESS ENVIRONMENT:**Features of Business Organization, Sole Proprietorship, Partnership and Joint Stock Company, Steps for formation and Registration of the company.

Monetary Economics: Inflation, GDP, Per-capita Income.

## UNIT-IV

**Introduction to Management**: Concept –nature and importance of Management –Generic Functions of Management – Evolution of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization – Organizational typology- Leadership – styles.

## UNIT – V

**Functional Management**: Concept of HRM, HRD and PMIR- Functions of HR Manager – Job Evaluation and Merit Rating .

**Marketing Management**- Functions of Marketing – Marketing strategies based on product Life Cycle, Channels of distributions.

**TEXT BOOKS:**

**1.** A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

2. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.

**REFERENCE BOOKS**:

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & CompanyLtd,

2. Suma Damodaran: Managerial Economics, Oxford 20113. Koontz & Weihrich: 'Essentials of management' TMH 2011

4. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications

5. K. Aswatappa: 'Human Resource Management – text & cases', TMH.

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## DEPARTMENT OF MECHANICAL ENGINEERING

# COURSE STRUCTURE& SYLLABUS
**(Regulations – R20)**

**For B. Tech DEPARTMENT OF MECHANICAL ENGINEERING**
**(Applicable for Batches admitted from 2020-2021*)***

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Andhra Pradesh. INDIA

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(Approved by AICTE, New Delhi || Affiliated to JNTU, Kakinada|| Accredited by NAAC with 'A' Grade & NBA)

**Vinjanampadu, Guntur, Andhra Pradesh. INDIA -522 017.**

**(AUTONOMOUS) R20**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**SEMESTER-I**

| S.No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 20SH1T05 | Engineering chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH1T06 | Differential Equations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS1T01 | Problem Solving and Programming Using C | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME1T01 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | 20EE1T02 | Basics of Elec.and Elec. EngG. | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20SH1L01 | Engineering Chemistry Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CS1L01 | Problem Solving and Programming Using C Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS1L02 | IT Workshop | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | | | | **Total** | **19.5** | **195** | **455** | **650** |

**SEMESTER-II**

| S.No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 20SH2T01 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH2T03 | Engineering Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20SH2T07 | Linear Algebra and Vector Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME2W01 | Engineering Workshop | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | 20ME2T03 | Engineering Mechanics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20SH2L01 | Communicative EnglishSkills Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20SH2L03 | Engineering Physics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CE2L01 | Computer AidedDrawing Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20GE2M01 | Environmental Science | 2 | 0 | 0 | 0 | _ | _ | _ |
| | | | | | **Total** | **19.5** | **195** | **485** | **650** |

## SEMESTER-III

| S.No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 20SH3T03 | Numerical Methods and Laplace Transformations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20ME3T01 | Mechanics of Solids | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20ME3T02 | Material Science & Metallurgy | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME3T03 | Manufacturing Processes | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20ME3T04 | Thermodynamics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20ME3L01 | Solid Mechanics and Metallurgy Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20ME3L02 | Manufacturing Processes Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20ME3L03 | Computer Aided MachineDrawing | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20ME3S01 | Skill Oriented Course **(**Welding Certification Course) | 1 | 0 | 2 | 2 | – | 50 | 50 |
| 10 | 20GE3M03 | Essence of Indian Traditional Knowledge | 2 | 0 | 0 | 0 | – | – | – |
| | | **Total** | | | | **21.5** | **195** | **505** | **700** |

## IV SEMESTER

| S.No | CourseCode | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 20ME4T01 | Manufacturing Technology | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20ME4T02 | Applied Thermodynamics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20ME4T03 | Kinematics of Machinery | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME4T04 | Fluid Mechanics & Hydraulic Machines | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20SH40T1 | Managerial Economics And Financial Accountancy | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20ME4L01 | Thermal Engineering Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20ME4L02 | Machine Tools Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20ME4L03 | Fluid Mechanics & Hydraulic Machines Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20ME4S01 | Skill Oriented Course (Certification Course on Modeling) | 1 | 0 | 2 | 2 | – | 50 | 50 |
| | **Total** | | | | | **21.5** | **195** | **505** | **700** |

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**DEPARTMENT OF MECHANICAL ENGINEERING**

**SEMESTER-V**

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20ME5T01 | Dynamics of Machinery | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20ME5T02 | Design of Machine Members-I | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20ME5T03 | Instrumentation and Engineering Metrology | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME5E01 -- 20ME5E04 | **Professional Elective-I**<br>1. IC Engines & Gas Turbines<br>2. Unconventional Machining Process<br>3. Industrial Robotics<br>4. Automobile Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20EE5O05 | **Open Elective-I**<br>1. Computer Graphics<br>2. Industrial Management<br>3. MEMS<br>4. Database Management Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE5M01 | **Mandatory Course**<br>Environmental Sciences | 2 | 0 | 0 | 0 | -- | -- | -- |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20ME5L01 | Theory of Machines Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20ME5L02 | Instrumentation and Metrology Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20ME5S01 | **Skill Oriented Course-III**<br>(Certificate Course on 3D Printing) | 1 | 0 | 2 | 2.0 | -- | 50 | 50 |
| 9 | ---- | Summer Internship 2 months (Mandatory) during summer vacation. | 0 | 0 | 0 | 1.5 | | | |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |

**Category Summary**

| Category | CREDITS |
|---|---|
| Professional Core courses | **12** |
| Professional Elective courses | **3** |
| Open Elective courses | **3** |
| **S**kill Oriented Course | **2** |
| Summer Internship | **1.5** |
| **TOTAL CREDITS** | **21.5** |

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**DEPARTMENT OF MECHANICAL ENGINEERING**

## SEMESTER - VI

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20ME6T01 | Design of Machine Members-II | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20ME6T02 | Heat Transfer | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20ME6T03 | Operations Research | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME6E01 -- 20ME6E04 | **Professional Elective- II**<br>1. Additive Manufacturing<br>2. Flexible Manufacturing Systems<br>3. Power Plant Engineering<br>4. CAD/CAM | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | **20EE6O02** | **Open Elective- II**<br>1. Renewable Energy Sources<br>2. Python Programming<br>3. Logistics and supply chain management<br>4. Mechatronics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20ME6L01 | Heat Transfer Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20ME6L02 | Simulation Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20ME6L03 | Computer Aided Production Drawing Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20ME6S01 | **Skill Oriented Course**<br>(Certificate course on Robot Programming ) | 1 | 0 | 2 | 2.0 | -- | 50 | 50 |
| 10 | 20GE6M04 | Intellectual Property Rights | 2 | 0 | 0 | 0 | | | |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |

**Category Summary**

| Category | CREDITS |
|---|---|
| Professional Core courses | **13.5** |
| Professional Elective courses | **3** |
| Open Elective courses | **3** |
| **S**kill Oriented Course | **2** |
| **TOTAL CREDITS** | **21.5** |

**SEMESTER-VII**

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | ---- | **Humanities and Social Science**<br>1.Management Science<br>2.Entrepreneurship Development<br>3.Digital Marketing<br>4.Human Resource Development & Organization Behaviour | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20ME7E01<br>--<br>20ME7E04 | **Professional Elective course**<br>1.Finite Element Methods<br>2.Advanced Materials<br>3.Non- Destructive Evaluation<br>4.Reliability Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20ME7E05<br>--<br>20ME7E08 | **Professional Elective course**<br>1.Mechanical Vibrations<br>2.Refrigeration and Air Conditioning<br>3.Welding Technology<br>4.Production Planning Control | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME7E09<br>--<br>20ME7E12 | **Professional Elective courses**<br>1.Automation in Manufacturing<br>2.Tribology<br>3.Material Handling Systems and Equipment<br>4.Total Quality Management | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20ME7ET0 | **Open Elective courses**<br>1.Elements of Civil Engineering<br>2.Principles of Software Engineering<br>3.Business Environment<br>4.Project Management | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20ME7OT0 | **Open Elective courses**<br>1. Fundamentals of Artificial Intelligence<br>2.Principles of Communication<br>3.Disaster Management<br>4.Electrical & Hybrid Vehicles | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 7 | 20ME7S01 | Skill Oriented Course( Certification course on NDT Techniques) | 1 | 0 | 2 | 2 | -- | 50 | 50 |
| 9 | 20ME7P01 | Summer Internship 2 months (Mandatory) during summer vacation | 0 | 0 | 0 | 3 | -- | 50 | 50 |
| **Total Credits** | | | | | | **23** | **180** | **520** | **700** |

| Category | CREDITS |
|---|---|
| Humanities and Social Science | **3** |
| Professional Elective courses | **9** |
| Open Elective courses | **6** |
| Skill Oriented Course | **2** |
| Summer Internship | **3** |
| **TOTAL CREDITS** | **23** |

**VIII SEMESTER**

| S. No. | CourseCode | Course Title | Hours / week | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | PROJ (20ME8P01) | Major Project: Project work, Seminar & Internship in Industry | 0 | 0 | 0 | 12 |
| | | **Total Credits** | | | | 12 |

| Category | CREDITS |
|---|---|
| Basic Science Course | **18** |
| Engineering Science Course | **24** |
| Humanities and Social Science | **10.5** |
| Professional core courses | **54** |
| Professional Elective courses | **15** |
| Open Elective courses | **12** |
| Skill Oriented Course | **10** |
| Summer Internships and Projects | **16.5** |
| **TOTAL CREDITS** | **160** |

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester : V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5T01 | **Dynamics of Machinery** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Core Course | | | | | |

**Course Objectives:**

To equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations

**Course outcomes:**

Upon successful completion of this course the student should be able to:
CO1. Compute frictional losses, torque transmission of mechanical systems.
CO2. Analyze dynamic force analysis of slider crank mechanism and design of flywheel.
CO3. Analyze stabilization of sea vehicles, aircrafts and automobile vehicles
CO4: Understand balancing of reciprocating and rotary masses
CO5. Understand how to determine the natural frequencies of continuous systems starting from the general equation of displacement.

## COURSE SYLLABUS

**UNIT – I**

**Bearings and Clutches**: Pivot and collar bearings, uniform pressure, uniform wear conditions, Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

**Brakes and Dynamometers**: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission,

**UNIT – II**

**Dynamic Force Analysis**: Introduction, D'Alembert's Principle, Equivalent Offset Inertia Force, Dynamic Analysis of Slider – Crank mechanism (Using Analytical method) Velocity and Acceleration of piston, Angular velocity and Angular Acceleration of Connecting Rod, Piston Effort

**Turning moment diagrams**: Turning moment diagrams – fluctuation of energy – fly wheels and their design

**UNIT –III**

**Governors**: Introduction, Types of Governors, Watt Governor, Porter Governor, Hartnell Governor, Sensitiveness of a Governor, Hunting, Isochronisms, Stability, Controlling force, Power of a Governor.

**Precession:** Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms.

**UNIT-IV**

**Balancing**: Introduction, Static balancing, Dynamic balancing, Transferring of a Force from one plane to another, Balancing of Several Masses in Different planes.

Primary & Secondary Balancing of Reciprocating Mass, Balancing of In line Engines and V Engines

**UNIT – V**

**Damped Free Vibrations of Single Degree of Freedom Systems**:-Introduction, Different types of damping, Free vibrations with viscous damping, Logarithmic Decrement, Viscous dampers, Coulomb damping.

**Forced Vibrations of Single Degree of Freedom Systems**:-Introduction, Forced vibrations with constant Harmonic excitation, Forced vibration with rotating and reciprocating unbalance, forced vibrations due to excitation of the support, Vibration, isolation and transmissibility.

**Text Books :**

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill
2. Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

**References :**

1. Theory of Machines / Shigley / MGH
2. Theory of Machines / Thomas Bevan / CBS Publishers
3. Theory of machines / Khurmi/S.Chand.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5T02 | **Design of Machine Members-I** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Core Course | | | | | |

**UNIT-I :**

**INTRODUCTION:** General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design, tolerances and fits –BIS codes of steels.

**STRESSES IN MACHINE MEMBERS:** Simple stresses – combined stresses – torsional and bending stresses – impact stresses – stress strain relation – various theories of failure – factor of safety – design for strength and rigidity – preferred numbers. the concept of stiffness in tension, bending, torsion and combined situations – static strength design based on fracture toughness.

**UNIT – II**

**STRENGTH OF MACHINE ELEMENTS:** Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor notch sensitivity – design for fluctuating stresses – endurance limit – estimation of endurance strength – Goodman's line – Soderberg's line – modified Goodman's line.

**UNIT – III**

**RIVETED AND WELDED JOINTS** – Design of joints with initial stresses – eccentric loading.
**BOLTED JOINTS** –Design of bolts with pre-stresses – design of joints under eccentric loading – locking devices – both of uniform strength, different seals.

**UNIT – IV**

**KEYS, COTTERS AND KNUCKLE JOINTS:** Design of keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints- knuckle joints.
**SHAFT COUPLING:** Rigid couplings – muff, split muff and flange couplings, flexible couplings – flange coupling (modified).

**UNIT – V**

**MECHANICAL SPRINGS:**

*Stresses and deflections of helical springs – extension -compression springs – springs for fatigue loading, energy storage capacity – helical torsion springs – co-axial springs, leaf springs.*

Note: Design data book is NOT Permitted for examinationText Books:

1. Machine Design/V.Bandari/ TMH Publishers
2. Machine design / NC Pandya & CS Shah/Charotar Publishing House Pvt. Limited

**References:**

1. Design of Machine Elements / V.M. Faires/McMillan
2. Machine design / Schaum Series/McGrawHill Professional
3. Machine Design/ Shigley, J.E/McGraw Hill.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5T03 | **Instrumentation and Engineering Metrology** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Core Course | | | | | |

**UNIT-I**

Definition – Basic principles of measurement – measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. dynamic performance characteristics – sources of error, classification and elimination of error.

**Measurement of Displacement:** Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.

**UNIT-II**

**MEASUREMENT OF TEMPERATURE:** Classification – ranges – various principles of measurement – expansion, electrical resistance – thermister – thermocouple – pyrometers – temperature indicators.

**MEASUREMENT OF PRESSURE:** Units – classification – different principles used. manometers, piston, bourdon pressure gauges, bellows – diaphragm gauges. low pressure measurement – thermal conductivity gauges

**UNIT-III**

**SYSTEMS OF LIMITS AND FITS:** Introduction, nominal size, tolerance, limits, deviations, fits -Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, determistic & statistical tolerances, selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning

**UNIT – IV**

**SURFACE ROUGHNESS MEASUREMENT:** Differences between surface roughness and surface waviness – Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, Method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish

**UNIT – V**

**LIMIT GAUGES:**

Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

**OPTICAL MEASURING INSTRUMENTS:** Tools maker's microscope and uses - autocollimators, optical projector, optical flats and their uses.

**Text Books:**

1. Engineering Metrology / R.K.Jain / Khanna Publishers
2. Measurement Systems: Applications & design / D.S Kumar/

**References:**

1. Engineering Metrology / Mahajan / Dhanpat Rai Publishers
2. Engineering Metrology and Measurements / NV Raghavendra, L Krishna murthy/ Oxford publishers.
3. Measurement systems: Application and design/Doeblin Earnest. O. Adaptation/ TMH

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5E01 | **IC ENGINES & GAS TURBINES** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT – I**

**Air standard Cycles:** otto, diesel and dual cycles, its comparison, Brayton cycle

**Actual Cycles and their Analysis**: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

**UNIT – II**

**I. C. ENGINES** : Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems – Fuel, Carburettor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of supercharging and turbo charging.

**UNIT – III**

**Combustion in S.I. Engines** : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables ,combustion chamber – requirements, types.

**Combustion in C.I. Engines** : Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock–open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

**UNIT – IV**

**Measurement, Testing and Performance**: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

**GAS TURBINES**: Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –closed cycle type gas turbines.

**UNIT –V**

**JET PROPULSION** : Principle of operation –classification of jet propulsive engines – working principles with schematic diagrams and representation on t-s diagram - thrust, thrust power and propulsion efficiency – turbo jet engines

**ROCKETS**: Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines (only Theoretical concepts).

**TEXT BOOKS**:

1. I.C. Engines - V.Ganesan - T.M.H., New Delhi, 3rd Edition
2. Thermal Engineering -Rajput, Laxmi Publ, New Delhi , 2012.

**REFERENCE BOOKS:**

1.Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, New Delhi, 4th Edition
2.. Fundamentals of I.C.Engines - H.N. Gupta, PHI, New Delhi, 2009
3.. Gas Turbine Theory - Cohen, Rogers and Sarvanamuttu, 5th Edition.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5E02 | **UNCONVENTIONAL MACHINING PROCESSES** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT – I**

**INTRODUCTION:** Need for non-traditional machining methods-classification of modern machining processes – considerations in process selection, applications.

**Ultrasonic machining** – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

**UNIT – II**

**ELECTRO – CHEMICAL MACHINING:** Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate, fundamentals of chemical, machining, advantages and applications.

**UNIT - III**

**THERMAL METAL REMOVAL PROCESSES:** General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface

**UNIT – VI**

Electron Beam Machining, Laser Beam Machining - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications

**Plasma Machining:** Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

**UNIT-V**

Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations, Magnetic abrasive finishing, Abrasive flow finishing, Electrostream drilling, shaped tube electrolytic machining.

**Text Books:**

1. Fundamentals of Machining Processes-Conventional and non – conventional processes / Hassan Abdel – Gawad El-Hafy/CRC Press-2016.
2. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.

**References:**

1. New Technology / Bhattacharya A/ the Institution of Engineers, India 1984.
2. Non Traditional Manufacturing Processes / Benedict

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5E03 | **Industrial Robotics** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT-I**

**INTRODUCTION**: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.
**COMPONENTS OF THE INDUSTRIAL ROBOTICS**: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices

**UNIT – II**

**MOTION ANALYSIS**: Homogeneous transformations as applicable to rotation and translation – problems.
**MANIPULATOR KINEMATICS**: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

**UNIT – III**
Differential transformation and manipulators, Jacobians – problems.
Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

**UNIT – IV**
General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

**UNIT V:**
**ROBOT ACTUATORS AND FEED BACK COMPONENTS**: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

**ROBOT APPLICATIONS IN MANUFACTURING**: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

**Text Books:**
1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K &Nagrath I J / TMH.

**References:**
1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5E04 | **AUTOMOBILE ENGINEERING** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT – I**

**INTRODUCTION:** Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

**UNIT – II**

**TRANSMISSION SYSTEM:** Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

**UNIT – III**

**STEERING SYSTEM:** Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears types, steering linkages.

**UNIT – IV**

**SUSPENSION SYSTEM:** Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

**BRAKING SYSTEM:** Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

**UNIT – V**

**ELECTRICAL SYSTEM**: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

**ENGINE SPECIFICATION AND SAFETY SYSTEMS:** Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc.

**Safety:** Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, mirrors, central locking and electric windows, speed control.

**TEXT BOOKS:**

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering / William Crouse/TMH Distributors

**REFERENCES:**

1. Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr.,/ Pearson education inc.
2. Automotive Engineering / K Newton, W.Steeds & TK Garrett/SAE
3. Automotive Mechanics : Principles and Practices/ Joseph Heitner /Van Nostrand Reinhold

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5L01 | **Theory of Machines Lab** | 0 | 0 | 3 | 1.5 |
| Subject Category : Professional Lab Course | | | | | |

**List of Experiments**

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel
8. To plot follower displacement vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage , velocity ratio and efficiency
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME5L01 | ***INSTRUMENTATION & METROLOGY LAB*** | 0 | 0 | 3 | 1.5 |
| Subject Category : Professional Lab Course | | | | | |

**Note:** The students have to conduct at least 6 experiments from each lab

***INSTRUMENTATION LAB***

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

***METROLOGY LAB***

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micro meter for checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on drilling machine.
6. Machine tool alignment test on milling machine.
7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Thread inspection with two wire/ three wire method & tool makers microscope.
10. Surface roughness measurement with roughness measuring instrument.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6T01 | **DESIGN OF MACHINE MEMBERS– II** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Core Course | | | | | |

**UNIT – I**

**BEARINGS:** Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

**UNIT – II**

**ENGINE PARTS:** Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners,

**UNIT – III**

**DESIGN OF CURVED BEAMS**: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c – clamps**.**

**POWER TRANSMISSIONS SYSTEMS, PULLEYS**: Transmission of power by belt and rope drives , transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives

**UNIT – IV**

**DESIGN OF POWER SCREWS:** Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

**SPUR & HELICAL GEAR DRIVES:** Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

**UNIT – V**

**MACHINE TOOL ELEMENTS:** Levers and brackets: design of levers – hand levers-foot lever – cranked lever of a lever loaded safety valve- rocker arm straight – angular- design of a crank pin – brackets- hangers- wall boxes.

Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums.

***Note: Design data book is permitted for examination***

**TEXT BOOKS:**

1. Machine Design/V.Bandari/TMH Publishers
2. Machine Design/ NC Pandya & CS Shaw/ Charotar publishers
3. Design data book Md.Jallaluddhin, Anuradha Publications

**REFERENCES:**

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education
3. Design of machine elements- spots/Pearson Publications

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6T02 | **HEAT TRANSFER** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Core Course | | | | | |

**UNIT I**

**Introduction**: Basic Modes of heat transfer- Conduction, Convection and Radiation definitions, their mechanisms and their governing laws-Steady state Heat Conduction- General conduction equation in Cartesian and Cylindrical coordinates Initial and Boundary conditions One-Dimensional Steady State Heat Conduction: Heat flow through plane wall and cylinder with constant thermal conductivity, Heat flow through composite slab and Cylinders, Thermal resistance, Electrical analogy, critical insulation thickness, uniform heat generation in slabs.

**UNIT II**

**Extended Surfaces**: Types, Applications, Fin materials, Heat transfer from fins with uniform cross section, Fin efficiency and Effectiveness. Transient Heat Conduction: (One dimensional only) - Lumped heat capacity systems –plane wall, cylinder and sphere

**UNIT III**

**Forced Convection**: External Flows: Introduction, Principles of convection Hydrodynamic and thermal boundary layers and their thicknesses, concept of turbulence. Correlations for heat transfer in Laminar and Turbulent flows over a flat plate relation between fluid friction and heat transfer in laminar flows – Reynolds Colburn Analogy.

**UNIT IV**

**Natural Convection**: Mechanism of natural convection, Velocity and Temperature profiles over a vertical heated plate, Correlations for vertical plates, horizontal plates, vertical and horizontal cylinders –Problems. Heat Exchangers: Classification, types of heat exchangers, Flow arrangement, Temperature distribution, Overall heat transfer coefficient, Fouling factor, LMTD and NTU methods of Heat exchanger analysis, correction for LMTD for use with multi pass and cross flow Heat Exchangers, Effectiveness.

**UNIT V**

**Radiation:** Basic Concepts and definitions, Absorptivity, Reflectivity, Transmissivity, Concept of Black body, Intensity of radiation and Solid angle, Lambers Cosine law, Laws of Radiation- Planck's distribution law, Wein's displacement law, Stefan Boltzmann's law, Radiation from non black surface-emissivity, Kirchoff's law. Radiant Heat Transfer: Radiative heat exchange between Black surfaces –Radiation shape factor, Radiation heat exchange between Gray bodies

**TEXT BOOKS:**

1. Heat Transfer - Cengel and Boles, TMH, New Delhi , 2008.
2. Heat Transfer-Rajput, Laxmi Publ, New Delhi,2011.

**REFERENCE BOOKS:**

1. Heat transfer - J.P.Holman, MGH, New York , 6th Edition.
2. Heat transfer - S.P.Sukhatme, TMH ,2009.
3.. Heat and Mass Transfer - Sachdeva, New Age India, New Delhi, 2009.

NOTE: Heat and Mass Transfer Data Book by Kothandaraman and Subramanian to be allowed in Semester Examination.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6T03 | **OPERATIONS RESEARCH** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Core Course | | | | | |

**UNIT – I**

Development – definition– characteristics and phases – operation research models – applications. **LINEAR PROGRAMMING**: problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

**UNIT – II**

**TRANSPORTATION PROBLEM:** Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.

**SEQUENCING** – Introduction – flow **–**shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm' machines.

**UNIT – III**

**REPLACEMENT:** Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

**UNIT – IV**

**THEORY OF GAMES:** Introduction to decision theory – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

**WAITING LINES:** Introduction to Kendallis notation–classification of queuing models, single channel – with infinite population and finite population models– multichannel – with infinite population.

**UNIT – V**

**Network Analysis:** Project planning, scheduling and controlling – tools for project management – critical path method – programme evaluation and review technique (PERT) – cost analysis and crashing – resource leveling – updating.

**TEXT BOOKS:**

1. Operations Research-An Introduction/Hamdy A Taha/Pearson publishers

2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

**REFERENCES:**

1. Introduction to O.R/Hiller & Libermann/TMH

2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.

3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman/Wiley

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6E01 | **ADDITIVE MANUFACTURING** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT – I**

**INTRODUCTION**: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

**LIQUID-BASED RAPID PROTOTYPING SYSTEMS**: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

**UNIT-II**

**SOLID-BASED RAPID PROTOTYPING SYSTEMS**: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modelling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

**POWDER BASED RAPID PROTOTYPING SYSTEMS**: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

**UNIT – III**

**RAPID TOOLING**: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

**UNIT-IV**

**RAPID PROTOTYPING DATA FORMATS**: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, Newly Proposed Formats.

**RAPID PROTOTYPING SOFTWARE'S**: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

**UNIT – V**

**RP APPLICATIONS**: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices, forensic science and anthropology, visualization of bimolecular.

**TEXT BOOKS:**

1. Rapid prototyping: Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific publications
2. Rapid Manufacturing / D.T. Pham and S.S. Dimov/Springer

**REFERENCES:**

1. Wohlers Report 2000 /Terry T Wohlers/Wohlers Associates
2. Rapid Prototyping & Manufacturing / Paul F.Jacobs/ASME Press
3. Rapid Prototyping / Chua &Liou

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6E02 | **FLEXIBLE MANUFACTURING SYSTEMS** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT-I**

Types of production, production planning and control, manufacturing in a competitive environment, concept, automation of manufacturing process , numerical control, adaptive control, material handling and movement, industrial robots, flexible fixturing, design for assembly, disassembly and service. types of FMS, types of FMS layouts, advantages and disadvantages of FMS Group technology – composite part families - classification and coding - production flow analysis,

**UNIT-II**

Planning issues: components of FMS, types of flexibility, tradeoffs, computer control and functions, planning, scheduling and control of FMS, scheduling and knowledge-based scheduling. Hierarchy of computer control, supervisory computer, introduction to turning center, machining center, cleaning and deburring equipment, coordinate measuring machines: types, working and capabilities.

**UNIT-III**

System support equipment, types, working capability, automated material movement and automated storage and retrieval systems, scheduling of AGVs, cutting tools and tool management, work holding considerations

**UNIT-IV**

FMS computer hardware and software, general structure and requirements, PLCs, FMS installation and implementation, acceptance testing

**UNIT-V**

Characteristics of JIT pull method, small lot sizes, work station loads, flexible work force, line flow strategy. supply chain management Preventive maintenance - Kanban system, value engineering, MRD JIT, lean manufacture, quality concepts and management

**TEXT BOOK:**

1. Shivanand H.K., Benal MM, Koti V, "Flexible Manufacturing System", New age international (P) Limited, New Delhi, 2006

**REFERENCES:**

1. Mikell P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", PHI, 2008.
2. Kalpakjin, "Manufacturing Engineering and Technology ", Addison Wesley Publishing Co., 1995

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6E03 | **POWER PLANT ENGINEERING** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT – I**

Introduction to the sources of energy – resources and development of power in india.

**STEAM POWER PLANT:** Plant layout, working of different circuits, fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems. Combustion: properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, dust collectors, cooling towers and heat rejection. corrosion and feed water treatment.

**UNIT – II**

**INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:**

**DIESEL POWER PLANT:** Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.

**GAS TURBINE PLANT:** Introduction – classification - construction – layout with auxiliaries, combined cycle power plants and comparison.

**UNIT – III**

**HYDRO ELECTRIC POWER PLANT:** Water power – hydrological cycle / flow measurement – drainage area characteristics – hydrographs – storage and pondage – classification of dams and spill ways.

**HYDRO PROJECTS AND PLANT:** Classification – typical layouts – plant auxiliaries – plant operation pumped storage plants.

**UNIT – IV**

**NUCLEAR POWER STATION:** Nuclear fuel – breeding and fertile materials – nuclear reactor – reactor operation.

**TYPES OF REACTORS:** Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding – radioactive waste disposal.

**UNIT – V**

**COMBINED OPERATIONS OF DIFFERENT POWER PLANTS:** Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant,run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro-electric and gas turbine stations, co-ordination of hydro-electric and nuclear power stations, co-ordination of different types of power plants.

**POWER PLANT INSTRUMENTATION AND CONTROL:**

Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis, O2 and CO2 measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

**TEXT BOOKS:**

1. A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai & Co.
2. Power Plant Engineering /P.C.Sharma / S.K.Kataria Pub

**REFERENCES:**

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power station Engineering – ElWakil / McGrawHill.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6E04 | **CAD/CAM** | 3 | 0 | 0 | 3 |
| Subject Category : Professional Elective Course | | | | | |

**UNIT – I**

Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

**COMPUTER GRAPHICS**: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

**UNIT – II**

**GEOMETRIC MODELING**: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

**DRAFTING AND MODELING SYSTEMS**: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modelling.

**UNIT – III**

**PART PROGRAMMING FOR NC MACHINES**: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

**UNIT – IV**

**GROUP TECHNOLOGY**: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types. FMS-Introduction, Equipment, Tool management systems, Layouts, FMS Control

**COMPUTER AIDED QUALITY CONTROL**: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

**UNIT – V**

**COMPUTER INTEGRATED MANUFACTURING SYSTEMS**: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

**TEXT BOOKS:**

1. CAD / CAM Principles and Applications/PN Rao / McGraw-Hill
2. Automation, Production systems & Computer integrated Manufacturing/ M.P. Groover/Pearson Education

**REFERENCES:**

1. Mastering CAD / CAM / Ibrahim Zeid / McGraw-Hill
2. Principles of Computer Aided Design and Manufacturing / FaridAmirouche / Pearson
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6L01 | **HEAT TRANSFER LAB** | 0 | 0 | 3 | 1.5 |
| Subject Category : Professional Core Lab Course | | | | | |

***Note: The students have to perform minimum 10 Experiments***.

1. COP of VCR System with Capillary and thermal expansion valve.
2. Determination of overall heat transfer co-efficient of a composite slab
3. Determination of heat transfer rate through a lagged pipe.
4. Determination of heat transfer rate through a concentric sphere
5. Determination of thermal conductivity of a metal rod.
6. Determination of efficiency of a pin-fin
7. Determination of heat transfer coefficient in natural and forced convection
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzman constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Determination of Thermal conductivity of liquids and gases.
14. Investigation of Lambert's cosine law.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6L02 | **SIMULATION LAB** | 0 | 0 | 3 | 1.5 |
| Subject Category : Professional Core Lab Course | | | | | |

## LIST OF EXPERIMENTS

1. Determination of deflection and stresses in 2D and 3D trusses and beams.
2. Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain components.
3. Determination of deflections component and principal and Von-mises stresses Axisymmetric components
4. Determination of stresses in 3D and shell structures (at least one example in each case)
5. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
6. Steady state heat transfer Analysis of plane and Axisymmetric components.
7. Convective heat transfer – Internal flow (study both velocity and thermal boundary layers)
8. Convective heat transfer – External flow (study both velocity and thermal boundary layers)
9. To get familiarize with MATLAB Programming
10. To do simple exercises on Numerical methods
11. Spring mass system using simulink

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VI | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME6L03 | **COMPUTER AIDED PRODUCTION DRAWING LAB** | 0 | 0 | 3 | 1.5 |
| Subject Category : Professional Core Lab Course | | | | | |

LIST OF EXPERIMENTS

1. INTRODUCTION TO PRODUCTION DRAWING CONCEPTS

**Preparation of part drawing, bill of materials, tolerance details and process chart for the given assembled parts**

2. BUSH BEARING
3. STUFFING BOX
4. FOOT STEP BEARING
5. UNIVERSAL COUPLING
6. STEAM ENGINE CROSS HEAD
7. STEAM ENGINE CONNECTING ROD END
8. BLOW-OFF COCK

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ME7E01 | **FINITE ELEMENT METHODS** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT-I**

**Introduction to finite element method**, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

**UNIT – II**

**Analysis of Trusses**: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations.

**Analysis of Beams:** Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

**UNIT – III**

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

**UNIT-IV**

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

**UNIT – V**

**Steady state heat transfer analysis** : one dimensional analysis of a fin and two dimensional analysis of thin plate

**Dynamic Analysis:** Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

**Text Books:**


1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Introduction to Finite Elements in Engineering/ Tirupathi R. Chandrupatla, Ashok D. Belegundu, Pearson Publishers.


**References:**


1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah/Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGraw Hill
3. The Finite Element Method for Engineers – Kenneth H. Huebner. John Wiley & sons (ASIA) Pte Ltd.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E02 | **ADVANCED MATERIALS** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT-I**

**INTRODUCTION TO COMPOSITE MATERIALS**: Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber- reinforced composites and nature-made composites, and applications
**REINFORCEMENTS:** Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and born carbide fibres.

**UNIT-II**
Polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications.
**MANUFACTURING METHODS:** Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM.

**UNIT-III**
**MACROMECHANICAL ANALYSIS OF A LAMINA**: Introduction, generalized Hooke's law, reduction of Hooke's law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

**UNIT-IV**
**FUNCTIONALLY GRADED MATERIALS**: Types of functionally graded materials-classification different systems-preparation-properties and applications of functionally graded materials.

**SHAPE MEMORY ALLOYS:** Introduction-shape memory effect-classification of shape memory alloys-composition-properties and applications of shape memory alloys.

**UNIT-V**

**NANO MATERIALS:** Introduction-properties at nano scales-advantages & disadvantages applications in comparison with bulk materials (nano – structure, wires, tubes, composites). State of art nano advanced- topic delivered by student.

**Text Books:**
1. Nano material /A.K. Bandyopadyay/New age Publishers
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH

**References:**
1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York.
2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E03 | **NON - DESTRUCTIVE EVALUATION** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT – I**

**Introduction to non-destructive testing**: Visual Inspection. Radiography: Sources of ray-x-ray production - properties of d and x rays - film characteristics - exposure charts - contrasts – operational characteristics of x ray equipment - applications.

**UNIT – II**

**Ultrasonic test:** Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect .Production of ultrasonic waves - different types of waves - general characteristics of waves - pulse echo method –A, B, C scans - Principles of acoustic emission techniques – Advantages and limitations - Instrumentation - applications. Ultrasonic Transducers and their Characteristics.

**UNIT – III**

**Liquid Penetrant Test:** Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing, Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing

**UNIT – IV**

**Magnetic Particle Test:** Magnetic Materials, Magnetization of Materials , Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

**UNIT – V**

**Industrial Applications of NDE:** Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

**TEXT BOOKS:**

1. Non-Destructive Examination and Quality Control, ASM International, Vol.17, 9th edition.
2. J.Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGraw-Hill Education, 2nd edition (2011).

**REFERENCES:**

1. Ultrasonic inspection training for NDT/ E. A. Gingel/Prometheus Press,
2. Non-destructive, Hand Book – R. Hamchand

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| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E04 | **RELIABILITY ENGINEERING** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**Unit I : Concepts of Reliability**

Definition of Reliability – Reliability Vs Quality-Reliability Function-MTTF – Hazard Rate Function-Bathtub Curve – Derivation Of The Reliability Function-Constant Failure Rate Model – Time Dependent Failure Models. Weibull Distribution – Normal Distribution – The Lognormal Distribution.

**Unit II: System and Models**

Serial Configuration – Parallel Configuration – Combined Series Parallel Systems – System Structure Function, Minimal Cuts And Minimal Paths – Markov Analysis – Load Sharing Systems, Standby System, Degraded Systems, Three State Devices – Covariate Models, Static Models, Dynamic Models, Physics Of Failure Models.

**Unit : III Design for Reliability**

Reliability Design Process – System Effectiveness – Economic Analysis And Life Cycle Cost – Reliability Allocation – Optimal, Arinc, Agree, – Design Methods – Parts And Material Selection, Derating, Stress- Strength Analysis – Failure Analysis – Identification Of Failure Mode – Determination Of Causes –Assessment Of Effects – Classification Of Seventy – Computation Of Critically Index –Corrective Action – System Safety And Fta.

**Unit-IV: Maintainability**

Analysis Of Downtime – The Repair Time Distribution – Stochastic Point Processes – System Repair Time – Reliability Under Preventive Maintenance – State Dependent Systems With Repair – Mttr-Mean System Downtime – Mtr – Mh/Oh – Cost Model – Fault Isolation And Self Diagnostics – Repair Vs Replacement – Replacement Model – Proactive, Preventive, Predictive Maintenance – Maintenance And Spares Provisioning – Maintainability Prediction And Demonstration – Concepts And Definition Of Availability.

**Unit-V : Optimization Of System Reliability**

Optimization Techniques For System Reliability With Redundancy – Heuristic Methods Applied To Optimal System Reliability- Redundancy Allocation By Dynamic Programming – Reliability Optimization By Non Linear Programming.

**Text Books:**


1. Charles E. Ebling, "An Introduction To Reliability And Maintainability Engg", Tata Mcgraw- Hill, 2000.
2. D T O'connor, "Practical Reliability Engineringt", John-Wiley And Sons Inc, 2002.


**References:**


1. Patrick □David J Smith, "Reliability, Maintainability And Risk: Practical Methods For Engineers",Butterworth, 2002
2. Srinath I.S, Engineering Design And Reliability, Iste, 1999.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E05 | **MECHANICAL VIBRATIONS** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**Unit I**

**Single degree of Freedom systems:** Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation, Vibration isolation and transmissibility,.

**Unit II**

Vibration Measurement: Vibrometers, velocity meters & accelerometers

**Two degree of freedom systems:** Principal modes – undamped and damped free and forced vibrations; undamped vibration absorbers.

**UNIT-III**

**Multi degree of freedom systems:** Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

**Unit IV**

**Numerical Methods:** Rayleigh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

**Unit V**

**Application of concepts:** Free vibration of strings – longitudinal oscillations of bars-transverse vibrations of beams- Torsional vibrations of shafts. Critical speeds without and with damping, secondary critical speed

**TEXT BOOKS:**

1. Elements of Vibration Analysis by Meirovitch.
2. Mechanical Vibrations by G.K. Groover.

**REFERENCES:**

1. Vibrations by W.T. Thomson
2. Mechanical Vibrations – Schaum series.
3. Vibration problems in Engineering by S.P. Timoshenko.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E06 | **REFRIGERATION AND AIR CONDITIONING** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT – I:**

**Introduction to Refrigeration: -** Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycle of refrigeration.

Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Aircrafts- Air systems – Actual Air refrigeration system – Refrigeration needs of Aircrafts – Application of Air Refrigeration, Justification – Types of systems – Problems.

**UNIT – II:**

Vapour compression refrigeration – working principle and essential components of the plant – Simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – Problems

**UNIT III:**

**System Components:** Compressors – General classification – comparison – Advantages and Disadvantages. Condensers – classification – Working Principles, Evaporators – classification – Working Principles. Expansion devices – Types – Working Principles,

**Refrigerants:** Desirable properties – common refrigerants used – Nomenclature – Ozone Depletion – Global Warming – Azeotropes and Zeotropes

**UNIT IV:**

**Vapor Absorption System** – Calculation of max COP – description and working of NH3 – water system – Li – Br system. Principle of operation Three Fluid absorption system, salient features.

**Steam Jet Refrigeration System** – Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

**UNIT – V:**

**Introduction to Air Conditioning:**

Concept of human comfort and effective temperature –Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations. Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers. Heat Pump – Heat sources – different heat pump circuits – Applications.

**TEXT BOOKS:**

1. A Course in Refrigeration and Air conditioning - SC Arora &Domkundwar, Dhanpatrai Rai Publishers
2. Refrigeration and Air Conditioning - CP Arora, Tata McGraw Hill

**REFERENCE BOOKS:**

1. Refrigeration and Air Conditioning - Manohar Prasad, New Age
2. Principles of Refrigeration - Dossat, Pearson Education
3. Basic Refrigeration and Air-Conditioning- Ananthanarayanan, TMH

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E07 | **WELDING TECHNOLOGY** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT-I**

**Introduction**- Welding as a production process – its advantages and limitations. Gas welding process, Types of fuels, Acetylene, Indane, Butane etc. Gas welding equipment, Gas welding technique. Electric arc welding – Manual metal arc welding – Power supplies, cables and other accessories for arc welding, Welding technique - atomic, hydrogen welding, Thermit welding, soldering, brazing and braze welding.

**UNIT-II**

**Special Welding Processes**- Power sources, equipments and accessories, application ,limitation and other characteristics of: (a) Gas tungsten arc (TIG) welding (b) Gas metal arc (MIG) welding (c) Submerged arc welding (d) Electro slag welding processes. Resistance welding processes-principle-Types (spot, seam, projection, percussion, flash), Equipment required for each application.

**UNIT-III**

**Modern Welding Processes**-Electron beam welding, Laser beam welding, Plasma arc welding, Friction welding, Explosive welding, Ultrasonic welding, Stud welding, Under water welding, Diffusion bonding, Cold welding, Welding of dissimilar metals.

**UNIT-IV**

**Weldment Testing- Defects in welding in various processes**-Causes and remedies; Destructive testing of weldments - Strength, hardness, ductility, fatigue, creep properties etc. Nondestructive testing of weldments; Ultrasonic dye penetrant, magnetic particle inspection. X ray testing procedures and identification of defects – case studies. Weld thermal cycle – Residual stressed distortion in welding stress relieving techniques.

**UNIT-V**

**Weldability, Automation And Design In Welding-Weldability** –definition. Temperature distribution in welding –heat affected zone weldability of steel, cast iron. Aluminum, Pre heating and post heating of weldments. Estimation of transition temperature. Automation in welding – Seam tracking vision and arc sensing welding robots. Design of weldments-Welding symbols positions of welding joint and groove design. Weld stress –Calculations – Design of weld size.

**Text Books:**


1. Abbott, J., & Smith, K. M.Welding Technology: Texas State Technical College Publishing.
2. Radhakrishnan.V.M. Welding Technology and Design, New Age International Pub. Ltd.,


**Reference Books**


1. Little R.L.,Welding Technology Tata McGraw-Hill
2. Partner R.S.Welding Process and Technology, Khanna Publishers
3. Lancaster J.F.,Metallurgy of Welding,George Allen and Unwin.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E08 | **PRODUCTION PLANNING & CONTROL** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT – I**

Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department.

**UNIT – II**

Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitive methods.

**UNIT – III**

Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems

**UNIT – IV**

Capacity planning, factors, measures of capacity, economies of scale, aggregate planning, long term and short term strategies, LPP models to solve Aggregate planning problems, Disaggregating

**UNIT – V**

Material Requirement Planning, Master Production Schedule, Bill of Materials, Lot sizing Methods, MRP-II, Introduction to ERP, Line balancing Methods

.

**TEXT BOOKS:**

1. Elements of Production Planning and Control / Samuel Eilon/Universal Book Corp.
2. Manufacturing, Planning and Control/Partik Jonsson Stig-Arne Mattsson/TataMcGrawHill

**REFERENCES:**

1. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/Prentice-Hall
2. Production Planning and Control/Mukhopadyay/PHI.
3. Production Control A Quantitative Approach / John E. Biegel/Prentice-Hall

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E09 | **AUTOMATION IN MANUFACTURING** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT –I**

**Introduction:** Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools, Mechanical Feeding and to changing and machine tool control transfer the automation.

**UNIT –II**

**Automated flow lines**: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines .

**UNIT –III**

**Assembly system and line balancing**: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

**UNIT –IV**

**Automated material handling**: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems. Automated storage systems: Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

**UNIT –V**

**Fundamentals of Industrial controls:** Review of control theory, logic controls, sensors and actuators, Data communication and LAN in manufacturing. Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

**TEXT BOOKS**:


1. M.P.Groover 3e - Automation, Production Systems and Computer Integrated Manufacturing, PHI,2009.
2. Frank Lamb - Industrial Automation , Mc Graw Hill,2013


REFERENCE BOOKS:


1. Nick Dawkins - Automation and Controls
2. Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang - Computer Aided Manufacturing, Pearson 2009
3. Peter G. Martin and Gregory Hale - Automation Made Easy

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Vinjanampadu, Vatticherukuru (Mandal), Guntur, Andhra Pradesh522017

**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E10 | **TRIBOLOGY** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT – I**

**Introduction:** Nature of surfaces and contact-Surface topography-friction and wear mechanisms, wear maps, effect of lubricants- methods of fluid film formation.

**Lubrication:** Choice of lubricants, types of oil, Grease and solid lubricants- additives- lubrication systems and their selection.

**UNIT – II**

**Selection of rolling element bearings:** Nominal life, static and dynamic capacity-Equivalent load, probabilities of survival- cubic mean load- bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

**UNIT – III**

**Hydrostatic Bearings:** Thrust bearings – pad coefficients- restriction- optimum film thickness- journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings – design procedure.

**UNIT – IV**

**Hydrodynamic bearings:** Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number- performance parameters – optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiple pad bearings-optimum condition with largest minimum film thickness

**UNIT – V**

**Seals:** different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection of mechanical seals.

**Failure of Tribological components:** Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using soap and Ferrography.

**Dry rubbing Bearings:** porous metal bearings and oscillatory journal bearings – qualitative approach only.

**TEXT BOOKS**


1. Rowe WW& O' Dionoghue,"Hydrostatic and Hybrid bearing design " Butterworths & Co.Publishers Ltd,1983.
2. Bernard J.Hamrock, "Fundamentals of fluid film lubricant", McGraw-Hill Co., 1994.


**REFERENCES:**


1. Neale MJ, (Editor) " Tribology hand Book"NeumannButterworths, 1975.
2. Shigley J, E Charles," Mechanical Engineering Design", McGraw Hill Co., 1989
3. Introduction to Tribology of bearings – B.C.Majumdar – S Chand Publishing.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E11 | **MATERIAL HANDLING SYSTEMS AND EQUIPMENT** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**Unit-I**

**Elements of Material Handling System**-Importance, Terminology, Objectives and benefits of better Material Handling; Principles and features of Material Handling System; Interrelationships between material handling and plant layout, physical facilities and other organizational functions; Classification of Material Handling Equipment.

**Unit-II**

**Selection of Material Handling Equipment**-Factors affecting for selection; Material Handling Equation; Choices of Material Handling Equipment; General analysis Procedures; Basic Analytical techniques; The unit load concept; Selection of suitable types of systems for applications ; Activity cost data and economic analysis for design of components of Material Handling Systems; functions and parameters affecting service; packing and storage of materials.

**Unit-III**

**Design of Mechanical Handling Equipment**- Design of Hoists, Drives for hoisting, components, and hoisting mechanisms; rail travelling components and mechanisms; hoisting gear operation during transient motion; selecting the motor rating and determining breaking torque for hoisting mechanisms

.

**Unit-IV**

**Design of Cranes,** Hand-propelled and electrically driven E.O.T. overheat Travelling cranes; Traveling mechanisms of cantilever and monorail cranes; design considerations for structures of rotary cranes with fixed radius ; fixed post and overhead travelling cranes; Stability of stationary rotary and travelling rotary cranes.

**Unit-V**

**Design of load lifting attachments**- Load chains and types of ropes used in Material Handling System; Forged, Standard and Ramshorn Hooks; Crane Grabs and Clamps; Grab Buckets; Electromagnet; Design consideration for conveyor belts; Application of attachments.

**Text Books:**


1. N. Rudenko, „Material Handling Equipments", Peace Publishers, Moscow.
2. James M. Apple, „Material Handling System Design", John-Willlwy and Sons Publication, New York.


**Reference Books**


1. John R. Immer, „Material Handling" McGraw Hill Co. Ltd., New York.
2. Colin Hardi, „Material Handling in Machine Shops". Machinery Publication Co. Ltd., London.

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**DEPARTMENT OF MECHANICAL ENGINEERING**

| Programme: ME Semester: VII | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| 20ME7E12 | **TOTAL QUALITY MANAGEMENT** | 3 | 0 | 0 | 3 |
| Subject Category : PROFESSIONAL ELECTIVE COURSE | | | | | |

**UNIT – I:**

**INTRODUCTION:** The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

**UNIT – II:**

**CUSTOMER FOCUS AND SATISFACTION**: The importance of customer satisfaction and loyalty- Crating satisfied customers, Understanding the customer needs, Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marketing: Evolution of Bench Marketing, meaning of Benchmarketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

**UNIT – III:**

**ORGANIZING FOR TQM**: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

**UNIT – IV:**

**THE COST OF QUALITY:** Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

**UNIT – V:**

**ISO9000:** Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

**TEXT BOOKS:**

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI

**REFERENCES:**

1. Beyond TQM / Robert L.Flood
2. Statistical Quality Control / E.L. Grant / McGraw Hill.
3. Total Quality Management- A Practical Approach/H. Lal

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

# KKR & KSR Institute of Technology and Sciences

## (AUTONOMOUS)

**Vinjanampadu, Vatticherukuru (Mandal), Guntur, AndhraPradesh-522017**

## R20 Regulation Course Structure (Choice Based Credit System) Bachelor of Technology (B.Tech)

(Applicable from the batches admitted in AY: 2020-2021& Lateral Entry AY:2021-2022)

**Department of Electronics and Communication Engineering**

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**SEMESTER-I (I-I)**

| S.No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20SH1T01 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH1T02 | Applied Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20SH1T07 | Linear Algebra and Vector Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EE1T01 | Electrical Installation and Electronics Engineering Practice | 2 | 0 | 2 | 3 | 30 | 70 | 100 |
| 5 | 20CS1T01 | Problem Solving and Programming Using C | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE1M01 | Environmental Science | 2 | 0 | 0 | --- | --- | --- | --- |
| PRACTICAL | | | | | | | | | |
| 7 | 20SH1L01 | English Communicative Skills Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20SH1L02 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS1L01 | Problem Solving and Programming Using C Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory: BSC-2, HSMC-1, ESC-2 Practical: BSC-1, HSMC-1, ESC-1**

**SEMESTER-II (I-II)**

| S.No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20SH2T04 | Applied Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH2T06 | Differential Equations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20ME2T01 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 4 | 20CS2T01 | Python Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20EE2T01 | Network Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| PRACTICAL | | | | | | | | | |
| 6 | 20SH2L04 | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CS2L01 | Python Programming Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS2L02 | IT Workshop | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory: BSC-2, ESC-3 Practical: BSC-1, ESC-2**

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**SEMESTER-III (II-I)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20SH3T03 | Numerical Methods & Transformations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EC3T01 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC3T02 | Digital System Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EC3T03 | Signals and Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20SH3T01 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| PRACTICAL | | | | | | | | | |
| 6 | 20EC3L01 | Electronic Devices and Circuits Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20EC3L02 | Digital System Design Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS3L03 | OOP's Through C++ Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20IT3S01 | Skilloriented Course–I (**Basic level skill Oriented courses-I**) | 1 | 0 | 2 | 2.0 | ….. | 50 | 50 |
| 10 | 20GE3M01 | Indian Constitution | 2 | 0 | 0 | 0 | | | |
| | | | | | **Total Credits** | **21.5** | **195** | **505** | **700** |

**Theory: BSC-1, PCC-3, ESC-1 Practical: PCC-2, ESC-1, SC-1, MC-1**

**SEMESTER-IV (II-II)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EC4T01 | Electronic Circuit Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EC4T02 | Analog Communication | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC4T03 | Electro Magnetic Waves and Transmission Lines | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EE4T02 | Control Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS4T04 | Data Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| PRACTICAL | | | | | | | | | |
| 6 | 20EC4L01 | Electronic Circuit Analysis Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20EC4L02 | Analog Communication Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS4L04 | Data Structures using Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20IT4S01 | SkillOrientedCourse-II | 1 | 0 | 2 | 2.0 | ---- | 50 | 50 |

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **(Basic level skill Oriented courses-II)** | | | | | | | |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |
| **11** | | **Honors/Minor Courses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |

**Theory: PCC-4, HSMC-1 Practical: ESC-1, PCC-2, SC-1**

**Honors/MinorCourses-1**

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

## SEMESTER-V (III-I)

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EC5T01 | Microprocessor and Microcontrollers | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EC5T02 | Linear IC applications | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC5T03 | Antennas and Wave Propagation | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EC5E04 | Random Variable Stochastic Process | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20ITXO01 | Data Base Management System | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE5M04 | Intellectual Property Rights and Patents | 2 | 0 | 0 | 0 | ….. | …. | ….. |
| PRACTICAL | | | | | | | | | |
| 7 | 20EC5L01 | Microprocessor and Microcontrollers Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20EC5L02 | Linear IC applications Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20EC5S01 | Advanced VLSI | 1 | 0 | 2 | 2.0 | ---- | 50 | 50 |
| 10 | 20EC5I01 | Summer Internship During 2 Year | 0 | 0 | 0 | 1.5 | | 50 | 50 |
| | | | **Total Credits** | | | **21.5** | **180** | **520** | **700** |
| **11** | | **Honors/Minor Courses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |

**Theory: PCC-3, OEC-1, PEC-1 Practical: PCC-2, SC-1, SI-1, MC-1**
**Honors/MinorCourses-1**

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**SEMESTER-VI(III-II)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EC6T02 | Digital Signal Processing | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EC6T03 | VLSI Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC6T04 | Digital Communications | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EC6E-- | **Professional Elective Course-II** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS6O-- | Open Elective-II | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE6M02 | Professional Ethics and Human Values | 2 | 0 | 0 | 0 | ….. | …. | ….. |
| PRACTICAL | | | | | | | | | |
| 7 | 20EC6L02 | Digital Signal Processing Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20EC6L03 | VLSI Design Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20EC6L04 | Digital Communication Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20EC6S01 | Soft Skills | 1 | 0 | 2 | 2.0 | --- | 50 | 50 |
| | | **Total Credits** | | | | **21.5** | | | |
| **11** | | **Honors/Minor Courses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |

**Theory: PCC-3, OEC-1, PEC-1 Practical: PCC-3, SC-1, MC-1**

**Honors/MinorCourses-1**

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**SEMESTER-VII (IV-I)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EC7E01 | **Professional Elective Course-III** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EC7E05 | **Professional Elective Course-IV** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC7E09 | **Professional Elective Course-V** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20XX7O-- | **Open Elective-III** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20XX7O-- | **Open Elective-IV** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20SH7E-- | **Humanity Elective** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| PRACTICAL | | | | | | | | | |
| 7 | 20SH7S-- | Soft Skill Courses | 1 | 0 | 2 | 2.0 | --- | 50 | 50 |
| 8 | 20EC7E-- | Summer Internship During 3 Year | 0 | 0 | 0 | 3 | --- | 50 | 50 |
| | | | | | **Total Credits** | **23** | **180** | **520** | **700** |
| **9** | | **Honors/MinorCourses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |

**Theory: OEC-2, PEC-3,HSMEC-1 Practical: SC-1, SI-1**
**Honors/MinorCourses-1**

**SEMESTER-VIII (IV-II)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EC8P01 | Project Work/ Internship in Industry | 0 | 0 | 0 | 12 | 60 | 140 | 200 |
| | | | | | **Total Credits** | **12** | **60** | **140** | **200** |
| 2 | | **Honors/MinorCourses (**MOOCS-I) | - | - | - | 2 | - | - | - |
| 3 | | **Honors/MinorCourses**(MOOCS-II) | - | - | - | 2 | - | - | - |

**Practical: PROJ-1,**

**Honors/Minor Courses-2**

**MOOCS-I & II***

(*– Equivalent grades will be given by BOS)

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE
**LIST OF PROFESSIONAL ELECTIVE COURSES**

| | | |
|---|---|---|
| **Elective-I (Semester V) (III-I)** | | |
| Track 1 | 20EC5E01 | Electronic Measurements and Instrumentation. |
| Track 2 | 20EC5E02 | Pulse and Digital Circuits. |
| Track 3 | 20EC5E03 | Computer Architecture &Organisation. |
| Track 4 | 20EC5E04 | Random Variable & Stochastic Process |
| **Elective-II (Semester VI) (III-II)** | | |
| Track 1 | 20EC6E01 | Embedded Systems. |
| Track 2 | 20EC6E02 | Data Communications. |
| Track 3 | 20EC6E03 | Telecommunication Switching Networks. |
| Track 4 | 20EC6E04 | Digital IC applications. |
| **Elective-III (Semester VII) (IV-I)** | | |
| Track 1 | 20EC7E01 | Information Theory and Coding |
| Track 2 | 20EC7E02 | Wireless Sensors and Networks. |
| Track 3 | 20EC7E03 | Optical Communication. |
| Track 4 | 20EC7E04 | Radar Engineering. |
| **Elective-IV (Semester VII) (IV-I)** | | |
| Track 1 | 20EC7E05 | Satellite Communication. |
| Track 2 | 20EC7E06 | Low Power VLSI Design |
| Track 3 | 20EC7E07 | Internet of Things. |
| Track 4 | 20EC7E08 | Microwave Engineering. |
| **Elective-V (Semester VII) (IV-I)** | | |
| Track 1 | 20EC7E09 | Digital Image Processing |
| Track 2 | 20EC7E010 | Photonics Devices |
| Track 3 | 20EC7E011 | Cellular Mobile Communication. |
| Track 4 | 20EC7E012 | Nano Electronics. |

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**LIST OF OPEN ELECTIVE COURSES**

| S. No. | Course Code | Course Title | Offering Dept. |
|---|---|---|---|
| 1 | 20CEXO01 | Elements of Civil Engineering | CE |
| 2 | 20CEXO02 | Disaster Management | |
| 3 | 20CEXO03 | Intelligent Transport Systems | |
| 4 | 20CEXO04 | Remote sensing & Geographical Information systems | |
| 5 | 20EEXO01 | Electrical Safety Management | EEE |
| 6 | 20EEXO02 | Non-conventional Energy sources | |
| 7 | 20EEXO03 | Electrical and Hybrid Vehicle | |
| 8 | 20EEXO04 | Electrical Energy Conservation and Auditing | |
| 9 | 20EEXO05 | Industrial Robotics | |
| 10 | 20MEXO01 | Optimization Techniques | ME |
| 11 | 20MEXO02 | Robotics | |
| 12 | 20MEXO03 | Industrial Management Sciences | |
| 13 | 20MEXO04 | Automation in Manufacturing | |
| 14 | 20ECXO01 | Principles of Communication | ECE |
| 15 | 20ECXO02 | Digital image Processing | |
| 16 | 20ECXO03 | Bio Medical Engineering | |
| 17 | 20ECXO04 | Design of IOT System (IOT) | |
| 18 | 20ECXO05 | MEMS | |
| 19 | 20ECXO06 | Mechatronics | |
| 20 | 20CSXO01 | Computer Graphics | CSE |
| 21 | 20CSXO02 | Cloud Computing | |
| 22 | 20CSXO03 | Computer Networks | |
| 23 | 20CSXO04 | Cryptography and Network Security | |
| 24 | 20ITXO01 | Data Base Management systems (DBMS) | IT |
| 25 | 20ITXO02 | Java Programming | |
| 26 | 20ITXO03 | Principle of software Engineering (PSE) | |
| 27 | 20ITXO04 | Introduction to Machine Learning | |
| 28 | 20CIXO01 | Python Programming | CAI |
| 29 | 20CIXO02 | Fundamentals of Artificial Intelligence | |
| 30 | 20CIXO03 | Human Computer Interaction | |
| 31 | 20CIXO04 | Applications of AI | |
| 32 | 20CDXO01 | Object Oriented Programming (C++) | CSD |
| 33 | 20CDXO02 | Data Structures | |
| 34 | 20CDXO03 | Data warehouse and Mining | |
| 35 | 20CDXO04 | Big Data Analysis | |

**HUMANITIES AND SOCIAL SCIENCE ELECTIVE**

| **S. No.** | Course Code | **Course Title** |
|---|---|---|
| 1 | 20SH7E01 | Entrepreneurship Development |
| 2 | 20SH7E02 | Business Environment |
| 3 | 20SH7E03 | Digital Marking |
| 4 | 20SH7E04 | Human Resource development and OB |

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE
**LIST OF HONORS COURSES**

| **Year/Sem: II-II (Pool-1)** | | |
|---|---|---|
| S. No | Course Code | Course Name |
| 1 | 20EC4H01 | Data Communications & Computer Networks |
| 2 | 20EC4H02 | Speech Signal Processing |
| 3 | 20EC4H03 | System on Chip |
| 4 | 20EC4H04 | Transducers & sensors |
| **Year/Sem: III-I (Pool-2)** | | |
| 1 | 20EC5H01 | Global navigational satellite systems |
| 2 | 20EC5H02 | Adaptive Signal Processing |
| 3 | 20EC5H03 | CMOS Analog IC Design |
| 4 | 20EC5H04 | Process Control Instrumentation |
| **Year/Sem: III-II (Pool-3)** | | |
| 1 | 20EC6H01 | Cognitive radio |
| 2 | 20EC6H02 | DSP Processors and Architectures |
| 3 | 20EC6H03 | CMOS Digital IC design |
| 4 | 20EC6H04 | Intelligent & Smart Instrumentation |
| **Year/Sem: IV-I (Pool-4)** | | |
| 1 | 20EC7H01 | 5G Communications |
| 2 | 20EC7H02 | Multirate Systems And Filter Banks |
| 3 | 20EC7H03 | Low Power VLSI Design |
| 4 | 20EC7H04 | Data Acquisition systems |

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**LIST OF MINORS COURSE (GENERAL)**

| S. No | Course Code | Course Name |
|---|---|---|
| 1 | 20EC4M01 | Electronics Devices and Basic Circuits |
| 2 | 20EC5M01 | Digital Electronics |
| 3 | 20EC6M01 | Principles of Communication |
| 4 | 20EC7M01 | Signal Analysis |

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E01 | **INFORMATION THEORY AND CODING** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Design an Application with Error-Control coding

CO2 : Use Compression and Decompression Techniques

CO3 : Perform source coding and channel coding

CO4 : Perform cyclic coding techniques

CO5 : Construction of convolution coding techniques

**SYLLABUS**

**UNIT-I : INFORMATION THEORY AND SOURCE CODING**

Uncertainty, information, entropy and its properties, entropy of binary memory less source and its extension to discrete memory less source, source coding theorem, data compression, prefix coding, Huffman coding, Lempel-Ziv coding, Source with memory and its entropy.

**UNIT-II : DISCRETE CHANNELS**

Binary Symmetric Channel, mutual information & its properties, Channel capacity, channel coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth - S/N trade off, practical communication systems in light of Shannon's theorem, Fading channel, channels with memory.

**UNIT-III : GROUPS, FIELDS AND LINEAR BLOCK CODES**

Galois field and its construction in GF(2m) and its basic properties, vector spaces and matrices in GF(2), Linear block codes, systematic codes and its encoding circuit, syndrome and error detection, minimum distance, error detecting and correcting capabilities of block code, decoding circuit, probability of undetected error for linear block code in BSC, Hamming code and their applications.

**UNIT-IV : CYCLIC CODES AND BCH CODES**

Basic properties of Cyclic codes, Generator and parity check matrix of cyclic codes, encoding and decoding circuits, syndrome computation and error detection, cyclic Hamming codes, encoding and decoding of BCH codes, error location and correction.

**UNIT-V : CONVOLUTIONAL CODES**

Introduction to convolution code, its construction and Viterbi algorithm for maximum likelihood decoding. Automatic repeat request strategies and their throughput efficiency considerations.

**Text Books:**

1. Sklar, Digital Communication, Pearson Education Asia, 2nd Edition,2001.
2. Shu Lin and Costello, Error Control Coding: Fundamentals and Applications, 2ndEdition, Pearson,2004.

**Reference Books:**

1. Haykin Simon, Digital Communication, Wiley Publications,2013.
2. Information theory and coding, Muralidhar Kulkarni, KS AShiva prakash,2015.
3. JS Chithode, Information theory and coding, Technical publishers, 1st Edition,2014.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E02 | **WIRELESS SENSOR NETWORKS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Explain the significance of sensor network mechanisms.

CO2 : Explain the various architectures of sensor network

CO3 : Describe the roles of supporting communication protocols as how they assist Wireless Sensor Networks.

CO4 : Compare the performance of different techniques applied for node positioning and localization in wireless sensor network.

CO5 : Explain how transport layer mechanisms applied to achieve the required QoS.

**SYLLABUS**

**UNIT-I: OVERVIEW OF WIRELESS SENSOR NETWORKS**

Definition, advantages, Applications with examples – Types of applications – Challenges for Wireless sensor networks – Characteristic requirements – required mechanisms – Comparison of Mobile ad hoc networks and wireless sensor networks.

**UNIT-II : WIRELESS SENSOR NETWORK ARCHITECTURES**

Single–Node Architecture – Hardware Components – Energy Consumption of Sensor Nodes – Operating Systems and Execution Environments – Network Architecture – Sensor Network Scenarios – Optimization Goals and Figures of Merit – Design Principles and service interfaces – Gateway Concepts.

**UNIT-III : HARDWARE & SOFTWARE TOOLS**

**Hardware**: Examples like mica2, micaZ, telosB, Imote2, tmote, btnode, and Sun SPOT, **Software (Operating Systems)**: tiny OS, MANTIS, Contiki, and RTOS.

**Programming tools:** C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet).

**UNIT-IV : LOCALIZATION AND POSITIONING**

Properties of localization and positioning – Proximity – Trilateration and Triangulation – Single–hop localization – Positioning in multi–hop environments, Topology Control – Controlling topology in flat networks – Hierarchical networks by dominating sets and

clustering – Combining hierarchical topologies and power control – Adaptive node activity.

**UNIT-V : TRANSPORT LAYER AND QUALITY OF SERVICE**

Coverage and deployment – Reliable data transport – Single packet delivery – Block delivery – Congestion control and rate control – Advanced application support – Security and Application specific support.

**TEXTBOOKS:**

1. J. Millman and C.C. Halkias, "Electronic Devices and Circuits", 4th edition, Tata Mc-Graw Hill, 2015.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits",pearson/Prentice Hall, 4th edition, 2015.

**REFERENCEBOOKS:**

1. Kazem Sohraby, Daniel Minoli, &Taieb Znati, "Wireless Sensor Networks Technology, Protocols and Applications", John Wiley, 2011.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E03 | **OPTICAL COMMUNICATIONS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the concepts of Optical fiber structure and Single and Multimode Fibers

CO2 : Study the properties of optical fiber that affect the performance of a communication link and types of fiber materials with their properties and the losses occur in fibers.

CO3 : Design the connection between two optical fibers and misalignments present in the fibers due to losses in fiber end separation.

CO4 : Analyze the operation of LEDs, laser diodes, PIN &APD photo detectors

CO5 : Analyze the Source to Fiber power coupling and design the optical system

**SYLLABUS**

**UNIT-I : Optical Fiber Communications**

Overview of optical fiber communication - Historical development, Block diagram of optical fiber communication, advantages of optical fiber communications, Applications of optical fiber, Ray theory transmission, Total Internal Reflection, Acceptance angle, Critical angle, Numerical Aperture, Meridional Rays & Skew rays, V-number, Mode coupling, Types of Optical Fibers: Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Related problems.

**UNIT-II : Optical Fiber Materials**

Fiber materials: Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Information capacity determination, Group delay, Types of Dispersion: Material dispersion, Wave-guide dispersion, Modal Birefringence, Polarization-Mode dispersion.

**UNIT-III : Optical Fiber Connectors and Splicers**

Optical fiber Connectors-Requirements, Connector types, Fiber Splicing, Splicing techniques, Losses in Fiber end Separation: Intrinsic, Extrinsic coupling loss and Reflection losses, Mis alignments of Single mode Fiber joints, Misalignments of Multimode fiber joints.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**UNIT-IV : Optical Sources and Detectors**

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Power bandwidth product, Injection Laser Diodes- Modes, quantum efficiency, Laser diode rate equations, Optical detectors- Physical principles of PIN and APD, Comparison of Photo detectors, Optical receiver operation, Digital signal transmission, Digital receiver performance: Probability of Error (BER), Quantum Limit, Related problems.

**UNIT-V : Source to Fiber power launching& Optical system Design**

**Source to fiber power launching** - Output patterns, Power coupling Calculation, Power launching Versus Wavelength, Equilibrium Numerical Aperture, Lensing Schemes for Coupling Improvement, Laser diode to fiber coupling.

**Optical system design** – System Design Considerations, Point-to- point link, Link power budget, Rise time budget, WDM: Principle, Types of WDM, Measurement of Dispersion, Eye pattern.

**TEXT BOOKS:**

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

**REFERENCES:**

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E04 | **Radar Engineering** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Derive the Radar Range Equation and to solve some analytical problems.
CO2 : To Study the different types of Radars and its applications.
CO3 : Distinguish the fixed and moving targets in Radar systems.
CO4 : Understand the concept of tracking and different tracking techniques.
CO5 : Analyze the characteristics of a matched filter receiver and its performance; Identify the different types of display devices & Duplexers.

**SYLLABUS**

**UNIT-I :**

**Basics of Radar:** Introduction, Maximum Unambiguous Range, Simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems.
**Radar Equation: Modified** Radar Range Equation, SNR, probability of detection, probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses, Illustrative Problems

**UNIT-II :**

**CW and Frequency Modulated Radar:** Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar.
**FM-CW Radar:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW Altimeter, Multiple Frequency CW Radar.

**UNIT-III : MTI and Pulse Doppler Radar**

Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

**UNIT-IV : Tracking Radar**

Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

**UNIT-V : Detection of Radar Signals in Noise**

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Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise, Radar Receivers- Noise Figure and Noise Temperature, Displays – types, Duplexers – Branch type and Balanced type, Circulators as Duplexer, Radomes.

**TEXT BOOKS:**

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.

**REFERENCE BOOKS:**

1. Introduction to Radar Systems, 3rd edition – M.I. Skolnik, TMH Ed., 2005
2. Radar Principles – Peyton Z.Peebles, Jr.,Wiley India Pvt Ltd.,2009.
3. Radar Engineering – GSN Raju, IK International.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E05 | **SATELLITE COMMUNICATIONS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the basic concepts, applications, frequencies used and types of satellite communications.

CO2 : Understand the concept of look angles, launches and launch vehicles and orbital effects in satellite communications and the various satellite subsystems and its functionality.

CO3 : Understand the concepts of satellite link design and calculation of C/N ratio.

CO4 : Understand the concepts of multiple access and various types of multiple access techniques in satellite systems.

CO5 : Understand the concepts of satellite navigation, architecture and applications of GPS.

**SYLLABUS**

**UNIT-I : INTRODUCTION, ORBITALMECHANICS AND LAUNCHERS**

Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications Future Trends of Satellite Communications.

**ORBITALMECHANICSANDLAUNCHERS**: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launch and launch vehicles, Orbital effects in communication systems performance.

**UNIT-II : SATELLITE SUBSYSTEMS**

Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication sub systems, Satellite antenna Equipment reliability and Space qualification.

**SATELLITE LINK DESIGN:** Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

**UNIT-III : MULTIPLE ACCESS**

Frequency division multiple access (FDMA) Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA On board processing, DAMA, Code Division Multiple access (CDMA), Spread spectrum transmission and reception.

**UNIT-IV : EARTH STATION TECHNOLOGY**

Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

**LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS [1] :** Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs.

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COURSE STRUCTURE

**UNIT-V : SATELLITE NAVIGATION & THE GLOBALPOSITIONINGSYSTEM**

Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPSN avigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

**TEXTBOOKS:**

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy All nutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyder houd, 2nd Edition, Pearson Publications, 2003.

**REFERENCEBOOKS:**

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
4. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E06 | **Low Power VLSI Design** | 3 | 0 | 0 | 3 |

**Course Outcomes**:

CO1 : Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon Technologies
CO2 : Students able to understand deep submicron CMOS technology and digital CMOS design styles
CO3 : To design chips used for battery-powered systems and high-performance circuits.
CO4 : Learn the design of various CMOS dynamic logic circuits
CO5 : Learn the design techniques low voltage and low power CMOS circuits for various applications and different types of memory circuits and their design

**SYLLABUS**

**UNIT-I : Sources of Power Dissipation**

Introduction, Short-Circuit Power Dissipation, Switching Power Dissipation, Dynamic Power for a Complex Gate, Reduced Voltage Swing, Switching Activity, Leakage Power Dissipation, p–n Junction Reverse-Biased Current, Band-to-Band Tunneling Current, Subthreshold Leakage Current, Short-Channel Effects

**UNIT-II : Supply Voltage Scaling for Low Power**

Device Feature Size Scaling, Constant-Field Scaling, Constant-Voltage Scaling, Architectural-Level Approaches: Parallelism for Low Power, Pipelining for Low Power, Combining Parallelism with Pipelining, Voltage Scaling Using High-Level Transformations: Multilevel Voltage Scaling Challenges in MVS Voltage Scaling Interfaces, Static Timing Analysis Dynamic Voltage and Frequency Scaling

**UNIT-III : Switched Capacitance Minimization**

Probabilistic Power Analysis: Random logic signals, probability and frequency, probabilistic power analysis techniques, signal entropy, Bus Encoding: Gray Coding, One-Hot Coding, Bus-Inversion, T0 Coding, Clock Gating, Gated-Clock FSMs FSM State Encoding, FSM Partitioning, Precomputation, Glitching Power Minimization

**UNIT-IV : Leakage Power Minimization**

Fabrication of Multiple Threshold Voltages, Multiple Channel Doping, Multiple Oxide CMOS, Multiple Channel Length, Multiple Body Bias, VTCMOS Approach, MTCMOS Approach, Power Gating, Clock Gating Versus Power Gating, Power-Gating Issues, Isolation Strategy, State Retention Strategy, Power-Gating Controller, Power Management,

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Combining DVFS and Power Management

**UNIT-V : Low power clock distribution& Simulation Power Analysis**

Low power clock distribution: Power dissipation in clock distribution, single driver versus distributed buffers, Zero skew versus tolerable skew, chip and package co design for clock network. Simulation Power Analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, architecture level analysis, data correlation analysis of DSP systems, Monte Carlo Simulation Special Techniques: Power Reduction in Clock networks, CMOS Floating Node, Low Power Bus Delay balancing, and Low Power Techniques for SRAM.

**TEXT BOOKS:**

**1.** Low-Power VLSI Circuits and Systems, Ajit Pal, SPRINGER PUBLISHERS
2. PRACTICAL LOW POWER DIGITAL VLSI DESIGN , Gary Yeap Motorola, SPRINGER SCIENCE, BUSINESS MEDIA, LLC.

**REFERENCE BOOKS:**

1. Low Power CMOS Design – Anantha Chandrakasan, IEEE Press/Wiley International, 1998.
2. Massoud Pedram, Jan M. Rabaey , “Low power design methodologies “, Kluwer Academic Publishers.
3. Low Power CMOS VLSI Circuit Design – A. Bellamour, M. I. Elamasri, Kluwer Academic Press, 1995.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E07 | **INTERNET OF THINGS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Explain Internet of Things and its hardware.

CO2 : Explain Components of Internet of Things.

CO3 : Interface I/O Devices, Sensors, and Communication modules.

CO4 : Monitor data and control devices.

CO5 : Implement real time IoT based applications.

**SYLLABUS**

**UNIT-I : Introduction to IoT**

Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gate ways, Data management, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

**UNIT-II : Elements of IoT**

Hardware Computing Components- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set.

**UNIT-III : IoT Application Development**

Communication, IoT Applications, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth. Bluetooth Smart Connectivity, Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and Component Overview.

**UNIT-IV : Solution framework for IoT applications**

Implementation of Device integration, Data acquisition and integration, Device data storage-Unstructured data storage on cloud/local server, Authentication, authorization of devices.

**UNIT-V : IoT Case Studies**

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

**TEXTBOOKS:**

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education,2017.
2. The Definitive Guide to the ARM Cortex-M0 by JosephYiu,2011 3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, "A Hands-on Approach", UniversityPress,2015

**REFERENCEBOOKS:**

1. Cypress Semiconductor/PSoC4 BLE (Bluetooth Low Energy) Product Training Modules.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press,2017

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E08 | **MICRO WAVE ENGINEERING** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Identify various applications and measurement schemes for micro wave circuits

CO2 : Comprehend the performance of different micro wave sources and ferrite devices

CO3 : Analyze micro wave circuits using scattering parameters

CO4 : Design and analyze power dividers and couplers at micro wave frequencies

CO5 : Design and analyze low pass filters at micro wave frequencies.

**SYLLABUS**

**UNIT-I : Microwave introduction &Types of waveguides**

Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides - TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics - Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide, Impossibility of TEM mode. Introduction to circular waveguides, Microstrip lines and cavity resonators basics, Related Problems

**UNIT-II : Microwave Sources**

Microwave Tubes: TWT, Klystron amplifier, Reflex Klystron, Magnetron. Semiconductor Devices: Gunn diode, Tunnel diode, IMPATT-TRAPATT-BARITT diodes, PIN Diode.

**UNIT-III : Microwave Network Analysis**

Scattering matrix-reciprocal networks and lossless networks, generalized S-parameters-signal
flowgraph–decomposition of signal flow graphs.

**UNIT-IV : Power dividers**

S-matrix analysis of E-Plane Tee, H-Plane Tee, Magic Tee, Multi-hole directional coupler. Introduction to Micro strip lines. Tjunction and resistive power divider, Wilkinson power divider,

**UNIT-V : Microwave measurements**

Description of Microwave Bench - Different Blocks and their Features, Precautions; Microwave Power Measurement - Bolometer Method. Measurement of Attenuation, Frequency, VSWR, Cavity Q. Impedance Measurements.

**Textbook(s)**

1. D.M.Pozar, Microwaveengineering,2012,4thedition,JohnWiley&Sons,USA
2. Microwave Devices and Circuits - Samuel Y. Liao, PHI, 3rdEdition,1994.

**Reference Books**

1. Robert, E.Collin, Foundations of Microwave Engineering, 2014 (Reprint), 2nd edition, John Wiley & Sons, USA
2. Annapurna Das and S. K .Das, MicrowaveEngineering,2017,3rdedition,TataMcGraw-Hill, India.

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COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E09 | **DIGITAL IMAGE PROCESSING** | **3** | **0** | **0** | **3** |

CO1 : Perform image manipulations and different digital image processing techniques
CO2 : Perform basic operations like – Enhancement, segmentation, compression, Image transforms and restoration techniques on image.
CO3 : Analyze pseudo and full color image processing techniques.
CO4 : Apply various morphological operators on images
CO5 : Compress digital image and video by applying digital image and video compression algorithm

**SYLLABUS:**

**UNIT-I : Digital Image Fundamentals**

**Introduction**: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

**Image Transforms:** Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform.

**UNIT-II : Intensity Transformations and Spatial Filtering**

**Intensity Transformations and Spatial Filtering:** Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters.

**UNIT-III : Image Restoration**

**Image compression**: Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding.

**Image compression**: Fundamentals, Basic compression methods: Huffman coding, Golomb

coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding.

**UNIT-IV : Image segmentation**

**Image segmentation:** Fundamentals, point, line, edge detection, thresholding, region –based segmentation. **Morphological Image Processing:** Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

**UNIT-V : Color image processing**

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

**TEXTBOOKS:**

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.

2. Jayaraman, S. Esakkirajan, and T. Veera kumar," Digital Image Processing", Tata McGraw-Hill Education, 2011.

**REFERENCEBOOKS:**

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.

2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E10 | **PHOTONIC DEVICES** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Explain fundamentals of optoelectronics

CO2 : Explain basics of light emitting diodes.

CO3 : Acquire knowledge on optical Devices Structures

CO4 : Develop knowledge on opto electronic Integrated Circuits.

CO5 : Construct Photonic devices applications.

**SYLLABUS**

**UNIT-I : Optoelectronics**

Review of Semiconductor device Physics, Semiconductor Opto electronics- Solid State Materials, Emitters, Detectors and Amplifiers, Semiconductor Emitters- LEDs, Diodes, SLDs, CCDs, Semiconductor lasers- basic Structure, theory and device characteristics, DFB, DBR, Quantum well lasers, Laser diode arrays, VCSEL etc.

**UNIT-II : Semiconductor photo diodes**

Materials - Si, Hg Cd Te, InGa As, Al Ga As for different wavelengths, Photoconductors, photo diodes, PIN, APD, Photo transistors, solar cells, CCDs, IR and UV detectors

**UNIT-III : Optical Devices Structures**

Band gap Engineering, Quantum well structures, size effects, Hetero and nano structures. Fabrication techniques [MBE, CVD, Lithography, Thin films technology and Device characterization. Integrated Optics Optical wave guide theory, wave guide structures. Fiber optic interconnects- Fiber lasers and amplifiers, fiber sensors.

**UNIT-IV : Optoelectronic Integrated Circuits**

Directional couplers, Dividers, Multiplexers, Phase and Amplitude Modulators, Polarization and polarization controllers, etc. Photonics Signal processing, Nonlinear optics- Frequency Converters, Phase conjugation, optical Correlation etc

**UNIT-V : Photonic devices and applications**

Intensity, phase and polarization-based Fiber optic sensors for measurement of temperature, pressure, stress etc., for space craft health monitoring, Hydrogen leakage sensing in cryo engines. Fiber Optic Gyroscope for navigation application. Optical Intra Satellite links using

ELED's, VCSELs. Fiber Bragg gratings for health monitoring and smart materials.

**TEXTBOOKS:**

1. Physics of Semiconductor devices-S.M.Sze& Kwok K Ng, Third edition,Wiley-2007[parts I, II and
2. Fundamentals of Photonics, by Bahaa E. A. Saleh and Malvin Carl Teich, Wiley Series in Pure and Applied Optics

**REFERENCEBOOKS:**

1. Physics of Opto-electronic Devices- Shun Lien Chuang-Wiley, John&Sons-2009
2. Infrared Photon detectors-Antoni Rogalski [Ed]-SPIE Optical Engineering Press-1995
3. CCD arrays, Cameras & Displays-Gerald C Hoist 1998 [2nd Ed], JCD Publishing-SPIE Optical Engg.Press
4. Photonic Devices By Jia-Ming Liu Cambridge University Press, 2005
5. Photonic Devices and Systems –by Robert G. Hunsperger, Taylor & Francis, 1994

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E11 | **CELLULAR MOBILE COMMUNICATION** | 3 | 0 | 0 | 3 |

**Course Outcomes:**

**After successful completion of this course, students should be able to**

CO1 : Understand the basic cellular concepts and various cellular systems.

CO2 : Summarize different types of interferences influencing cellular and mobile communications.

CO3 : Understand the frequency management, channel assignment and various propagation effects in cellular environment.

CO4 : Summarizing the different types antennas used at cell site and mobile.

CO5 : Estimate the architectures of GSM and 3G cellular systems

**UNIT-I : CELLULAR MOBILE RADIO SYSTEMS**

Introduction to Cellular Mobile System, uniqueness of mobile radio environment, operation of cellular systems, consideration of the components of Cellular system, Hexagonal shaped cells, Analog and Digital Cellular systems.

**UNIT-II : CELLULAR CONCEPTS**

Evolution of Cellular systems, Concept of frequency reuse, frequency reuse ratio, Number of channels in a cellular system, Cellular traffic: trunking and blocking, Grade of Service; Cellular structures: macro, micro, pico and femto cells; Cell splitting, Cell sectoring.

**UNIT-III : INTERFERENCE**

Types of interferences, Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni-directional Antenna system, design of Antenna system, antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.

**UNIT-IV : FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT**

Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units: fixed channel and non-fixed channel assignment, channel sharing and borrowing, overlaid cells.

**CELL COVERAGE FOR SIGNAL AND TRAFFIC**: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, antenna height gain, form of a point-to-

point model.

**UNIT-V : HANDOFF STRATEGIES**

Concept of Handoff, types of handoffs, handoff initiation, delaying handoff, forced handoff, mobile assigned handoff, intersystem handoff, soft and hard hand offs, vehicle locating methods, dropped call rates and their evaluation.

**DIGITAL CELLULAR NETWORKS**: GSM architecture, GSM channels, multiple access schemes; TDMA, CDMA, OFDMA.3G and 4G Wireless Standards GSM, GPRS , WCDMA , LTE , Wi-MAX, Introduction to 5G standards

**TEXT BOOKS:**

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2nd Edn., 2006.
2. Principles of Mobile Communications – Gordon L. Stuber, Springer International 2 nd Edition, 2007.
3. Advanced Wireless Communications-4G By. Savo G Glisic, John Wiley & Sons Publication 2nd Edition

**REFERENCES:**

1. Wireless Communications – Theodore. S. Rapport, Pearson education, 2nd Edn.,2002.
2. Fundamentals of Wireless Communication By. David Tse and Pramod Viswanath, Cambridge University Press

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7E12 | **NANO ELECTRONICS** | **3** | **0** | **0** | **3** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Explain fundamentals of Nano Technology
CO2 : Explain basics of Nano structures
CO3 : Acquire knowledge on Fabrication of Nano Layers
CO4 : Report Characteristics of Nano Structures.
CO5 : Explain about Nano electronic Devices.

**SYLLABUS**

**UNIT-I : Introduction to Nano Technology**

Introduction to nanotechnology, Impacts, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics. Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence

**UNIT-II : Nano Structures**

Classification of Nano structures, Low dimensional structures Quantum wells, wires and dots, Density of states and dimensionality. Basic properties of two-dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, Quantum wires and quantum dots, carbon nano tube.

**UNIT-III : Fabrication of Nano Layers**

Introduction to methods of fabrication of nano-layers, different approaches, physical vapour deposition, chemical vapour deposition. Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide- dry and wet oxidation methods. Fabrication of nano particle- grinding with iron balls, laser ablation, reduction methods, sol gel, self-assembly, precipitation of quantum dots.

**UNIT-IV : Characteristics of Nano Structures**

Introduction to characterization of nanostructures, tools used for of nano materials characterization, microscope-optical, electron, and electron microscope. Principle of operation of Scanning Tunnelling Microscope, Atomic Force Microscope, Scanning Electron microscope, Specimen interaction. Transmission Electron Microscope, X-Ray Diffraction analysis, PL & UV Spectroscopy, Particle size analyser.

**UNIT-V : Nano Electronic Devices**

Nanoelectonic devices- MODFETS, heterojunction bipolar transistors. Resonant tunnel effect, RTD, RTT, Hot electron transistors, Coulomb blockade effect and single electron transistor, CNT transistors, Heterostructure semiconductor laser, Quantum well laser, quantum dot LED

**TEXTBOOKS:**

1. J.M. Martinez-Duart, R.J. Martin Palma, F. Agulle Rueda Nanotechnology for Microelectronics and optoelectronics, Elsevier, 2006
2. W.R. Fahrner, Nanotechnology and Nano elctronics, Springer, 2005

**REFERENCEBOOKS:**

1. Chattopadhyay, Banerjee, Introduction to Nanoscience & Technology, PHI, 2012
2. George W. Hanson, Fundamentals of Nanoelectronics, Pearson Education, 2009.
3. K. Goser, P. Glosekotter, J. Dienstuhl, Nanoelectronics and nano systems, Springer 2004.
4. Murty, Shankar, Text book of Nanoscience and Nanotechnology, Universities Press, 2012.
5. Poole, Introduction to Nanotechnology, John Wiley, 2006.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC7M01 | **MANAGEMENT SCIENCE** | **3** | **0** | **0** | **3** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : To familiarize with the process of management and to provide basic insight into organizational behaviour

CO2 : To provide conceptual knowledge on functional management and project management

**UNIT-I : Introduction to Management**

Concept –nature and importance of Management —Generic Functions of Management- Administration vs. Management – Evolution of Management thought- Decision making process- organization structure: Principles of organization & its types.

**UNIT-II : Operations Management**

production & its types, plant layout, Work study- method study and work measurement - Statistical Quality Control- Control charts -Simple problems

**Material Management:** Need for Inventory control- EOQ (simple problems), ABC analysis and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

**UNIT-III :**

**Human Resource Management**: Concept of HRM, HRD - Functions of HR Manager- types of Wage payment plans – Job Evaluation and Merit Rating- Grievance & redressal mechanism.

**Marketing Management**: Functions of Marketing – Marketing Mix-Marketing strategies based on product Life Cycle, Channels of distribution.

**UNIT-IV : Project Management**

(PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems)

**UNIT-V : Organisational behaviour**

Attitude & behaviour; Leadership styles; motivation- significance, theories; Perception- Perceptual process-Group Dynamics: Types of Groups, Stages of Group Development, Group Behaviour and Group Performance Factors.

**Text Books**

1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, '*Management Science'* Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, *Management Science'* TMH 2011.
3. L. M. Prasad, '*Organisational Behavior'* Sultan Chand Publications.

**References:**

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

1. Koontz & Weihrich: 'Essentials *of management'* TMH 2011
2. Anil Bhat& Arya Kumar : Principles of Management, Oxford University Press, New Delhi,2015.
3. Robbins: Organizational Behaviour, Pearson publications, 2011
4. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011
5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications
6. K. Aswatappa: 'Human Resource Management – text & cases', TMH.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ECXO01 | **PRINCIPLES OF COMMUNICATIONS** | 3 | 0 | 0 | 3 |

**Course outcomes:**

**After successful completion of this course, students should be able to**

CO1 : Analyze the performance of analog modulations schemes in time and frequency domains

CO2 : Analyze the performance of angle modulated signals.

CO3 : Characterize analog signals in time domain as random processes and noise.

CO4 : Characterize the influence of channel on analog modulated signals.

CO5 : Determine the performance of analog communication systems in terms of SNR.

**UNIT-I : Amplitude modulation:**

Introduction, Amplitude Modulation: Time & Frequency – Domain description, switching modulator, Envelop detector.

**UNIT-II :**

**Double side band-suppressed carrier modulation:** Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

**Single side–band and vestigial sideband methods of modulation:** SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB, Transmission of Analog and Digital Television

**UNIT-III :**

**Angle modulation**: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing,

**Phase–Locked Loop:** Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super heterodyne Receiver

**UNIT-IV : Noise in analog modulation:**

Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

**UNIT-V : Digital representation of analog signals**

Introduction, Why Digitize Analog Sources. The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise,

**Pulse Code Modulation:** Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**Text books:**

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 2007, 3rdEdition.
2. Communication Systems – B.P. Lathi, BS Publication, 2006.

**References:**

1. Principles of Communication Systems - Simon Haykin, John Wiley,2nd Edition.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH, 2007.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ECXO02 | **DIGITAL IMAGE PROCESSING** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Perform image manipulations and different digital image processing techniques

CO2 : Perform basic operations like – Enhancement, segmentation, compression, Image transforms and restoration techniques on image.

CO3 : Analyze pseudo and full color image processing techniques.

CO4 : Apply various morphological operators on images

CO5 : Compress digital image and video by applying digital image and video compression algorithm

**SYLLABUS:**

**UNIT-I : Digital Image Fundamentals**

**Introduction**: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

**Image Transforms:** Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform.

**UNIT-II : Intensity Transformations and Spatial Filtering**

**Intensity Transformations and Spatial Filtering:** Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods.

**Filtering in the Frequency Domain**: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters.

**UNIT-III : Image Restoration**

**Image compression**: Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding.

**Image compression**: Fundamentals, Basic compression methods: Huffman coding, Golomb

coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding.

**UNIT-IV : Image segmentation**

**Image segmentation:** Fundamentals, point, line, edge detection, thresholding, region–based segmentation.

**Morphological Image Processing:** Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

**UNIT-V : Color image processing**

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

**TEXTBOOKS:**

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", TataMcGraw-Hill Education, 2011.

**REFERENCEBOOKS:**

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC6O03 | **BIO-MEDICAL ENGINEERING** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**
**After successful completion of this course, students should be able to**

CO1 : Distinguish and describe the Various bio electric potentials provoked by living system
CO2 : Predict and produce the suitable transducer for bio medical application
CO3 : Distinguish the cardio and respiratory instruments and its prosecution
CO4 : Recognize the minor and major instruments in ICU and take curative steps
CO5 : Apply the various electronics signals to know the structure of the body and convert the information of patient as image or Signal

**SYLLABUS**

**UNIT-I : INTRODUCTION TO BIOMEDICAL INSTRUMENTATION**
Age of Biomedical Engineering, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG.

**UNIT-II : ELECTRODES AND TRANSDUCERS**
Introduction, Electrode Theory, Biopotential Electrodes, Examples of Electrodes, Basic Transducer Principles, Biochemical Transducers, The Transducer and Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Transducers with Digital Output.

**UNIT-III : CARDIOVASCULAR SYSTEM AND RESPIRATORY SYSTEM**
The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement ofHeart Sound, Plethysmography, Pulse Sensors, The Physiology of The Respiratory System, Tests and Instrumentation for The Mechanics of Breathing, Respiration Sensor, Respiratory Therapy Equipment.

**UNIT-IV : PATIENT CARE AND MONITORING**
Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Other Instrumentation for Monitoring Patients, Pacemakers, Defibrillators, Radio Frequency Applications of Therapeutic use. Physiological Effects and Electrical Current, Shock Hazards from Electrical. Equipment, Methods of Accident Prevention

**UNIT-V : DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY**
Principles of Ultrasonic Measurement, Ultra sonic Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Ray and Radio-Isotope Instrumentations, CAT

Scan, Emission Computerized Tomography, MRI, Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, The Components of Biotelemetry System, Implantable Units, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring

**Text Books:**

1. "Bio-Medical Electronics and Instrumentation", Onkar N. Pandey, Rakesh Kumar, Katson Books.
2. "Bio-Medical Instrumentation", Cromewell ,Wiebell, Pfeiffer

**References:**

1. "Introduction to Bio-Medical Equipment Technology", 4th Edition, Joseph J. Carr, John M. Brown,
Pearson Publications.
2. "Hand Book of Bio-Medical Instrumentation", Khandapur. McGrawHill

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC6O04 | **Design of IoT Systems** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Explain Internet of Things and its hardware.
CO2 : Explain Components of Internet of Things.
CO3 : Interface I/O Devices, Sensors, and Communication modules.
CO4 : Monitor data and control devices.
CO5 : Implement real time IoT based applications.

**SYLLABUS**

# SYLLABUS

**UNIT-I : Introduction to IoT**

An Overview of Internet of things, IoT Conceptual Frame Work, Architectural Overview, M2M Communication, Technology Behind IoT, Major Components of IoT System, Role of Cloud in IoT, Examples of IoT.

## UNIT-II : Design Standards of IoT

Hardware Computing Components- Arduino, Raspberry Pi, Device Management, Data Enrichments and Consolidation at Gate ways, Business Models for Business Processes in the Internet of Things. IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High-level capabilities. Communication Technologies, Ease of Designing and Affordability.

**UNIT-III : IoT Application Development**

IoT Applications, Internet Connectivity for Communication, Sensing, Wireless Sensor Network, RFID, Actuation, I/O Interfaces. Connectivity and Communication Protocols: MQTT, SOAP, CoAP, UDP, TCP, Bluetooth, HTTP, HTTPS, FTP, TELNET, REST and Restful Environment in IoT.

**UNIT-IV : Business Models and Processing Solution Framework**

Business Models and Business Models Innovation, Business Model Scenarios for IoT, Implementation of Device integration, Data Acquisition, Integration, Storage and Analytics. Cloud Computing Paradigm for Data Collection, Storage and Computing, IoT Cloud Based Services using the Xively and Nimbits, Everything as a Service and Cloud Service Models.

**UNIT-V : IoT Case Studies**

IoT case studies and mini projects based on Industrial Automation, Transportation, Agriculture, Healthcare, Home Automation, Environment Monitoring and other.

## TEXT BOOKS:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

## REFERENCEBOOKS:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley.
2. Getting Started with the Internet of Things CunoPfister , Oreilly.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies,Platforms, and Use Cases", CRC Press,2017.
4. Cypress Semi conductor /PSoC4 BLE (Bluetooth Low Energy) Product Training Modules.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ECXO05 | **MEMS** | **3** | **0** | **0** | **3** |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Understand the basic overview of MEMS and Microsystems with broad category of MEMS& Micro system applications.

CO2 : Understanding the working principles of Microsystems

CO3 : Understand the Scaling Laws in Miniaturization and Materials for MEMS and Microsystems

CO4 : Understand the Micro system Fabrication Process and Analyze the different Micro manufacturing process and Applications.

CO5 : Study and analyze the different types of RF switches, Various Switching Mechanism and their applications

**SYLLABUS**

**UNIT-I : Overview of MEMS and Microsystems**

MEMS and Microsystems, Typical MEMS and Micro-system products, Evolution of Micro-fabrication, Micro-system and Microelectronics, The Multidisciplinary nature of micro-system design and manufacture, Micro-system and Miniaturization. Application of Microsystems in the automotive industry, **Application of Microsystems in other industries**: Health care industry, Aerospace industry, Industrial products, Consumer products, Telecommunications. Markets for Microsystems.

**UNIT-II :**

**Working Principles of Microsystems:** Introduction, Micro-sensors: Acoustic Wave Sensors, Biomedical sensors and Biosensors, Chemical sensors, Pressure sensors, Thermal sensors.

**Micro actuation**: Actuation using thermal forces, shaped memory alloys, Piezoelectric crystals, Electrostatic forces. MEMS with Micro actuators: Micro-grippers, Micro-motors, Microvalves, Micro-pumps.

**UNIT-III :**

**Scaling Laws in Miniaturization**: Introduction to scaling, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Electromagnetic

Forces, Scaling in Electricity, Scaling in Fluid Mechanics, Scaling in Heat Transfer.

**Materials for MEMS and Microsystems**: Introduction, Substrates and wafers, Active substrate materials, Silicon as a substrate material. Silicon compounds, Silicon piezo resistors, Gallium Arsenide, Quartz, Piezoelectric crystals, Polymers, Packing materials.

**UNIT-IV : Micro system Fabrication Process**:

Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour Deposition, Deposition by Epitaxy, Etching.

**Overview of Micro manufacturing and Application**: Bulk Micro manufacturing- any one example of application, LIGA Process- any one example of application

**UNIT-V : Applications of MEMS-Switching**

Introduction, Switch parameters, Basics of switching, Mechanical switches, Electronic switches for RF and microwave applications, Mechanical RF switches, PIN diode RF switches.

**Text Books:**

1. MEMS, Nitaigour Prem chand Mahalik, TMH Publish ong co.
2. Tai-Ran Hsu, “MEMS and Microsystems: Design and Manufacture”, Tata McGraw Hill, (2002).
3. Gabriel M. Rebeiz, “RF MEMS Theory, Design and Technology”, Wiley India Pvt Ltd.

**Reference Books:**

1. Stephen D. Senturia, “Microsystem Design”, Springer International Edition, (2010).
2. Mohamed Gad-el-Hak, “The MEMS Handbook”, CRC Press, (2002).
3. Chang Liu, “Foundations of MEMS”, Second Edition, Pearson Publication.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ECXO06 | **MECHATRONICS** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Describe the various mechatronics systems devices and Design components in the design of electro mechanical systems.

CO2 : Demonstrate Basic electronic devices used in mechatronics design process

CO3 : Explain the Different Controllers and write the Assembly language program.

CO4 : Differentiate Hydraulic and pneumatic actuating systems and Construct a system based on requirement

CO5 : Compose simple ALP and PLC programs for different applications

**SYLLABUS**

**UNIT-I : MECHATRONICS SYSTEMS**

About Mechatronics, Elements & levels of mechatronics system, Need of Mechatronics, Mechatronics design process, Definition of system, measurement systems and control systems, advantages and disadvantages of mechatronics systems. Dynamic models and analogy, Design of mechatronics systems & future trends.

**UNIT-II : Basic Electronic Devices and Sensors**

PN Junction Diode, Zener Diode, Transistor, FET, Amplifiers, Filters, Op-Amp as Adder, Subtractor, Differential Amplifier, Logarithmic Amplifier, Comparator, Filter and instrumentation Amplifier. Sensors and transducers, types, displacement, position, motion, force, flow, liquid level, temperature and light sensors.

**UNIT-III : Digital Electronics**

Digital systems, Basic Gates, Digital logic control, Analog to Digital and Digital to Analog conversions, Microprocessors and micro controllers programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

**UNIT-IV : Hydraulic and pneumatic actuating systems**

Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electropneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

**UNIT-V : Programming**

Types of Languages (High level, Assembly level and Low level) Assembly language Program examples (Addition, Subtraction, Multiplication, Division, Ascending numbers, descending numbers, finding smallest number, largest number, even number and odd number in given numbers, interfacing motor, interfacing Seven segment display and LCD)
Ladder Programming: Ladder programming basic Symbols, Ladder Logic Programming Rules, Skip, Jump, Timers, Counters, data Registers, PLC program for realization of logic gates, PLC program for Elevator Control, PLC program for Bottle filling Plant, PLC

program for water level control, PLC program for with timers and counter

**TEXTBOOKS:**

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition.
2. Mechatronics – Smaili A, Mrad F, Oxford Higher Education, Oxford University Press.
3. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3 rdEdition,1994

**REFERENCEBOOKS:**

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdas shetty /Richard/Thomson.
4. Mechatronics/M.D.Singh /J.G.Joshi /PHI.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ITXO01 | **DATA BASE MANAGEMENT SYSTEM** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Describe a relational database and object-oriented database

CO2 : Create, maintain and manipulate are relational data base using SQL

CO3 : Describe ER model and normalization for data base design

CO4 : Examine issues in data storage and query processing and can formulate appropriate solutions.

CO5 : Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage

**SYLLABUS**

**UNIT-I : Introduction**

Database system, Characteristics (Database Vs File System), Database Users(Actors on Scene, Workers behind the scene), Advantages of Data base systems, Data base applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence.

**UNIT-II : Relational Model**

Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance

**BASICSQL**: Table definitions (create, alter), different DML operations(insert, delete, update),basic SQL querying(select and project) using where clause, arithmetic & logical operations, SQL functions: Date, Time, Numeric and String conversion

**UNIT-III : Entity Relationship Model**

Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams**.** ER Diagrams for Bus reservation system. Banking system and Library information system, Aggregation functions.

**UNIT-IV : Schema Refinement (Normalization)**

Purpose of Normalization or schem are finement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NFand3NF),Boyce-codd normal form(BCNF), 4NF and 5NF

**UNIT-V :**

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**Transaction Concept:** Introduction of Transaction Processing, DBMS Buffers, Types of Failures, Transaction states and Operations, System log, Transaction Properties, Schedules and Types of Schedules.

**File Organizations and Indexing**: File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes.

**TEXTBOOKS:**

1. Data base Management Systems,3/e, Raghurama Krishnan, Johannes Gehrke,TMH
2. Data base System Concepts,5/e, Silber schatz, Korth, TMH

**REFERENCEBOOKS:**

1) IntroductiontoDatabaseSystems,8/e CJDate,PEA.
2) Data base Management System,6/eRamez Elmasri, Shamkant B.Navathe,PEA
3) Data base Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

**e-Resources:**

1) https://nptel.ac.in/courses/106/105/106105175
2) https://www.geeksforgeeks.org/introduction-to-nosql

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ITXO03 | **Principles of Software Engineering** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Transform an Object-Oriented Design into high quality, executable code

CO2 : Skills to design, implement, and execute test cases at the Unit and Integration level

CO3 : Compare conventional and agile software methods

**SYLLABUS:**

**UNIT-I**

The Nature of Software, The Unique Nature of Web Apps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths, How It All Starts. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.

**UNIT-II**

Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements. Requirements Analysis

**UNIT-III**

Scenario-Based Modelling, UML Models That Supplement the Use Case, Data Modelling Concepts, Class-Based Modelling, Requirements Modelling Strategies, Flow-Oriented Modelling, Creating a Behavioural Model, Requirements Modelling for WebApps.

**UNIT-IV**

Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Styles, Architectural Mapping Using Data Flow, Conducting Component-Level Design, Component-Level Design for Web Apps, Designing Traditional Components, Component-Based Development, The Golden Rules

**UNIT-V**

A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for WebApps, Validation Testing, System Testing, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing and Black Box Testing.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**TEXTBOOKS:**

1. Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
2. Software Engineering, Ian Sommerville, Ninth Edition, Pearson.

**REFERENCE BOOKS:**

1. Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010.
2. Software Engineering, UgrasenSuman, Cengage.

**E-REFERENCES:**

1. https://nptel.ac.in/Courses/SoftwareEngineering
2. https://www.Coursera.org/Courses?query=softwareeni

neering

.https://www.udemy.com/Courses/development/software-engineering

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ITXO04 | **Introduction to Machine Learning** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Identify the characteristics of data sets and compare the trivial data and big data for various applications.
CO2 : Understand machine learning techniques and computing environment that are suitable for the applications under consideration.

CO3 : Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
CO4 : Developscalingupmachinelearningtechniquesandassociatedcomputingtechniquesandtechnologiesforvariousapplications.
CO5 : Implement various ways of selecting suitable model parameters for different machine learning techniques.

**SYLLABUS**

**UNIT-I : Brief Introduction to Machine Learning**

What is Machine learning, Machine learning models, Machine learning applications, Challenges. Major advantages and drawbacks Types of Machine learning, Supervised Learning, Unsupervised Learning, Reinforcement Learning

**UNIT-II : Statistics basics**

Mean, median, mode, Variance, standard deviation and correlation, Statistical Decision Theory, Regression & Classification Bias, Types of regression, Linear Regression, Multiple Regression

**UNIT-III : Dimensionality Reduction**

Subset Selection, Shrinkage Methods, Principal Components Regression Linear Classification, Logistic Regression, Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification

**UNIT-IV :**

Artificial Neural Networks (Early models, Back Propagation, Initialization, Training & Validation) Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation) Decision Trees Evaluation Measures, Hypothesis Testing Ensemble Methods, Graphical Models

**UNIT-V :**

Clustering, Gaussian Mixture Models, Spectral Clustering Ensemble Methods Learning Theory, Reinforcement Learning

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

**Text Book**

1. T. Hastie, R.Tibshirani, J.Friedman. TheElementsofStatisticalLearning,2e, 2008.
2. Christopher Bishop. PatternRecognitionandMachineLearning.2e.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CSXO02 | **Cloud Computing** | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : To implement Virtualization

CO2 : To implement Task Scheduling algorithms
CO3 : Apply Map-Reduce concept to applications
CO4 : To build Private Cloud
CO5 : Broadly educate to know the impact of engineering on legal and societal issues involved

**SYLLABUS:**

**UNIT-I : Introduction**

Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing. Parallel and Distributed Systems: introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, and model concurrency with Petri Nets.

**UNIT-II : Cloud Infrastructure**

At Amazon, The Google Perspective, Microsoft Windows Azure, Open-Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing, Cloud Computing: Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, HPC on cloud.

**UNIT-III : Cloud Resource virtualization**

Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades, Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource

management and dynamic application scaling

**UNIT-IV : Storage Systems**

Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2), Cloud Security: Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

**UNIT-V : Cloud Application Development**

Amazon Web Services: EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming ( Text Book 1), Google: Google App Engine, Google Web Toolkit (Text Book 2), Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

**Text Books:**

1. Cloud Computing, Theory and Practice,1st Edition, Dan C Marinescu, MK Elsevier publisher ,2013
2. Cloud Computing, A Practical Approach, 1st Edition, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH, 2017

**Reference Books:**

1. Mastering Cloud Computing, Foundations and Application Programming,1st Edition, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH,2013
2. Essential of Cloud Computing, 1st Edition, K Chandrasekharan, CRC Press, 2014.
3. Cloud Computing, A Hands on Approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| R20GE5M04 | INTELLECTUAL PROPERTY RIGHTS AND PATENTS (IPR& P) | 2 | 0 | 0 | 0 |

**Course Objectives**:

- To know the importance of Intellectual property rights, which plays a vital role in Advanced Technical and Scientific disciplines.
- Imparting IPR protections and regulations for further advancement, so that the Students can familiarize with the latest developments.

**COURSE OUTCOMES:**

**CO 1**: Identify different types of intellectual property rights may be prescribed by an output with supporting agencies internationally.
**CO 2**: Explain the ways to protect literary and artistic works of the authors.
**CO 3**: Illustrate the process of registering innovative products i.e., Patents
**CO 4**: Analyze the ways to maintain of Trade Marks
**CO 5**: Suggest the ways to protect trade secrets in the organizations Explain different laws available related to cybercrimes.

**UNIT – I: Introduction to Intellectual property:**

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT – II: Law of Copyrights:**

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**UNIT – III: Law of Patents:**

Foundation of patent law, patent searching process, ownership rights and transfer. Patent litigation. Dilution of patent rights, patent registration.

**UNIT – IV: Trade Marks**:

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter (strength and categories of trade marks), selecting, and evaluating trade mark, trade mark registration processes.

**UNIT - V: Trade Secrets and Cyber law:**

Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation. Introduction to Cyber Law – Information Technology Act 2000 & Cyber Crimes & its types.

**Real time examples must be added to the concepts requires.**

**REFERENCES:**

1. Intellectual property right, Deborah, E. Bouchoux, Cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc- Graw Hill Publishing Company Ltd.
3. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4. Cyber Law - Texts & Ca

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE6M02 | **Professional Ethics and Human Values** | 2 | 0 | 0 | 0 |

COURSE OBJECTIVES:

- To give basic insights and inputs to the student to inculcate Human values to growas a responsible human being with proper personality.
- Professional Ethics instills the student to maintain ethical conduct and dischargetheir professional duties.

COURSE OUTCOMES:

CO 1: Student can be able to Define, Civic Values, Ethics, Behavior, Honesty, Co-Operation& Commitment
**CO 2**: Student can be able to Discuss Engineering Ethics and Social Experimentation for the benefit of stakeholders
**CO 3**: Analyze the responsibilities of Engineers towards Safety & risk, to improve the Safety and minimize the risk.
**CO 4**: Present the duties & rights of Engineers
CO 5: Elucidate the role of Engineers in the ever changing the global Marketing

**UNIT I: Human Values & Principles for Harmony**: Morals, Values and Ethics – Integrity - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment– Self-confidence – Spirituality- Character. Truthfulness – Customs and Traditions -Value Education –Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence.

**UNIT II: Engineering Ethics and Social Experimentation:**

History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments — Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

**UNIT III: Engineers' Responsibilities towards Safety and Risk:**

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/s Immediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

**UNIT IV: Engineers' Duties and Rights:**

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving- Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.

**UNIT V: Global Issues:**

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

## References:

1. Professional Ethics, R. Subramaniam – Oxford Publications, New Delhi.
2. Professional Ethics and Morals, A. R. Aryasri, Dharanikota Suyodhana - Maruthi Publications.
3. Engineering Ethics, Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
4. Engineering Ethics & Human Values, M. Govindarajan, S. Natarajan and V. S.Senthil Kumar- PHI Learning Pvt. Ltd – 2009.
5. Professional Ethics and Human Values, A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
6. Professional Ethics and Human Values, D. R. Kiran-Tata McGraw-Hill - 2013

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## COURSE STRUCTURE & SYLLABUS – R20 Regulation

### SEMESTER -I

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH1T06 | Differential Equations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH1T04 | Applied Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS1T01 | Problem Solving and Programming Using C | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME1T01 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | 20EE1T02 | Basics of Electrical & Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20SH1L04 | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CS1L01 | Problem Solving and Programming Using C Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS1L02 | IT Workshop | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory:** BSC-2, ESC-3 **Practical:**BSC-1, ESC-2

### SEMESTER-II

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH2T07 | Linear Algebra & Vector Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH2T02 | Applied Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20SH2T01 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EC2T01 | Digital Logic Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS2T01 | Python Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE2M01 | Environmental Sciences | 2 | 0 | 0 | 0 | -- | -- | -- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20SH2L01 | English Communicative Skills Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20SH2L02 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS2L01 | Python Programming Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory:** BSC-2, HSMC-1, ESC-2 **Practical:** MC-1, BSC-1, HSMC-1, ESC-1

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**SEMESTER-III**

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CS3T03 | Software Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CS3T05 | Data Structures & Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20IT3T01 | Object Oriented Programming through Java | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20IT3T03 | Discrete Mathematics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS3T02 | Computer Organization and Architecture | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE3M01 | Constitution of India | 2 | 0 | 0 | 0 | -- | -- | -- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CS3L02 | Object Oriented Analysis and Design Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS3L03 | Data Structures & Algorithms Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20IT3L01 | Object Oriented Programming through Java lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20CS3S01 | Mobile App Development | 1 | 0 | 2 | 2.0 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **21.5** | **210** | **490** | **700** |

**Theory:** PCC-5, MC-1 **Practical:** PCC-3, SC-1

**SEMESTER-IV**

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH4T05 | Probability & Statistics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CS4T02 | Formal Languages and Automata Theory | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS4T01 | Database Management Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20IT4T02 | Web Technologies | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20SH4T01 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20CS4L01 | Database Management Systems Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20IT4L02 | Web Technologies Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS4L02 | Data Visualization Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS4S01 | Mongo DB | 1 | 0 | 2 | 2.0 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **21.5** | **210** | **490** | **700** |
| 10 | | Honor/Minor Courses | 3 | 1 | 0 | 4 | 30 | 70 | 100 |

**Theory:** BSC-1, PCC-3, HSMS-01 **Practical:** PCC-3, SC-1

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**SEMESTER-V**

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CS5T01 | Computer Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20IT5T02 | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20IT5T01 | Operating systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EC5OXX | **Open Elective-I** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS5EXX | **Professional Elective - I**<br>1. Data warehousing and Data Mining<br>2. Software Project Management<br>3. Object Oriented Analysis and Design<br>4. Advanced Unix Programming<br>5. Advanced Computer Architecture | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE5M01 | Professional Ethics and Human Values | 2 | 0 | 0 | 0 | ---- | --- | --- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CS5L01 | Computer Networks Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20IT5L02 | Unix Operating Systems Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS5S01 | **Skill Oriented CourseIII/Soft Skill Course** | 1 | 0 | 2 | 2.0 | 15 | 35 | 50 |
| 10 | | **Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)** | 0 | 0 | 0 | 1.5 | --- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |
| 11 | | Honor/Minor Courses | 3 | 1 | 0 | 4 | 30 | 70 | 100 |

**Theory:** PCC-4, OE-1, HSMS-1 **Practical:** PCC-2, SC-1

**SEMESTER -VI**

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CS6T01 | Cryptography and Network Security | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CS6T02 | Compiler Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS6T03 | Artificial Intelligence | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EC6OXX | **Open Elective-II** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS6EXX | **Professional Elective - II**<br>1. Cloud Computing<br>2. Big Data Analytics<br>3. Machine Learning<br>4. Network Programming<br>5. Internet of Things | 3 | 0 | 0 | 3 | 30 | 70 | 100 |

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|---|---|---|---|---|---|---|---|---|---|
| 6 | 20GE6M04 | IPR & PATENTS | 2 | 0 | 0 | 0 | | | |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CS6L01 | Cryptography and Network Security Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS6L02 | Compiler Design Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS6L03 | Artificial Intelligence Lab using Python | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20SH6S01 | Soft Skills | 1 | 0 | 2 | 2.0 | -- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |
| 11 | | Honor/Minor Courses | 3 | 1 | 0 | 4 | 30 | 70 | 100 |

**Theory:** PCC-4, OE-1, HSMS-1 **Practical:** PCC-3, SC-1

**SEMESTER-VII**

| SNo | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CS7EXX | **Professional Elective - III**<br>1. Mobile Computing<br>2. Neural Networks and Soft Computing<br>3. Ad-hoc and Sensor Networks<br>4. Deep Learning Techniques<br>5. Information Retrieval System | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CS7EXX | **Professional Elective - IV**<br>1. Distributed systems<br>2. Social Networks & Semantic Web<br>3. Computer Vision<br>4. MOOCS-NPTEL / SWAYAM<br>5. Game Theory | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS7EXX | **Professional Elective - V**<br>1. Block Chain Technologies<br>2. Quantum Computing<br>3. Ethical Hacking<br>4. MOOCS-NPTEL / SWAYAM<br>5. Parallel Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME7O3X | **Open Elective-III** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS704X | **Open Elective-IV** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20SH70XX | **Management Science** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 7 | PR | **Industrial / Research Internship 2 months (Mandatory) after third year (to be evaluated during VII** | 0 | 0 | 0 | 3 | ---- | 50 | 50 |

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|---|---|---|---|---|---|---|---|---|---|
| | | **semester)** | | | | | | | |
| 8 | 20CS7S01 | Skill Oriented Course (Advanced) **Devops** | 1 | 0 | 2 | 2 | 15 | 35 | 50 |
| | | | | | | **Total Credits** | **23** | **195** | **505** | **700** |
| 9 | | Honor /Minor Courses | 3 | 1 | 0 | 4 | 30 | 70 | 100 |

**Theory:** PCC-3, OE-2, HSMS-1 **Practical:** PR-1, SC-1

**SEMESTER-VIII**

| S No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | | | |
| 1 | 20CS8P01 | Major Project Work, Seminar, Internship in industry | 0 | 0 | 0 | 12 | 60 | 140 | 200 |
| | | **Total Credits** | | | | 12 | 60 | 140 | 200 |
| 2 | | Honor/Minor Courses (MOOCS-I) | - | - | - | 2 | - | - | - |
| 3 | | Honor/Minor Courses (MOOCS-II) | - | - | - | 2 | - | - | - |

**Practical: PROJ-1,Honor/Minor Courses-2, MOOCS-I & II***,(*– Equivalent grades will be given by BOS)

**LIST OF OPEN ELECTIVE COURSES**

| S. No. | Course Code | Course Title | Offering Dept. |
|---|---|---|---|
| 1 | 20CEXO01 | Elements of Civil Engineering | CE |
| 2 | 20CEXO02 | Disaster Management | |
| 3 | 20CEXO03 | Intelligent Transport Systems | |
| 4 | 20CEXO04 | Remote sensing & Geographical Information systems | |
| 5 | 20EEXO01 | Electrical Safety Management | EEE |
| 6 | 20EEXO02 | Non-conventional Energy sources | |
| 7 | 20EEXO03 | Electrical and Hybrid Vehicle | |
| 8 | 20EEXO04 | Electrical Energy Conservation and Auditing | |
| 9 | 20EEXO05 | Industrial Robotics | |
| 10 | 20MEXO01 | Optimization Techniques | ME |
| 11 | 20MEXO02 | Robotics | |
| 12 | 20MEXO03 | Industrial Management Sciences | |
| 13 | 20MEXO04 | Automation in Manufacturing | |
| 14 | 20ECXO01 | Principles of Communication | ECE |
| 15 | 20ECXO02 | Digital image Processing | |
| 16 | 20ECXO03 | Bio Medical Engineering | |
| 17 | 20ECXO04 | Introduction to Internet of Things | |
| 18 | 20ECXO05 | MEMS | |
| 19 | 20ECXO06 | Mechatronics | |
| 20 | 20CSXO01 | Computer Graphics | CSE |
| 21 | 20CSXO02 | Cloud Computing | |
| 22 | 20CSXO03 | Computer Networks | |
| 23 | 20CSXO04 | Cryptography and Network Security | |

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|---|---|---|---|
| 24 | 20ITXO01 | Data Base Management systems (DBMS) | IT |
| 25 | 20ITXO02 | Java Programming | |
| 26 | 20ITXO03 | Principle of software Engineering (PSE) | |
| 27 | 20ITXO04 | Introduction to Machine Learning | |
| 28 | 20CIXO01 | Python Programming | CAI |
| 29 | 20CIXO02 | Fundamentals of Artificial Intelligence | |
| 30 | 20CIXO03 | Human Computer Interaction | |
| 31 | 20CIXO04 | Applications of AI | |
| 32 | 20CDXO01 | Object Oriented Programming (C++) | CSD |
| 33 | 20CDXO02 | Data Structures | |
| 34 | 20CDXO03 | Data warehouse and Mining | |
| 35 | 20CDXO04 | Big Data Analysis | |

**HUMANITIES AND SOCIAL SCIENCE ELECTIVE**

| S. No. | Course Code | Course Title |
|---|---|---|
| 1 | 20SH7E01 | Entrepreneurship Development |
| 2 | 20SH7E02 | Business Environment |
| 3 | 20SH7E03 | Digital Marking |
| 4 | 20SH7E04 | Human Resource development and OB |

**LIST OF HONORS COURSES**

| S. No | Course Code | Course Name |
|---|---|---|
| **Year/Sem: II-II (Pool-1) Data Science** | | |
| 1 | 20CS4H01 | Introduction to Data Science |
| 2 | 20CS4H02 | Statistical Foundations for Data Science |
| 3 | 20CS4H03 | Data Analytics and Visualization |
| 4 | 20CS4H04 | Python for Data Science |
| **Year/Sem: III-I (Pool-2) AI & ML** | | |
| 1 | 20CS5H01 | Mathematics for Machine Learning |
| 2 | 20CS5H02 | Text Mining and Time Series Analysis |
| 3 | 20CS5H03 | Natural Language Processing |
| 4 | 20CS5H04 | Reinforcement Learning |
| **Year/Sem: III-II (Pool-3) Cyber Security** | | |
| 1 | 20CS6H01 | Cyber Security Essentials |
| 2 | 20CS6H02 | Secure Coding |
| 3 | 20CS6H03 | Vulnerability Assessment & Penetration Testing |
| 4 | 20CS6H04 | Malware Analysis |
| **Year/Sem: IV-I (Pool-4) Systems Engineering** | | |
| 1 | 20CS7H01 | Data Communications and Information Coding Theory |
| 2 | 20CS7H02 | Service Oriented Architectures |
| 3 | 20CS7H03 | Design of Secure Protocols |
| 4 | 20CS7H04 | Network Coding |

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**LIST OF MINORS COURSE (GENERAL)**

| S. No | Course Code | Course Name |
|---|---|---|
| 1 | 20CS4M01 | Fundamentals of Data Structures |
| 2 | 20CS5M01 | Programming with JAVA |
| 3 | 20CS6M01 | Operating Systems |
| 4 | 20CS7M01 | Computer Networks |
| 5 | 20CS7M02 | Database Management Systems |

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SEMESTER -V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS5T01 | COMPUTER NETWORKS | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objectives are

- Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model
- Study data link layer concepts, design issues, and protocols
- Gain core knowledge of Network layer routing protocols and IP addressing
- Study Session layer design issues, Transport layer services, and protocols
- Acquire knowledge of Application layer and Presentation layer paradigms and protocols

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Illustrate the OSI and TCP/IP reference model
**CO-2:** Analyze MAC layer protocols and LAN technologies
**CO-3:** Summarize various Routing algorithms and Congestion control principles.
**CO-4:** Describe Transport layer protocols.
**CO-5:** Develop application layer protocols

**UNIT I**

**Introduction:** History and development of computer networks, Basic Network Architectures: OSI reference model, TCP/IP reference model, and Networks topologies, types of networks (LAN, MAN, WAN)

**Physical layer:** Different types of transmission media Guided and unguided, Multiplexing methods : TDM, FDM

**UNIT II**

**Data Link Layer:** Design Issues and services: framing, error control, flow control, medium access control. Error & Flow control mechanisms: sliding window protocols: stop and wait, Go back N and selective repeat.

**MAC Sub Layer:** MAC protocols: Aloha, slotted aloha, CSMA, CSMA/CD, CSMA/CA, polling, token passing, scheduling.

**UNIT III**

**Network Layer:** Network Layer Services, packet switching, Network Layer Performance, IPv4 addresses, Forwarding of IP packets, Internet Protocol (IP), IPv6 Protocol and addressing, Transition from IPv4 to IPv6, Mobile IP.

**Routing Algorithms:** Least Cost Routing, Distance vector Routing, Link-State Routing, and Hierarchical Routing.

**Congestion control:** Approaches to Congestion Control, Traffic-Aware Routing, Traffic

Throttling, Load shedding, traffic shaping.
**Internet Control Protocols:** ARP, RARP, ICMP and DHCP.

**UNIT IV**

**Transport Layer**: The Transport Service-Services Provided to the Upper Layers, Transport Service Primitives, Elements of Transport Protocols –Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Congestion control-Desirable Bandwidth allocation, Regulating the sending rate, The Internet Transport Protocols: Introduction to UDP, Remote procedure call, Real-Time transport protocols, Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, SCTP.

**UNIT V**

**Application Layer**: Domain Name Space (DNS), SNMP, Electronic mail: MIME,SMTP, IMAP, WWW, FTP, HTTP

**Text Books:**

1) Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Pearson Education India; 5th Edition, 2013
2) Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2012

**Reference Books:**

1) Computer Networks: A Systems Approach, LL Peterson, BS Davie, Morgan-Kauffman, 5th Edition, 2011.
2) Computer Networking: A Top-Down Approach JF Kurose, KW Ross, Addison-Wesley, 5th Edition, 2009
3) Data and Computer Communications, William Stallings, Pearson, 8th Edition, 2007

**E-Resources:**

1)https://nptel.ac.in/courses/106/105/106105183/

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SEMESTER -V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT5T02 | DESIGN AND ANALYSIS OF ALGORITHMS | 3 | 0 | 0 | 3 |

**Course Objectives:**

• To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms

• To introduce the different algorithmic approaches for problem solving through numerous example problems

• To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Describe asymptotic notation used for analyze the performance of algorithms, denote its time complexity, apply sets and graph search algorithms to real world problems

**CO-2:** Solve problems using divide and conquer and greedy method algorithmic approaches

**CO-3:** Solve problems using dynamic programming algorithmic approaches

**CO-4:** Solve problems using backtracking and branch and bound algorithmic approaches

**CO-5:** Demonstrate an understanding of NP- Completeness theory and string matching

**UNIT-I**

**Introduction:** Algorithm Definition, Algorithm Specification, Pseudo code for expressing algorithm, performance Analysis, asymptotic notation.

**Sets & Disjoint set union:** introduction, union and find operations.

**Basic Traversal & Search Techniques:** Techniques for Graphs, connected components and Spanning Trees, Bi-connected components and DFS.

**UNIT-II**

**Divide and Conquer:** General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort.

**The Greedy Method:** The general Method, container loading, knapsack problem, Job sequencing with deadlines, minimum-cost spanning Trees.

**UNIT-III**

**Dynamic Programming:** The general method, multistage graphs, All pairs-shortest paths, single-source shortest paths: general weights, optimal Binary search trees, 0/1 knapsack, reliability Design, The traveling salesperson problem

**UNIT-IV**

**Backtracking:** The General Method, The 8-Queens problem, sum of subsets, Graph coloring,

Hamiltonian cycles

**Branch and Bound:** FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack problem, Traveling salesperson problem.

**UNIT-V**

**NP-Hard and NP-Complete problems**: Basic concepts, Cook's Theorem.

**String Matching**: Introduction, String Matching-Meaning and Application, Naive String Matching Algorithm, Rabin-Karp Algorithm, Knuth-Morris-Pratt Automata.

**Text Books:**

1) Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
2) Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press.

**Reference Books:**

1) Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia Publications, 2008.
2) S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press.

**E-Resources:**

1)http://nptel.ac.in/courses/106101060/

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SEMESTER -V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT5T01 | OPERATING SYSTEMS | 3 | 0 | 0 | 3 |

**Course Objectives:**

The objectives of this course are to

- Introduce to the internal operation of modern operating systems
- Define, explain, processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems
- Understand File Systems in Operating System like UNIX/Linux and Windows
- Understand Input Output Management and use of Device Driver and Secondary Storage (Disk) Mechanism
- Analyze Security and Protection Mechanism in Operating System

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Describe various generations of Operating System and functions of Operating System

**CO-2:** Describe the concept of program, process and thread and analyze various CPU Scheduling Algorithms and compare their performance

**CO-3:** Solve Inter Process Communication problems using Mathematical Equations by various methods

**CO-4:** Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques

**CO-5:** Outline File Systems in Operating System like UNIX/Linux and Windows

**UNIT I**

**Operating Systems Overview**: Operating system functions, Operating system structure, Operating systems operations, Open-Source Operating Systems.

**System Structures**: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls.

**UNIT II**

**Process Concept:** Process scheduling, Operations on processes, Inter-process communication. Multithreaded Programming: Multithreading models, Thread libraries, threading issues. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling.

**Inter-process Communication:** Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Classical IPC Problems - Dining philosopher's problem.

**UNIT III**

**Memory-Management Strategies**: Introduction, Swapping, Contiguous memory allocation,

Paging, Segmentation.
**Virtual Memory Management**: Introduction, Demand paging, Page replacement Algorithms.

**UNIT IV**
**Deadlocks**: Resources, Conditions for resource deadlocks, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.
**File Systems**: Files, Directories, File system implementation.
**Secondary-Storage Structure**: Overview of disk structure, and attachment, Disk scheduling.

**UNIT V**
**System Protection**: Goals of protection, Principles and domain of protection, Access control.
**System Security**: Introduction, Program threats, System and network threats, Cryptography for security, User authentication, implementing security defenses, Firewalling to protect systems and networks.
Case Studies: Linux, Microsoft Windows.

**Text Books:**
1) Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
2) Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Inter process Communication and File systems.)

**Reference Books:**
1) Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
2) Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
3) Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004.

**E-Resources:**
1)https://nptel.ac.in/courses/106/105/106105214/

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| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS5E01 | PROFESSIONAL ELECTIVE-I<br>1. DATA WAREHOUSING AND DATA MINING | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Design a Data warehouse system and perform business analysis with OLAP tools
**CO-2:** Apply suitable pre-processing and visualization techniques for data analysis
**CO-3:** Apply frequent pattern and association rule mining techniques for data analysis
**CO-4:** Apply appropriate classification techniques for data analysis
**CO-5:** Apply appropriate clustering techniques for data analysis.

**UNIT I**

**Data Warehousing, Business Analysis and On-Line Analytical Processing (OLAP):** 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 – Introduction:** Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues, applications, Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III**

**Data Mining - Frequent Pattern Analysis:** 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**

**Classification:** 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.

## UNIT V

**Clustering:** 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.

## Text Books:

1) Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2) Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson, 2016.

## 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, ShyamDiwakar 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.

## E-Resources:

1) https://www.saedsayad.com/data_mining_map.htm
2) https://nptel.ac.in/courses/106/105/106105174/
3) (NPTEL course by Prof.PabitraMitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview
4) (NPTEL course by Dr. Nandan Sudarshanam) http://www.saedsayad.com/

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SEMESTER -V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS5E02 | PROFESSIONAL ELECTIVE-I<br>2. SOFTWARE PROJECT MANAGEMENT | 3 | 0 | 0 | 3 |

**Course Objectives:**

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

•To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project

•To compare and differentiate organization structures and project structures

•To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Apply the process to be followed in the software development life-cycle models.

**CO-2:** Apply the concepts of project management & planning.

**CO-3:** Implement the project plans through managing people, communications and change

**CO-4:** Conduct activities necessary to successfully complete and close the Software projects

**CO-5:** Implement communication, modeling, and construction & deployment practices in software development.

**UNIT I**

**Conventional Software Management:** The waterfall model, conventional software Management performance.

**Evolution of Software Economics:** Software Economics, pragmatic software cost estimation.

**Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

**UNIT II**

**The Old Way and The New:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

**Life Cycle Phases:** Engineering and production stages, inception, Elaboration, construction, transition phases.

**Artifacts of the Process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

**UNIT III**

**Model Based Software Architectures:** A Management perspective and technical

perspective.

**Work Flows of the Process**: Software process workflows, Iteration workflows. **Checkpoints of the Process**: Major mile stones, Minor Milestones, Periodic status assessments.

**UNIT IV**

**Iterative Process Planning**: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

**Project Organizations and Responsibilities**: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

**UNIT V**

**Process Automation**: Automation Building blocks, The Project Environment.

**Project Control and Process Instrumentation**: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

**Project Estimation and Management**: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2)

**Text Books:**

1) Software Project Management, Walker Royce, Pearson Education, 2005.
2) Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH.

**Reference Books:**

1) Software Project Management, Joel Henry, Pearson Education.
2) Software Project Management in practice, PankajJalote, Pearson Education, 2005.
3) Effective Software Project Management, Robert K.Wysocki, Wiley, 2006.

**E-Resources**

1. https://archive.nptel.ac.in/courses/106/105/106105218/

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SEMESTER -V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS5E03 | PROFESSIONAL ELECTIVE-I<br>3. OBJECT ORIENTED ANALYSIS AND DESIGN | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand how to solve complex problems
- Analyze and design solutions to problems using object-oriented approach
- Study the notations of Unified Modeling Language

**Course Outcomes:**

**At the end of the course, students will be able to:**

**CO-1:** Find solutions to the complex problems using object-oriented approach
**CO-2:** Represent classes, responsibilities and states using UML notation
**CO-3:** Identify classes and responsibilities of the problem domain
**CO-4**: Develop and explore the behavioral model
**CO-5**: Apply the concepts of architectural design for deploying the code for software

**UNIT-I:**

**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems, Evolution of Object Model, Foundation of Object Model, Elements of Object Model, Applying the Object Model.

**UNIT-II:**

**Classes and Objects**: Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.

**UNIT-III:**

**Introduction to UML:** Why we model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams.

**UNIT-IV:**

**Basic Behavioral Modeling**: Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.
**Advanced Behavioral Modeling**: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

**UNIT-V:**

**Architectural Modeling:** Component, Deployment, Component diagrams and Deployment

diagrams. Case Study: The Unified Library application.

**TEXT BOOKS:**

1. "Object- Oriented Analysis And Design with Applications", Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, 3rd edition, 2013, PEARSON.
2. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON.

**REFERENCE BOOKS:**

1. "Object-oriented analysis and design using UML", Mahesh P. Matha, PHI
2. "Head first object-oriented analysis and design", Brett D. McLaughlin, Gary Pollice, Dave West, O Reilly
3. "Object-oriented analysis and design with the Unified process", John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning
4. "The Unified modeling language Reference manual", James Rumbaugh, Ivar Jacobson, Grady Booch, Addison

**E-Resources:**

1. https://archive.nptel.ac.in/courses/106/105/106105153/

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SEMESTER -V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS5E04 | Professional Elective-I<br>4. Advanced Unix Programming | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To provide introduction to UNIX commands File System
- To gain an understanding of important aspects related to the SHELL and the process
- To provide a comprehensive introduction to SHELL programming, services and utilities

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Understanding the basic set of commands and utilities in Linux/UNIX systems
**CO-2:** To learn to develop software for Linux/UNIX systems and file system
**CO-3:** To learn the important Linux/UNIX library functions and system calls and shell
**CO-4:** To understand the inner workings of filters.
**CO-5:** To obtain a foundation for an Shell Programming

**UNIT-I**

**Introduction to Unix-Brief History**-What is Unix-Unix Components-Using Unix-Commands in Unix Some Basic Commands-Command Substitution-Giving Multiple Commands.

**UNIT-II**

**The File system** –The Basics of Files-What's in a File-Directories and File Names-Permissions-I Nodes The Directory Hierarchy, File Attributes and Permissions-The File Command knowing the File Type The Chmod Command Changing File Permissions-The Chown Command Changing the Owner of a File-The Chgrep Command Changing the Group of a File.

**UNIT-III**

**Using the Shell**-Command Line Structure-Met characters-Creating New Commands-Command Arguments and Parameters-Program Output as Arguments-Shell Variables- -More on I/O Redirection Looping in Shell Programs.

**UNIT-IV**

**Filters**-The Grep Family-Other Filters-The Stream Editor Sed-The AWK Pattern Scanning and processing Language-Good Files and Good Filters.

**UNIT-V**

**Shell Programming**-Shell Variables-The Export Command-The Profile File a Script Run During Starting-The First Shell Script-The read Command-Positional parameters-The $?

Variable knowing the exit Status-More about the Set Command-The Exit Command-Branching Control Structures-Loop Control Structures-The Continue and Break Statement-The Expr Command: Performing Integer Arithmetic-Real Arithmetic in Shell Programs-The here Document(<<)-The Sleep Command Debugging Scripts-The Script Command-The Eval Command-The Exec Command. The Process-The Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background processes-Internal and External Commands-Process Creation-The Trap Command-The Stty Command The Kill Command-Job Control.

**TEXT BOOKS:**

1. The UNIX programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
2. Introduction to UNIX Shell Programming by M.G.Venkateshmurthy, Pearson.

**REFERENCE BOOKS:**

1. Unix and shell programming by B.M. Harwani, OXFORD university press.

**E-Resources**

1. **https://nptel.ac.in/courses/117106113**

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| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS5E05 | Professional Elective-I<br>5. Advanced Computer Architecture | 3 | 0 | 0 | 3 |

**Course Objectives:**

- Understand the Concept of Parallel Processing and its applications
- Implement the Hardware for Arithmetic Operations
- Analyze the performance of different scalar Computers
- Develop the Pipelining Concept for a given set of Instructions
- Distinguish the performance of pipelining and non-pipelining environment in a processor

**Course Outcomes:**

After the completion of the course, student will be able to

**CO-1:** Illustrate the types of computers, and new trends and developments in computer architecture

**CO-2:** Outline pipelining, instruction set architectures, memory addressing

**CO-3:** Apply ILP using dynamic scheduling, multiple issue, and speculation

**CO-4:** Illustrate the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges

**CO-5:** Apply multithreading by using ILP and supporting thread-level parallelism (TLP)

**UNIT I**

**Computer Abstractions and Technology**: Introduction, Eight Great Ideas in Computer Architecture, Below Your Program, Under the Covers, Technologies for Building Processors and Memory, Performance, The Power Wall, The Sea Change: The Switch from Uni-processors to Multiprocessors, Benchmarking the Intel Core i7, Fallacies and Pitfalls.

**UNIT II**

**Instructions: Language of the Computer:** Operations of the Computer Hardware, Operands of the Computer Hardware, Signed and Unsigned Numbers, Representing Instructions in the Computer, Logical Operations, Instructions for Making Decisions, Supporting Procedures in Computer Hardware, Communicating with People, MIPS Addressing for 32-Bit Immediates and Addresses, Parallelism and Instructions: Synchronization, Translating and Starting a Program, A C Sort Example to Put It All Together, Arrays versus Pointers, ARMv7 (32-bit) Instructions, x86 Instructions, ARMv8 (64-bit) Instructions.

**UNIT III**

**Arithmetic for Computers:** Introduction, Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Sub word Parallelism, Streaming SIMD Extensions and Advanced Vector Extensions in x86, Sub word Parallelism and Matrix Multiply.

**UNIT IV**

**The Processor:** Introduction, Logic Design Conventions, building a Datapath, A Simple Implementation Scheme, An Overview of Pipelining, Pipelined Datapath and Control, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions, The ARM Cortex-A8 and Intel Core i7 Pipelines.

**UNIT V**

**Large and Fast:** Exploiting Memory Hierarchy: Introduction, Memory Technologies, The Basics of Caches, Measuring and Improving Cache Performance, Dependable Memory Hierarchy, Virtual Machines, Virtual Memory, A Common Framework for Memory Hierarchy, Using a Finite-State Machine to Control a Simple Cache, Parallelism and Memory Hierarchies: Cache Coherence, Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks, **Advanced Material:** Implementing Cache Controllers, The ARM Cortex-A8 and Intel Core i7 Memory Hierarchies.

**Text Books:**

1) Computer Organization and Design: The hardware and Software Interface, David A Patterson, John L Hennessy, 5th edition, MK.
2) Computer Architecture and Parallel Processing – Kai Hwang, Faye A.Brigs, Mc Graw Hill.

**Reference Books:**

1) Modern Processor Design: Fundamentals of Super Scalar Processors, John P. Shen and Miikko H. Lipasti, Mc Graw Hill.
2) Advanced Computer Architecture – A Design Space Approach – Dezso Sima, Terence Fountain, Peter Kacsuk , Pearson.

**e-Resources:**

1) https://nptel.ac.in/courses/106/105/106105163/

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SEMESTER -V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE5M01 | Employability skills-I<br>Professional Ethics and Human Values | 2 | 0 | 0 | 0 |

**Course Objectives:**

- To give basic insights and inputs to the student to inculcate Human values to growas a responsible human being with proper personality.
- Professional Ethics instills the student to maintain ethical conduct and dischargetheir professional duties.

**COURSE OUTCOMES:**

**At the end of the course, the students will be able to:**

**CO 1**: Student can be able to Define, Civic Values, Ethics, Behavior, Honesty, Co-Operation& Commitment

**CO 2**: Student can be able to Discuss Engineering Ethics and Social Experimentation for the benefit of stakeholders

**CO 3**: Analyze the responsibilities of Engineers towards Safety & risk, to improve the Safety and minimize the risk.

**CO 4**: Present the duties & rights of Engineers

**CO 5:** Elucidate the role of Engineers in the ever changing the global Marketing

**UNIT I:**

**Human Values & Principles for Harmony**: Morals, Values and Ethics – Integrity - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment–Self-confidence – Spirituality- Character. Truthfulness – Customs and Traditions -Value Education –Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence.

**UNIT II:**

**Engineering Ethics and Social Experimentation:**

History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism ––Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments –– Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

**UNIT III:**

**Engineers' Responsibilities towards Safety and Risk:**

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk –

Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/s Immediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

**UNIT IV:**

**Engineers' Duties and Rights:**

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving- Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.

**UNIT V:**

**Global Issues:**

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

**Text Books:**

1. Professional Ethics, R. Subramaniam – Oxford Publications, New Delhi.
2. Professional Ethics and Morals, A. R. Aryasri, Dharanikota Suyodhana – Maruthi Publications.

**References:**

1. Engineering Ethics, Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
2. Engineering Ethics & Human Values, M. Govindarajan, S. Natarajan and V. S. SenthilKumar- PHI Learning Pvt. Ltd – 2009.
3. Professional Ethics and Human Values, A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
4. Professional Ethics and Human Values, D. R. Kiran-Tata McGraw-Hill – 2013

**E-Resources:**

1. https://nptel.ac.in/courses/109106117

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SEMESTER- V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS5L01 | COMPUTER NETWORKS LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

• Understand and apply different network commands

• Analyze different networking functions and features for implementing optimal solutions Apply different networking concepts for implementing network solution

• Implement different network protocols

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Apply the basics of Physical layer in real time applications

**CO-2:** Apply data link layer concepts, design issues, and protocols

**CO-3:** Apply Network layer routing protocols and IP addressing

**CO-4:** Implement the functions of Application layer paradigms and protocols

**CO-5**: Implement the functions of Presentation layer paradigms and Protocols

**Experiments:**

1) Implement the data link layer framing methods such as character stuffing and bit stuffing.

2) Write a C program to develop a DNS client server to resolve the given hostname.

3) Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16 and CRC-CCIP.

4) Implement Dijkstra's algorithm to compute the Shortest path in a graph.

5) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

6) Take an example subnet of hosts. Obtain broadcast tree for it.

7) Write a client-server application for chat using UDP

8) Implement programs using raw sockets (like packet capturing and filtering)

9) Write a C program to perform sliding window protocol.

10) Get the MAC or Physical address of the system using Address Resolution Protocol.

11) Simulate the Implementing Routing Protocols using border gateway protocol(BGP)

12) Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

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SEMESTER- V

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT5L02 | UNIX OPERATING SYSTEM LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

- To understand the design aspects of operating system
- To study the process management concepts & Techniques
- To study the storage management concepts
- To familiarize students with the Linux environment
- To learn the fundamentals of shell scripting/programming

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** To use UNIX utilities and perform basic shell control of the utilities
**CO-2:** To use the UNIX file system and file access control
**CO-3:** To use of an operating system to develop software
**CO-4:** Students will be able to use Linux environment efficiently
**CO-5:** Solve problems using bash for shell scripting

1) a) Study of Unix/Linux general purpose utility command list: man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.
b) Study of vi editor
c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system
d) Study of Unix/Linux files system (tree structure)
e) Study of .bashrc, /etc/bashrc and Environment variables.

2) Write a C program that makes a copy of a file using standard I/O, and system calls

3) Write a C program to emulate the UNIX ls –l command.

4) Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort

5) Simulate the following CPU scheduling algorithms:
(a) Round Robin (b) SJF (c) FCFS (d) Priority

6) Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit (), System calls

7) Simulate the following:
a) Multiprogramming with a fixed number of tasks (MFT)
b) Multiprogramming with a variable number of tasks (MVT)

8) Simulate Bankers Algorithm for Dead Lock Avoidance

9) Simulate Bankers Algorithm for Dead Lock Prevention.

10) Simulate the following page replacement algorithms:
a) FIFO b) LRU c) LFU

11) Simulate the following File allocation strategies
(a) Sequenced (b) Indexed (c) Linked

12) Write a C program that illustrates two processes communicating using shared memory

13) Write a C program to simulate producer and consumer problem using semaphores

14) Write C program to create a thread using pthreads library and let it run its function

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SEMESTER –VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6T01 | Cryptography and Network Security | 3 | 0 | 0 | 3 |

**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, and SSL/TLS and email
- Concepts of cryptographic utilities and authentication mechanisms to design secure applications

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory

**CO-2:** Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication

**CO-3:** Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.

**CO-4:** Apply different digital signature algorithms to achieve authentication and create secure applications

**CO-5:** Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP

**UNIT I**

**Classical Encryption Techniques**: Classical Encryption Techniques-Substitution techniques, Transposition techniques, Security Attacks, Services & Mechanisms, Symmetric Cipher Model, Cyber Threats, Phishing Attack, Web Based Attacks.

**Block Ciphers**: Traditional Block Cipher Structure, Block Cipher Design Principles.

**UNIT II**

**Symmetric Key Cryptography**: Data Encryption Standard (DES), Advanced Encryption

Standard (AES), Blowfish, IDEA, Block Cipher Modes of Operations.
**Number Theory**: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, the Chinese Remainder Theorem, Discrete Logarithms.

## UNIT III

**Public Key Cryptography**: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. **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, Key Management and Distribution.

## UNIT IV

**User Authentication**: Remote User Authentication Principles, Kerberos. ElectronicMail Security: Pretty Good Privacy (PGP) And S/MIME.
**IP Security**: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and KeyManagement.

## UNIT V

**Transport Level Security**: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Shell (SSH)
**Firewalls:** Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted Systems.

**Text Books:**

1) Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition.
2) Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition.

**Reference Books:**

1) Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyaya, Mc-GrawHill, 3rd Edition, 2015.
2) Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

**E-Resources:**

1)https://nptel.ac.in/courses/106/105/106105031/lecture by Dr.Debdeep Mukhopadhyay IIT Kharagpur [Video Lecture]
2) https://nptel.ac.in/courses/106/105/106105162/

lecture by Dr. Sourav Mukhopadhyay IIT Kharagpur [Video Lecture]
3)https://www.mitel.com/articles/web-communication-cryptography-and-network-security
web articles by Mitel Power Connections.

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SEMESTER-VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6T02 | **Compiler Design** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To study the various phases in the design of a compiler
- To understand the design of top-down and bottom-up parsers
- To understand syntax directed translation schemes
- To learn to develop algorithms to generate code for a target machine
- To develop algorithms to Optimize code

**Course Outcomes:**

**At the end of the course, the students will be able to**:

**CO-1:** Design, develop, and implement a compiler for any language
**CO-2:** Use LEX and YACC tools for developing a scanner and a parser
**CO-3:** Design and implement LL and LR parsers
**CO-4:** Apply algorithms to generate machine code
**CO-5:** Develop Machine Dependent and Independent code optimization Algorithms

**UNIT I**

**Introduction:** Overview of compilation, Language Processors, The structure of a Compiler, Pass and Phases of translation, Interpretation and bootstrapping.
**Lexical Analysis**: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, Design of a Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers, The Lexical-Analyzer Generator(LEX) tool.

**UNIT II**

**Syntax Analysis:** Introduction, Context free Grammars, Writing a Grammar.
**Top down Parsing:** Backtracking, Recursive descent parsing, Predictive parsing, LL(1) grammars.
**Bottom up Parsing:** Introduction to LR parsing, Shift reduce parsing, Simple LR, LR(0) items, SLR table construction, Algorithm, More powerful LR Parsers: LR(1) items, CLR table constructions, LALR table constructions, Error recovery in Parsing, YACC-automatic parser generator tool.

**UNIT III**

**Syntax-Directed Translation:** Syntax-Directed Definitions, Evaluation Orders for SDD's, Application of Syntax-Directed Translation, Syntax Directed Translation Schemes, Implementing L-Attributed SDD's.
**Intermediate-Code Generation:** Variants of Syntax Trees, Three-Address Codes,

Types and Declarations, Type checking, Control Flow, Back Patching, Switch Statements, Intermediate Code for Procedures.

**UNIT IV**

**Run Time Environments:** Symbol table entries & operations, Storage organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management

**Code Generation:** Issues in the design of a Code Generator , The target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, A simple Code generator, Register Allocation and Assignment.

**UNIT V**

**Machine Independent Optimization:** Function preserving Optimization: Common Sub expression elimination, Folding, Dead code elimination, Copy Propagation.

**Machine-dependent Optimizations**: Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.

**Text Books:**

1) Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson.
2) Compiler Construction-Principles and Practice, Kenneth C Louden, Cengage Learning.

**Reference Books:**

1) Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
2) The Theory and Practice of Compiler writing, J. P. Tremblay and P. G. Sorenson, TMH
3) Writing compilers and interpreters, R. Mak, 3rd edition, Wiley student edition.

**E-Resources:**

**1)** https://nptel.ac.in/courses/106/104/106104123/

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SEMESTER-VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6T03 | **Artificial Intelligence** | **3** | **0** | **0** | **3** |

**Course Objectives:**

• To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language

• To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs

• To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Outline problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem

**CO-2:** Apply the language/framework of different AI methods for a given problem

**CO-3:** Implement basic AI algorithms- standard search algorithms or dynamic programming

**CO-4:** Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

**CO-5:** Outline various uncertainty measures, fuzzy sets and fuzzy logic applications.

**UNIT I**

**Introduction:** history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.

**UNIT II**

**Problem solving**: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction.

**Problem reduction and game playing**: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.

**UNIT III**

**Logic concepts**: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic,

resolution refutation in proportional logic, predicate logic.

**UNIT IV**

**Knowledge representation**: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames.

**Advanced knowledge representation techniques**: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web

**UNIT V**

**Expert system and applications**: Introduction phases in building expert systems, expert system versus traditional systems

**Uncertainty measure**: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory.

**Fuzzy sets and fuzzy logic:** Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

**Text Books:**

1) Artificial Intelligence- SarojKaushik, CENGAGE Learning
2) Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, PEA

**Reference Books:**

1) Artificial Intelligence- Deepak Khemani, TMH, 2013
2) Introduction to Artificial Intelligence, Patterson, PHI
3) Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5thed, PEA

**E-Resources:**

1) https://nptel.ac.in/courses/106/105/106105077/
2) http://aima.cs.berkeley.edu/

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6E01 | PROFESSIONAL ELECTIVE- II<br>1. CLOUD COMPUTING | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

• The student will learn about the cloud environment, building software systems and components that scale to millions of users in modern internet cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas, and developing cloud-based software applications on top of cloud platforms.

**COURSE OUTCOMES:**

**At the end of the course, students will be able to:**

**CO-1:** Understanding the key dimensions of the challenge of Cloud Computing

**CO-2:** Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization

**CO-3:** Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.

**CO-4:** Assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas.

**CO-5**: Outline the cloud resource management and scheduling policies.

**UNIT -I:**

Systems modeling, Clustering and virtualization Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security and Energy Efficiency

**UNIT- II:**

Virtual Machines and Virtualization of Clusters and Data Centers Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation.

**UNIT- III:**

Cloud Platform Architecture Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

**UNIT -IV:**

Cloud Programming and Software Environments Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

**UNIT- V:**

Cloud Resource Management and Scheduling Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

**TEXT BOOKS:**

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
3. Cloud Computing, A Hands-on approach, Arshadeep Bahga, Vijay Madisetti, University Press

**REFERNCE BOOKS:**

1. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
2. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

**E-Resources:**

1. https://archive.nptel.ac.in/courses/106/105/106105167/

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6E02 | PROFESSIONAL ELECTIVE-II<br>2. BIG DATA ANALYTICS | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyze the big data using intelligent techniques
- To introduce programming tools PIG & HIVE in Hadoop echo system

**Course Outcomes:**

**At the end of the course, the students will be able to**

**CO-1**: Illustrate big data challenges in different domains including social media, transportation, finance and medicine

**CO-2**: Use various techniques for mining data stream

**CO-3**: Design and develop Hadoop

**CO-4**: Identify the characteristics of datasets and compare the trivial data and big data for various applications

**CO-5**: Explore the various search methods and visualization techniques

**UNIT I**

**Introduction:** Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

**UNIT II**

**Stream Processing:** Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.

**UNIT III**

**Introduction to Hadoop:** Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

**UNIT IV**

**Frameworks and Applications**: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.

**UNIT V**

**Predictive Analytics and Visualizations**: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application.

**Text Books:**

1) Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition, 2015.
2) Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Publishing, 2012.
3) Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012

**Reference Books:**

1) Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
2) Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data: The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
3) Arshdeep Bahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT, 2016.
4) Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014.

**E-Resources:**

1. https://archive.nptel.ac.in/courses/106/104/106104189/

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6E03 | PROFESSIONAL ELECTIVE- II<br>3. MACHINE LEARNING | 3 | 0 | 0 | 3 |

**Course Objectives:**

The course is introduced for students to

- Gain knowledge about basic concepts of Machine Learning
- Study about different learning algorithms
- Learn about of evaluation of learning algorithms
- Learn about Dimensionality reduction

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Identify machine learning techniques suitable for a given problem
**CO-2:** Solve the problems using various machine learning techniques
**CO-3:** Apply Dimensionality reduction techniques
**CO-4:** Design application using machine learning techniques.
**CO-5**: Develop solutions for decision problems using Bayesian and instance-based learning.

**UNIT I**

**Introduction**: Definition of learning systems, Goals and applications of machine learning, Aspects of developing a learning system: training data, concept representation, function approximation.

**Inductive Classification**: The concept learning task, Concept learning as search through a hypothesis space, General-to-specific ordering of hypotheses, finding maximally specific hypotheses, Version spaces and the candidate elimination algorithm, learning conjunctive concepts, the importance of inductive bias.

**UNIT II**

**Decision Tree Learning**: Representing concepts as decision trees, Recursive induction of decision trees, Picking the best splitting attribute: entropy and information gain, searching for simple trees and computational complexity, Occam's razor, Over fitting, noisy data, and pruning.

**Experimental Evaluation of Learning Algorithms**: Measuring the accuracy of learned hypotheses.

**Comparing learning algorithms**: cross-validation, learning curves, and statistical hypothesis testing.

**UNIT III**

**Computational Learning Theory**: Models of learnability: learning in the limit;

probably approximately correct (PAC) learning. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.

**Rule Learning**: Propositional and First-Order, translating decision trees into rules, Heuristic rule induction using separate and conquer and information gain, First-order Horn-clause induction (Inductive Logic Programming) and Foil, Learning recursive rules, Inverse resolution, Golem, and Progol.

**UNIT IV**

**Artificial Neural Networks**: Neurons and biological motivation, linear threshold units. Perceptrons: representational limitation and gradient descent training, Multilayer networks and back propagation, Hidden layers and constructing intermediate, distributed representations. Over fitting, learning network structure, recurrent networks.

**Support Vector Machines**: Maximum margin linear separators. Quadratic programming solution to finding maximum margin separators. Kernels for learning non-linear functions.

**UNIT V**

**Bayesian Learning**: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logisitic regression. Bayes nets and Markov nets for representing dependencies.

**Instance-Based Learning:** Constructing explicit generalizations versus comparing to past specific examples. K-Nearest-neighbor algorithm. Case-based learning.

**Text Books:**

1) T.M. Mitchell, “Machine Learning”, McGraw-Hill, 1997.
2) Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

**Reference Books:**

1) Ethern Alpaydin, “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.
3) Andreas C. Müller and Sarah Guido “Introduction to Machine Learning with Python: A Guide for Data Scientists”, Oreilly.

**E-Resources:**

1) Andrew Ng, “Machine Learning Yearning”
https://www.deeplearning.ai/machine-learning- yearning/
2) ShaiShalev-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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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6E04 | PROFESSIONAL ELECTIVE-II<br>4. NETWORK PROGRAMMING | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand to Linux utilities
- To understand file handling, signals
- To understand IPC, network programming in Java
- To understand processes to communicate with each other across a Computer Network

**Course Outcomes:**

**At the end of the course, students will be able to:**

**CO-1:** Demonstrate functional layering of network software architectures
**CO-2:** Write your own socket-based network application programs
**CO-3:** Apply software tools for network troubleshooting
**CO-4**: Acquire the knowledge of Shared Memory concepts
**CO-5**: Demonstrate the concepts of Files and Signals

**UNIT I**

**Linux Utilities**-File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking utilities, Filters, Text processing utilities and Backup utilities. Bourne again shell(bash) – Introduction, pipes and redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples. Review of C programming concepts-arrays, strings (library functions), pointers, function pointers,
structures, unions, libraries in C.

**UNIT II**

**Files**-File Concept, File types File System Structure, Inodes, File Attributes, file I/O in C using system calls, kernel support for files, file status information-stat family, file and record locking-lockf and fcntl functions, file permissions-chmod fchmod,\ file ownership-chown, lchown , fchown, links-soft links and hard links – sym link, link, unlink. File and Directory management – Directory contents, Scanning Directories-Directory file APIs. Process- Process concept, Kernel support for process, process attributes, process control – process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process.

**UNIT III**

**Signals-** Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise , alarm, pause, abort, sleep functions. Inter process Communication – Introduction to IPC mechanisms, Pipes- creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs(Named pipes),differences between unnamed and named pipes, popen and pclose library functions, Introduction to message queues, semaphores and shared memory. Message Queues- Kernel support for messages, UNIX system V APIs for messages, client/server example. Semaphores-Kernel support for semaphores, UNIX system V APIs for semaphores.

**UNIT IV**

**Shared Memory**- Kernel support for shared memory, UNIX system V APIs for shared memory, client/server example. Network IPC – Introduction to Unix Sockets, IPC over a network, Client-Server model ,Address formats(Unix domain and Internet domain), Socket system calls for Connection Oriented – Communication, Socket system calls for Connectionless-Communication, Example-Client/Server Programs- Single Server-Client connection, Multiple simultaneous clients, Socket options – setsockopt, getsockopt, fcntl.

**UNIT V**

**Network Programming** in Java-Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs that can handle one connection at a time and multiple connections (using multithreaded server), Remote Method Invocation (Java RMI)-Basic RMI Process, Implementation details-Client- Server Application.

**Text Books:**

1) Unix System Programming using C++, T.Chan, PHI.(Units II,III,IV)
2) Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.(Unit I)
3) An Introduction to Network Programming with Java, Jan Graba, Springer, rp 2010.(Unit V)
4) Unix Network Programming, W.R. Stevens, PHI.(Units II,III,IV)
5) Java Network Programming,3rd edition, E.R. Harold, SPD, O'Reilly.(Unit V)

**Reference Books:**

1) Linux System Programming, Robert Love, O'Reilly, SPD.
2) Advanced Programming in the UNIX environment, 2nd Edition, W.R.Stevens, Pearson Education.
3) UNIX for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson

Education.
4) Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones, Wrox, Wiley India Edition.
5) Unix Network Programming The Sockets Networking API, Vol.-I,W.R.Stevens, Bill Fenner, A.M.Rudoff, Pearson Education.
6) Unix Internals, U.Vahalia, Pearson Education.

**E-Resources:**

1. https://archive.nptel.ac.in/courses/106/105/106105183/

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6E05 | PROFESSIONAL ELECTIVE-II<br>5. Internet of Things | 3 | 0 | 0 | 3 |

**Course Objectives:**

• Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem

• Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc)

• Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming)

• Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

**Course Outcomes:**

**CO-1:** Describe the usage of the term 'the internet of things' in different contexts

**CO-2:** Discover the various network protocols used in IoTand familiar with the key wireless technologies used in IoT systems, such as Wi-Fi, 6LoWPAN, Bluetooth and ZigBee

**CO-3:** Define the role of big data, cloud computing and data analytics in a typical IoT system Design a simple IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software

**CO-4:** Build and test a complete working IoT system.

**UNIT I**

**The Internet of Things:** An Overview of Internet of Things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices.

**UNIT II**

Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.

**UNIT III**

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

**UNIT IV**

Data link layer of IoT, Wireless Communication Technologies, Wired Communication Technologies, Manet Networks: Network Layer of IoT, 6lowPAN adaptation layer for devices with limited resources, Dynamic routing protocols for wireless adhoc networks Communication protocols for IoT, Service oriented protocol(COAP), Communication protocols based on the exchange of messages(MQTT), Service discovery protocols.

**UNIT V**

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/ Services/ Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

**Text Books:**

1) Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education.
2) Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015.

**Reference Books:**

1) An Introduction to Internet of Things, Connecting devices, Edge Gateway and Cloud with Applications, Rahul Dubey, Cengage, 2019.
2) IoT Fundamentals, Networking Technologies, Protocols and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetette, rob Barton, Jerome Henry, CISCO, Pearson, 2018.
3) Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley.

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE6M01 | INTELLECTUAL PROPERTY RIGHTS AND PATENTS (IPR& P) | 2 | 0 | 0 | 0 |

**Course Objectives**:

- To know the importance of Intellectual property rights, which plays a vital role in Advanced Technical and Scientific disciplines.

- Imparting IPR protections and regulations for further advancement, so that the Students can familiarize with the latest developments.

**Course Outcomes:**

**CO-1**: Identify different types of intellectual property rights may be prescribed by an output with supporting agencies internationally.
**CO-2**: Explain the ways to protect literary and artistic works of the authors.
**CO-3**: Illustrate the process of registering innovative products i.e., Patents
**CO-4**: Analyze the ways to maintain of Trade Marks
**CO-5**: Suggest the ways to protect trade secrets in the organizations Explain different laws available related to cybercrimes.

**UNIT – I: Introduction to Intellectual property:**

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT – II: Law of Copyrights:**

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**UNIT – III: Law of Patents:**

Foundation of patent law, patent searching process, ownership rights and transfer. Patent litigation. Dilution of patent rights, patent registration.

**UNIT – IV: Trade Marks**:

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter (strength and categories of trade marks), selecting, and evaluating trade mark, trade mark registration processes.

**UNIT - V: Trade Secrets and Cyber law:**

Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes

litigation. Introduction to Cyber Law – Information Technology Act 2000 & Cyber Crimes & its types.

**Real time examples must be added to the concepts requires.**

**REFERENCES:**

1. Intellectual property right, Deborah, E. Bouchoux, Cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc- Graw Hill Publishing Company Ltd.
3. Kompal Bansal & Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4. Cyber Law - Texts & Cases, South-Western's Special Topics Collections.

**E-Resources:**

https://archive.nptel.ac.in/courses/110/105/110105139/

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6L01 | CRYPTOGRAPHY AND NETWORK SECURITY LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

- 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.

**Course Outcomes:**

- 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

**List of Experiments:**

1) Write a C program that contains a string (char pointer) with a value 'Hello world'.The program should XOR each character in this string with 0 and displays the result.
2) Write a C program that contains a string (char pointer) with a value 'Hello world'.The program should AND or and XOR each character in this string with 127 and display the result.
3) Write a Java program to perform encryption and decryption using the following algorithms:
   a. Ceaser cipher b. Substitution cipher
4) Write a C/JAVA program to implement the DES algorithm logic.
5) Write a C/JAVA program to implement the Blowfish algorithm logic.
6) Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world"using Blowfish. Create your own key using Java key tool.
7) Write a Java program to implement RSA algorithm.
8) Implement the Diffie-Hellman Key Exchange mechanism using HTML andJavaScript.
9) Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
10) Calculate the message digest of a text using the MD5 algorithm in JAVA.

**E-Resources:**

1) https://www.geeksforgeeks.org/caesar-cipher-in-cryptography/
   **https://www.javatpoint.com/hill-cipher-program-in-java**

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6L02 | COMPILER DESIGN LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

To enlighten the student with knowledge base in compiler design and its applications

**Course Outcomes:**

Demonstrate a working understanding of the process of lexical analysis, parsing and other compiler design aspects.

**Lab Experiments:**

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines
2. Simulate First and Follow of a Grammar.
3. Develop an operator precedence parser for a given language.
4. Construct a recursive descent parser for an expression.
5. Construct a LL(1) parser for an expression
6. Design predictive parser for the given language
7. Implementation of shift reduce parsing algorithm.
8. Design a LALR bottom-up parser for the given language.
9. Implement the lexical analyzer using JLex, flex or lex or other lexical analyzer generating tools
10. Write a program to perform loop unrolling.
11. Convert the BNF rules into YACC form and write code to generate abstract syntax tree.
12. Write a program for constant propagation.

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6L03 | **Artificial Intelligence Lab Using Python** | **0** | **0** | **3** | **1.5** |

## Course Objectives:

- Study the concepts of Artificial Intelligence
- Learn the methods of solving problems using Artificial Intelligence
- Introduce the concepts of machine learning

## Course Outcomes:

**At the end of the course, the students will be able to:**

**CO-1:** Identify problems that are amenable to solution by AI methods
**CO-2:** Identify appropriate AI methods to solve a given problem
**CO-3:** Use language/framework of different AI methods for solving problems
**CO-4:** Implement basic AI algorithms
**CO-5:** Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports

## Experiments:

1) Study of Prolog.
2) Write simple fact for the statements using PROLOG.
3) Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing
4) Write a program to solve the Monkey Banana problem.
5) Write a program in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts
6) Write a program to implement factorial, Fibonacci of a given number
7) Write a program to solve 4-Queen and 8-puzzle problem.
8) Write a program to solve traveling salesman problem.
9) Write a program to solve water jug problem using LISP
10) Implementation of A* Algorithm using LISP /PROLOG
11) Implementation of Hill Climbing Algorithm using LISP /PROLOG
12) Implementation of DFS and BFS for water jug problem using LISP /PROLOG
13) Implementation of Towers of Hanoi Problem using LISP /PROLOG

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E01 | PROFESSIONAL ELECTIVE-III<br>1. MOBILE COMPUTING | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To study the emerging technologies in the context of wireless networks
- To understand the mobile computing environment
- To learn about pervasive computing environment

**Course Outcomes:**

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

**CO-1:** Interpret Wireless local area networks (WLAN): MAC design principles, 802.11 WIFI

**CO-2:** Discuss fundamental challenges in mobile communications and potential Techniques in GSM

**CO-3:** Demonstrate Mobile IP in Network layer

**CO-4:** Illustrate different data delivery methods and synchronization protocols

**CO-5:** Develop applications that are mobile-device specific and demonstrate current Practice in mobile computing contexts.

**UNIT I**

**Mobile Communications:** An Overview- Mobile Communication-guided transmission, unguided transmission- signal propagation frequencies, antennae, modulation, modulation methods and standards for voice-oriented data communication standards, modulation methods and standards for data and voice communication, mobile computing- novel applications and limitations, mobile computing architecture, mobile system networks.

**Mobile devices and systems:** Cellular networks and frequency reuse, Mobile smart phones, Smart mobiles and systems, handheld pocket computers, Handheld devices, Smart systems, Limitations of mobile devices.

**UNIT II**

**GSM and other 2G Architectures:** GSM-services and system architecture, Radio interfaces of GSM, Protocols of GSM, Localization, Call handling, GPRS system architecture. Wireless medium access control, CDMA, 3G, 4G and 5G Communication: Modulation, Multiplexing, Controlling the medium access, Spread spectrum, Coding methods, IMT-20003G wireless communication standards, WCDMA3G communication standards, CDMA 3G communication standards, Broadband wireless access, 4G networks, 5G Networks.

**UNIT III**

**Mobile IP Network layer**: IP and Mobile IP network layers: OSI layer functions, TCP/IP and Internet protocol, Mobile internet protocol; Packet delivery and Handover Management; Location Management: Agent Discovery; Mobile TCP Introduction to Mobile Adhoc network: fixed infrastructure architecture, MANET infrastructure architecture; MANET: properties, spectrum, applications; Security in Ad-hoc network; Wireless sensor networks; sensor network applications.

**UNIT IV**

**Synchronization**: Synchronization in mobile computing systems, Usage models for Synchronization in mobile application, Domain-dependent specific rules for data synchronization, Personal information manager, synchronization and conflict resolution strategies, synchronizer; Mobile agent: mobile agent design, aglets; Application Server.

**UNIT V**

**Mobile Wireless Short Range Networks and Mobile Internet:** Wireless networking and wireless LAN, Wireless LAN (WLAN) architecture, IEEE 802.11protocol layers, Wireless application protocol(WAP)-WAP1.1 architecture, wireless datagram protocol (WDP), Wireless Transport Layer Security (WTLS), wireless transaction and session layers, wireless application environment.

**Text Books:**

1) Mobile Computing, 2nd edition, Raj kamal, Oxford,2011
2) Mobile Computing, Technology Applications and Service Creation, 2nd Edition, Asoke K Talukder, Hasanahmed, Roopa R Yavagal, McGraw Hill,2017

**Reference Books:**

1) “Principles of Mobile Computing,” 2nd Edition, UWE Hansmann, LotherMerk, Martin S.
Nocklous, Thomas Stober, Springer.2003

**E-Resources:**

1) https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

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| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E02 | PROFESSIONAL ELECTIVE- III<br>2. NEURAL NETWORKS AND SOFT COMPUTING | 3 | 0 | 0 | 3 |

**Course Objectives:**

• To have a detailed study of neural networks, Fuzzy Logic and uses of Heuristics based on human experience.
• To Familiarize with Soft computing concepts.
• To introduce the concepts of genetic algorithm and its applications to soft computing using some applications

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Identify and describe soft computing techniques and their roles in building intelligent machines.
**CO-2:** Recognize the feasibility of applying a soft computing methodology for a particular problem.
**CO-3**: Elaborate various Learning Algorithms used in neural networks.
**CO-4**: Outline fuzzy set operations and compare them with classical sets.
**CO-5:** Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.

**UNIT I:**

**INTRODUCTION**: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural

**UNIT II:**

**LEARNING PROCESS**: Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

**UNIT III:**

**CLASSICAL & FUZZY SETS**: Introduction to classical sets – properties, operations and relations; Fuzzy sets – memberships, uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions.

**UNIT IV:**

**FUZZY LOGIC SYSTEM COMPONENTS**: Fuzzification, Membership value assignment,

development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods

**UNIT V:**

**CONCEPT LEARNING**: Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm

**DECISION TREE LEARNING:** Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning

**TEXT BOOKS:**

1. Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition 2004
2. Neural Networks, Fuzzy Logic, Genetic Algorithms: Sysnthesis and Applications by Rajasekharan and Pai, PHI Publications
3. Machine Learning, Tom M. Mitchell, MGH

**REFERENCE BOOKS:**

1. Principles of Soft Computing, Deepa, S.N.S.S.N, Wiley india private limited, 2007.
2. Introduction to Soft Commputing: Neuro-Fuzzy and Genetic Algorithms, Samir Roy, Udit Chakraborty, Pearson India.

**E-RESOURCES:**

1. https://archive.nptel.ac.in/courses/106/105/106105173/
2. https://nptel.ac.in/courses/117105084

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E03 | Professional Elective- III<br>3. Ad-hoc and Sensor Networks | 3 | 0 | 0 | 3 |

**Course Objectives:**

From the course the student will learn

- Architect sensor networks for various application setups
- Devise appropriate data dissemination protocols and model links cost
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers
- Evaluate the performance of sensor networks and identify bottlenecks

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Evaluate the principles and characteristics of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks

**CO-2:** Determine the principles and characteristics of wireless sensor networks

**CO-3:** Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc sensor networks

**CO-4:** Illustrate the various sensor network Platforms, tools and applications

**CO-5:** Demonstrate the issues and challenges in security provisioning and also familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs

**UNIT I**

**Introduction to Ad Hoc Wireless Networks-** Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

**UNIT II**

**Routing Protocols for Ad Hoc Wireless Networks-** Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

**UNIT III**

**Security protocols for Ad hoc Wireless Networks-** Security in Ad hoc Wireless

Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

**UNIT IV**

**Basics of Wireless Sensors and Applications-** The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High- level application layer support, Adapting to the inherent dynamic nature of WSNs.

**UNIT V**

**Security in WSNs-** Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, Dataflow Style Language- TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

**Text Books:**

1) Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004.
2) Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal, World Scientific Publications / Cambridge University Press, March 2006.
3) Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.

**Reference Books:**

1) Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009.
2) Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
3) Ad hoc Networking, Charles E.Perkins, Pearson Education, 2001.
4) Wireless Ad hoc Networking, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007.

**E-Resources:**

1. https://archive.nptel.ac.in/courses/106/105/106105160/

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| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E04 | PROFESSIONAL ELECTIVE- III<br>4. DEEP LEARNING TECHNIQUES | 3 | 0 | 0 | 3 |

**Course Objectives:**

- Demonstrate the major technology trends driving Deep Learning
- Build, train and apply fully connected deep neural networks
- Implement efficient (vectorized) neural networks
- Analyze the key parameters and hyper parameters in a neural network's architecture

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Demonstrate the mathematical foundation of neural network
**CO-2:** Describe the machine learning basics
**CO-3:** Differentiate architecture of deep neural network
**CO-4:** Build a convolutional neural network
**CO-5:** Build and train RNN and LSTMs

**UNIT I**

**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, Marginal Probability, 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**

**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**

**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**

**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.

**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.

**Text Books:**

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.

**E-Resources:**

1) https://keras.io/datasets/
2) http://deeplearning.net/tutorial/deeplearning.pdf
3) https://arxiv.org/pdf/1404.7828v4.pdf

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E05 | PROFESSIONAL ELECTIVE- III<br>5. INFORMATION RETRIEVAL SYSTEM | 3 | 0 | 0 | 3 |

## COURSE OBJECTIVES

- To provide the foundation knowledge in information retrieval.
- To equip students with sound skills to solve computational search problems.
- To appreciate how to evaluate search engines.
- To appreciate the different applications of information retrieval techniques in the Internet or Web environment.
- To provide hands-on experience in building search engines and/or hands-on experience in evaluating search engines.

## COURSE OUTCOMES

**CO-1:** Identify basic theories in information retrieval systems
**CO-2:** Identify the analysis tools as they apply to information retrieval systems
**CO-3:** Understand the problems solved in current IR systems
**CO-4:** Describe the advantages of current IR systems
**CO-5:** Understand the difficulty of representing and retrieving documents.

## UNIT - I:

**Introduction to Information Storage and Retrieval System:** Introduction, Domain Analysis of IR systems and other types of Information Systems, IR System Evaluation. Introduction to Data Structures and Algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms

## UNIT- II:

**Inverted files:** Introduction, Structures used in Inverted Files, Building Inverted file using a sorted array, Modifications to Basic Techniques.

## UNIT -III:

**Signature Files:** Introduction, Concepts of Signature Files, Compression, Vertical Partitioning, Horizontal Partitioning.

## UNIT- IV:

**New Indices for Text:** PAT Trees and PAT Arrays: Introduction, PAT Tree structure, algorithms on the PAT Trees, Building PAT trees as PATRICA Trees, PAT representation as arrays.

**UNIT- V:**

**Stemming Algorithms**: Introduction, Types of Stemming Algorithms, Experimental Evaluations of Stemming to Compress Inverted Files.

**TEXT BOOK:**

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2 Modern Information Retrieval by Yates Pearson Education.
3 Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.

**REFERENCES:**

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. Information retrieval Algorithms and Heuristics, 2ed, Springer

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E06 | PROFESSIONAL ELECTIVE-IV<br>1. DISTRIBUTED SYSTEMS | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand the foundations of distributed systems.
- To learn issues related to availability of facilities for data transmission, IPC Mechanism.
- To learn distributed Objects and Remote Invocation and the operating system layer Protection.
- To understand the significance Distributed System File Service Architecture, Characteristics of peer-to-peer Systems, Group Communication & concurrency in Distributed System.
- To learn the Mutual exclusion and deadlock detection algorithms.

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Elucidate the foundations and issues of distributed systems

**CO-2:** Illustrate the various Interposes Communication techniques and Message ordering.

**CO-3:** Understand the concepts of Distributed Objects and Remote Invocation Techniques.

**CO-4:** Describe the Distributed File systems and the features of peer-to-peer System.

**CO-5:** Illustrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems.

**UNIT I**

**Characterization of Distributed Systems**: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges.

**System Models:** Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

**UNIT II**

**Inter process Communication**: Introduction, The API for the Internet Protocols- The Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication, Client-Server Communication.

**Message Ordering & Snapshots**: Message ordering and group communication, Group communication, Causal order (CO), Total order.

**UNIT III**

**Distributed Objects and Remote Invocation**: Introduction, Communication between Distributed Objects-Object Model, Distributed Object Modal, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications.

**Operating System Support**: Introduction, the Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

**UNIT IV**

**Distributed File Systems:** Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays. Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication.

**Transactions & Replications**: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

**UNIT V**

**Distributed Mutex & Deadlock**: Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm.

**Deadlock detection in distributed systems**: Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model.

**Text Books:**

1) Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012.
2) Distributed computing: Principles, algorithms, and systems, Ajay D Kshemkalyani and MukeshSinghal, Cambridge University Press, 2011.

**Reference Books:**

1) Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
2) Advanced concepts in operating systems. MukeshSinghal and Niranjan G. Shivaratri, McGraw-Hill, 1994.
3) Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M.,Pearson Education, 2007.

**E-Resources:**

1)https://nptel.ac.in/courses/106/106/106106168/

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E07 | PROFESSIONAL ELECTIVE- IV<br>2. SOCIAL NETWORKS & SEMANTIC WEB | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand semantic web
- To understand the role of ontology and inference engines in semantic web

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** demonstrate knowledge and be able to explain the three different "named" generations of the web.

**CO-2:** demonstrate the ability to anticipate materially in projects that develop programs relating to Web applications and the analysis of Web data.

**CO-3:** be able to understand and analyze key Web applications including search engines and social networking sites.

**CO-4:** be able to understand and explain the key aspects of Web architecture and why these are important to the continued functioning of the World Wide Web.

**CO-5:** be able to develop "linked data" applications using Semantic Web technologies.

**UNIT-I:**

**The Semantic web**: Limitations of the current Web, The semantic solution, Development of the Semantic Web, The emergence of the social web.

**UNIT-II:**

**Social Network Analysis**: What is network analysis?, Development of Social Network Analysis, Key concepts and measures in network analysis.

**Electronic sources for network analysis**: Electronic discussion networks, Blogs and online communities, Web-based networks.

**UNIT-III:**

**Knowledge Representation on the Semantic Web**: Ontologies and their role in the Semantic Web, Ontology languages for the semantic Web.

**UNIT-IV:**

**Modeling and Aggregating Social Network Data**: State of the art in network data representation, Ontological representation of Social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data.

**UNIT-V:**

**Developing social semantic applications**: Building Semantic Web applications with social network features, Flink- the social networks of the Semantic Web community, Open academia: distributed, semantic-based publication management.

**Text Book:**

1. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.
2. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, Rudi Studer, Paul Warren, John Wiley & Sons.

**Reference Books:**

1. Semantic Web and Semantic Web Services –Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
2. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications

**E-Resources:**

1. https://archive.nptel.ac.in/courses/106/106/106106169/
2. https://nptel.ac.in/courses/106105078

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E08 | PROFESSIONAL ELECTIVE- IV<br>3. COMPUTER VISION | 3 | 0 | 0 | 3 |

**Course Objectives:**

- Understanding basic concepts of image processing and their development.
- Knowledge of various configurations of image processing techniques used in industry, role in industry
- To know the application areas

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** To implement fundamental image processing techniques required for computer vision
**CO-2:** Understand Image formation process
**CO-3:** To perform shape analysis
**CO-4:** Extract features form Images and do analysis of Images
**CO-5:** To develop applications using computer vision techniques

**UNIT I**

**Introduction:** Image Processing, Computer Vision and Computer Graphics, what is Computer Vision - Low-level, Mid-level, High-level, Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

**UNIT II**

**Image Formation Models**: Monocular imaging system, Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination. shape from shading, Photometric Stereo, Depth from Defocus, Construction of 3D model from images.

**UNIT III**

**Shape Representation and Segmentation**: Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi resolution analysis.

**UNIT IV**

**Object recognition**: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching Principal component analysis, Shape priors for recognition Image Understanding: Pattern recognition methods, HMM, GMM and EM.

**UNIT V**

**Applications:** Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters –Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

**Text Books:**

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

**Reference Books:**

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision.Prentice-Hall, Englewood Cliffs, 1982.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010
4. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
5. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
7. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

**E-Resources:**

1. https://www.digimat.in/nptel/courses/video/108103174/L19.html

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SEMESTER -VI

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7T09 | PROFESSIONAL ELECTIVE- IV<br>5. GAME THEORY | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To familiarize with the process of game design and development
- To learn the processes, mechanics, issues in game design
- To understand the architecture of game programming
- To know about game engine development, modeling, techniques and frameworks.

**OUTCOME:**

Upon completion of the course, the students will:

**CO-1:** Develop basic gaming problems
**CO-2:** Develop game programming skills
**CO**-3: Understand gaming engine design
**CO-4:** Create interactive games
**CO-**5: Apply solution concepts to examples of games and explain them precisely.

**UNIT I - INTRODUCTION**

Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming – Sprite Animation - Multithreading – Importance of Game Design – Game Loop.

**UNIT II - 3D GRAPHICS FOR GAME PROGRAMMING**

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces.

**UNIT III - GAME DESIGN PRINCIPLES**

Character Development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding, Case study : Tetris.

**UNIT IV - GAMING ENGINE DESIGN**

Renderers, Software Rendering, Hardware Rendering, and Controller Based Animation, Spatial Sorting, Level of Detail, Collision Detection, Standard Objects, and Physics, Case study : The Sims

**UNIT V - GAME DEVELOPMENT**

Developing 2D and 3D Interactive Games Using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle Games, Single Player Games, Multi-Player Games. Case study: Mine craft.

**TEXT BOOKS:**

1. David H. Eberly, —"3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, Morgan Kaufmann, 2010.
2. Jung Hyun Han, —"3D Graphics for Game Programming", First Edition, Chapman and Hall/CRC, 2011.

**REFERENCES:**

1 Jonathan S. Harbour, —Beginning Game Programming, Course Technology, Third Edition PTR, 2009.
2. Ernest Adams and Andrew Rollings, —Fundamentals of Game Design, Third Edition, Pearson Education, 2014.
3. Scott Rogers, —Level Up: The Guide to Great Video Game Design, First Edition, Wiley, 2010.
4. Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, —Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer, First
Edition, Wiley, 2008.

**E-Resources:**

https://nptel.ac.in/courses/110104063

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E11 | PROFESSIONAL ELECTIVE- V<br>1. BLOCK CHAIN TECHNOLOGIES | 3 | 0 | 0 | 3 |

**Course Objectives:**

By the end of the course, students will be able to

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them,
- Design, build, and deploy smart contracts and distributed applications
- Integrate ideas from block chain technology into their own projects.

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** At the end of the course, student will be able to

**CO-2:** Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.

**CO-3:** Identify the risks involved in building Block chain applications.

**CO-4:** Review of legal implications using smart contracts.

**CO-5:** Choose the present landscape of Blockchain implementations and Understand Crypto currency markets

**UNIT I**

**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**

**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**: 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 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, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chain code 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.

**Text Books:**

1) Ambadas, ArshadSarfarzAriff, Sham "Blockchain for Enterprise Application Developers", Wiley
2) 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, McGraw Hill.
2) Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly.

**E-Resources:**

1) https://github.com/blockchainedindia/resources

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E12 | PROFESSIONAL ELECTIVE- V<br>2. QUANTUM COMPUTING | 3 | 0 | 0 | 3 |

**Course Objectives:**

• This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Analyze the behavior of basic quantum algorithms

**CO-2:** Implement simple quantum algorithms and information channels in the quantum circuit model

**CO-3:** Simulate a simple quantum error-correcting code

**CO-4:** Prove basic facts about quantum information channels

**CO-5**: Demonstrate the knowledge of various quantum computing models

**UNIT I**

**Introduction:** Quantum Measurements Density Matrices, Positive-Operator Valued Measure, Fragility of quantum information: Decoherence, Quantum Superposition and Entanglement, Quantum Gates and Circuits.

**UNIT II**

**Quantum Basics and Principles**: No cloning theorem & Quantum Teleportation, Bell's inequality and its implications, Quantum Algorithms & Circuits.

**UNIT III**

**Algorithms:** Deutsch and Deutsch–Jozsa algorithms, Grover's Search Algorithm, Quantum Fourier Transform, Shore's Factorization Algorithm.

**UNIT IV**

**Performance, Security and Scalability:** Quantum Error Correction: Fault tolerance; Quantum Cryptography, Implementing Quantum Computing: issues of fidelity; Scalability in quantum computing.

**UNIT V**

**Quantum Computing Models**: NMR Quantum Computing, Spintronics and QED MODEL, Linear Optical MODEL, Nonlinear Optical Approaches; Limits of all the discussed approaches, Future of Quantum computing.

**Text Books:**

1) Eric R. Johnston, NicHarrigan, Mercedes and Gimeno-Segovia "Programming Quantum Computers: Essential Algorithms And Code Samples, SHROFF/ O'Reilly.
2) Dr. Christine Corbett Moran, Mastering Quantum Computing with IBM QX: Explore the world of quantum computing using the Quantum Composer and Qiskit, Kindle Edition Packt
3) V.K Sahni, Quantum Computing (with CD), TATA McGrawHill.

**Reference Books:**

1) Chris Bernhardt, Quantum Computing for Everyone (The MIT Press).
2) Michael A. Nielsen and Issac L. Chuang, "Quantum Computation and Information", Cambridge (2002).
3) Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd (2012).
4) Scott Aaronson, "Quantum Computing since Democritus", Cambridge (2013).
5) P. Kok, B. Lovett, "Introduction to Optical Quantum Information Processing", Cambridge.

**E-Resources:**

1) https://nptel.ac.in/courses/104104082/
2) https://swayam.gov.in/nd1_noc19_cy31/preview

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E13 | PROFESSIONAL ELECTIVE- V<br>3. ETHICAL HACKING | 3 | 0 | 0 | 3 |

**Course Objectives**

The objective of this Course is to help the students to master an ethical hacking practice.

**Course Outcomes:**

**At the end of the course, the students will be able to:**

**CO-1:** Gain the knowledge of the use and availability of tools to support an ethical hack
**CO-2:** Gain the knowledge of interpreting the results of a controlled attack
**CO-3:** Understand the role of politics, inherent and imposed limitations and metrics for planning of a test
**CO-4:** Comprehend the dangers associated with penetration testing.
**CO-5**: Acquire the knowledge of defense planning and security policies.

**UNIT- I**

**Introduction**: Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

**UNIT - II**

**The Business Perspective**: Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement.

**UNIT - III**

**Preparing for a Hack:** Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance.

**UNIT - IV**

**Enumeration**: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase Exploitation: Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits,

applications, Wardialing, Network, Services and Areas of Concern

**UNIT - V**

**Deliverable**: The Deliverable, the Document, Overal Structure, Aligning Findings, Presentation

Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion

**TEXTBOOK:**

1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press.

**REFERENCE BOOKS:**

1. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning
2. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning.

**E-RESOURCES:**

1. https://archive.nptel.ac.in/courses/106/105/106105217/

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS7E14 | PROFESSIONAL ELECTIVE- V<br>5. PARALLEL ALGORITHMS | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand different parallel architectures and models of computation.
- To introduce the various classes of parallel algorithms.
- To study parallel algorithms for basic problems.

**OUTCOMES:**

Upon completion of this course, the students should be able to

**CO-1:** Develop parallel algorithms for standard problems and applications.
**CO-2:** Use message passing Models
**CO-3:** Analyse efficiency of different parallel algorithms.
**CO-4:** Understand SIMD Algorithms
**CO-5:** Apply MIMD Algorithms

**UNIT I**

**INTRODUCTION:** Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations - PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages.

**UNIT II**

**PRAM ALGORITHMS:** Parallel Algorithms for Reduction – Prefix Sum – List Ranking – Preorder Tree Traversal – Searching -Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring - Graph Searching.

**UNIT III**

**SIMD ALGORITHMS -I:** 2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication

**UNIT IV**

**SIMD ALGORITHMS -II:** Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model - Parallel Algorithms for Reduction -Bitonic Merge Sort - Matrix Multiplication - Minimum Cost Spanning Tree

**UNIT V**

**MIMD ALGORITHMS:** UMA Multiprocessor Model -Parallel Summing on

Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.

**TEXT BOOKS:**

1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition , 2011.
3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.

**REFERENCES**

1. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.
2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning , 2013.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

**E-RESOURCES:**

https://nptel.ac.in/courses/106103188

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SEMESTER -VII

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH70xx | MANAGEMENT SCIENCE | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To familiarize with the process of management and to provide basic insight into organizational behavior
- To provide conceptual knowledge on functional management and project management

**Course Outcome:**

**At the end of the course, the students will be able to:**

**CO 1:** Apply the concept of Management, Motivational theories, and designing different organizational structures in business organizations.
**CO 2:** Examine the quality of products using SQC and also maintain Inventory.
**CO 3:** Analyze different functions of an organization and strategies of product life cycles and channels of distribution
**CO 4:** Designing project schedules with the help of network analysis.
**CO 5:** Understanding the essential elements of acceptable organizational behavior.

**UNIT - I:**

**Introduction to Management**: Concept–nature and importance of Management –– Generic Functions of Management- Administration vs. Management –Evolution of Management thought-Decision making process- organization structure: Principles of organization & its types.

**UNIT - II:**

**Operations Management**: production & its types, plant layout, Work study- method study and work measurement – Statistical Quality Control-Control charts –Simple problems
**Material Management:** Need for Inventory control- EOQ (simple problems), ABC analysis and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

**UNIT - III:**

**Human Resource Management**: Concept of HRM, HRD - Functions of HR Manager-types of Wage payment plans – Job Evaluation and Merit Rating - Grievance & redressal mechanism,
**Marketing Management**: Functions of Marketing– Marketing Mix-Marketing strategies based on product Life Cycle, Channels of distribution.

**UNIT - IV:**

**Project Management**: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path-Probability-Project Crashing (Simple Problems)

**UNIT - V:**

**Organizational behavior:**

Attitude & behavior; Leadership styles; motivation- significance, theories; Perception-Perceptual process-Group Dynamics: Types of Groups, Stages of Group Development, Group Behavior and Group Performance Factors.

**Text Books**

1. Dr.P.VijayaKumar & Dr.N.AppaRao, '*Management Science*' Cengage, Delhi,2 012.
2. Dr.A.R.Aryasri, *Management Science*' TMH 2011.
3. L. M. Prasad, '*Organizational Behavior*' Sultan Chand Publications.

**Reference Books:**

1. Koontz & Weihrich: 'Essentials *of management*' TMH 2011
2. Anil Bhat & Arya Kumar: Principles of Management, Oxford University Press, New Delhi, 2015.
3. Robbins: Organizational Behavior, Pearson publications, 2011
4. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011
5. Philip Kotler& Armstrong: Principles of Marketing, Pearson publications
6. K. Aswatappa: 'Human Resource Management – text & cases', TMH.

**E-Resources:**

1. https://nptel.ac.in/courses/122102007

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| OPEN ELECTIVES OFFERED TO OTHER DEPARTMENTS |
|---|
| 1. Computer Graphics |
| 2. Cloud Computing |
| 3. Computer Networks |
| **4.** Cryptography and Network Security |

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CSXO01 | **1. Computer Graphics** | | **0** | **0** | **3** |

**Course Objectives:**

- To develop, design and implement two- and three-dimensional graphical structures
- To enable students to acquire knowledge Multimedia compression and animations
- To learn Creation, Management and Transmission of Multimedia objects.

**Course Outcome:**

**At the end of the course, the students will be able to:**

**CO 1:** Understand basics and primitives of computer graphics

**CO 2:** Describe the general software architecture of programs that use 2D computer graphics.

**CO 3:** Describe the general software architecture of programs that use 3D computer graphics.

**CO 4:** Know about visible surface detection methods

**CO 5:** Understanding the essential elements of computer animation behavior.

**UNIT I:**

**Introduction:** Application of Computer Graphics, raster scan systems, random scan systems, raster scan display processors.

**Output primitives:** Points and lines, line drawing algorithms (Bresenham's and DDA Line derivations and algorithms), mid-point circle and ellipse algorithms.

**UNIT II:**

**Filled area primitives:** Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms. Inside and outside tests.

**2-D geometrical transforms:** Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms,
transformations between coordinate systems.

**UNIT III:**

**2-D viewing:** The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-

beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

**UNIT IV:**

**3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces.

**3-D Geometric transformations**: Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3D Viewing pipeline, clipping, projections( Parallel and Perspective).

**UNIT V:**

**Visible surface detection methods**: Classification, back-face detection, depthbuffer, scan-line, depth sorting, BSPtree methods, area sub-division and octree methods.

**Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

**TEXT BOOKS:**

1. Computer Graphics C version, Donald Hearn, M.Pauline Baker, Pearson
2. Computer Graphics with Virtual Reality Systems, Rajesh K Maurya, Wiley
3. Introduction to Computer Graphics, Using Java 2D and 3D, Frank Klawonn, Springer
4. Computer Graphics, Steven Harrington, TMH
5. Computer Graphics, Amarendra N Sinha, Arun Udai, TMH.

**REFERENCE BOOKS:**

1. Computer Graphics Principles & practice, 2/e, Foley, VanDam, Feiner, Hughes, Pearson
2. Computer Graphics, Peter, Shirley, CENGAGE.
3. Principles of Interactive Computer Graphics, Neuman , Sproul, TMH.

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE

## SEMESTER-I (I-I)

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20SH1T01 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH1T02 | Applied Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20SH1T07 | Linear Algebra and Vector Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EE1T01 | Electrical Installation and Electronics Engineering Practice | 2 | 0 | 2 | 3 | 30 | 70 | 100 |
| 5 | 20CS1T01 | Problem Solving and Programming Using C | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE1M01 | Environmental Science | 2 | 0 | 0 | --- | --- | --- | --- |
| PRACTICAL | | | | | | | | | |
| 7 | 20SH1L01 | English Communicative Skills Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20SH1L02 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS1L01 | Problem Solving and Programming Using C Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory: BSC-2, HSMC-1, ESC-2 Practical: BSC-1, HSMC-1, ESC-1**

## SEMESTER-II (I-II)

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20SH2T04 | Applied Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH2T06 | Differential Equations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20ME2T01 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 4 | 20ME2T02 | Basic of Mechanical Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20EE2T01 | Network Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| PRACTICAL | | | | | | | | | |
| 6 | 20SH2L04 | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20ME2L01 | Mechanical Engineering Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS2L02 | IT Workshop | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory: BSC-2, ESC-3 Practical: BSC-1, ESC-2**

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE

**SEMESTER-III (II-I)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20SH3T03 | Numerical Methods and Transformations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EE3T01 | Electrical Circuits and Synthesis | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EE3T02 | Electrical Machines-I | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EE3T03 | Electromagnetic Fields | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20EC3T04 | Analog Electronics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE3M01 | Constitution of India | 2 | 0 | 0 | --- | --- | --- | --- |
| PRACTICAL | | | | | | | | | |
| 7 | 20EE3L01 | Electrical Circuits and Simulation Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20EE3L02 | Electrical Machines Lab-I | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20EC3L04 | Analog Electronics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20EE3S01 | MATLAB/Simulink (Basic level Skill Oriented courses-I) | 1 | 0 | 2 | 2.0 | --- | 50 | 50 |
| | | **Total Credits** | | | | **21.5** | **195** | **505** | **700** |

**Theory: BSC-1, PCC-4 Practical: PCC-3, SC-1, MC-1**

**SEMESTER-IV (II-II)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EE4T01 | Electrical Machines-II | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EE4T02 | Control Systems | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC4T04 | Digital Electronics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CS4T03 | Data Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20BM4T06 | Principles of Economics & Management | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| PRACTICAL | | | | | | | | | |
| 6 | 20EE4L01 | Electrical Machines Lab-II | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20EC4L03 | Digital Electronics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS4L03 | Data Structures Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20EE4S01 | PLC Programming for Automation (Basic level skill Oriented courses-II) | 1 | 0 | 2 | 2.0 | --- | 50 | 50 |
| | | **Total Credits** | | | | **21.5** | **195** | **505** | **700** |
| **10** | | **Honors/Minor Courses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |

**Theory: ESC-1, PCC-3, HSMC-1 Practical: ESC-1, PCC-2, SC-1, Honors/Minor Courses-1**

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE
**SEMESTER-V (III-I)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EE5T01 | Power Generation and Transmission Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EE5T02 | Electrical and Electronics Measurements | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC5T04 | Signals and Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | | **Professional Elective Course-I** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | | **Open Elective-I** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE5M04 | Intellectual Property Rights and Patents | 2 | 0 | 0 | --- | --- | --- | --- |
| PRACTICAL | | | | | | | | | |
| 7 | 20EE5L01 | Control System and Simulation Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20EE5L02 | Elect. and Electro. Measurements Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20EE5S01 | JAVA Programing (Advanced level skill Oriented courses I) | 1 | 0 | 2 | 2.0 | --- | 50 | 50 |
| 10 | 20EE5I01 | Summer Internship (During 2 Year) | 0 | 0 | 0 | 1.5 | --- | 50 | 50 |
| | | | | | **Total Credits** | **21.5** | **180** | **520** | **700** |
| **11** | | **Honors/Minor Courses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |
| **12** | **20EE5A01** | **IoT Applications of Electrical Engineering** | **0** | **0** | **2** | **-** | **-** | **-** | **-** |

**Theory: PCC-3, OEC-1, PEC-1 Practical: PCC-2, SC-1, SI-1, MC-1**

**Honors/Minor Courses-1**

**Additional Laboratory-1**

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE
**SEMESTER-VI (III-II)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EE6T01 | Power System Analysis and Protection | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20EE6T02 | Power Electronics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20EC6T04 | Microprocessor and Microcontroller | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | | **Professional Elective Course-II** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | | **Open Elective-II** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE6M02 | Professional Ethics and Human Values | 2 | 0 | 0 | 0 | --- | --- | --- |
| PRACTICAL | | | | | | | | | |
| 7 | 20EE6L01 | Power Systems and Programming Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20EE6L02 | Power Electronics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20EC6L04 | Microprocessor and Microcontroller Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20SH6S01 | Soft Skill Courses | 1 | 0 | 2 | 2.0 | --- | 50 | 50 |
| | | | **Total Credits** | | | **21.5** | **195** | **505** | **700** |
| **11** | | **Honors/Minor Courses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |
| **12** | **20EE6P01** | **Engineering Project in Community Services (EPICS)** | **0** | **0** | **2*** | **---** | **---** | **---** | **---** |

**Theory: PCC-3, OEC-1, PEC-1, Practical: PCC-3, SC-1, MC-1**

**Honors/Minor Courses-1**

***EPICS (Apart from regular timetable)**

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE
**SEMESTER-VII (IV-I)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | | **Professional Elective Course-III** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | | **Professional Elective Course-IV** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | | **Professional Elective Course-V** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | | **Open Elective-III** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | | **Open Elective-IV** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | | **Humanities and Social Science Elective** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| PRACTICAL | | | | | | | | | |
| 7 | 20EE7S01 | Python and its applications (Advanced skill Oriented courses-II) | 1 | 0 | 2 | 2.0 | --- | 50 | 50 |
| 8 | 20EE7I01 | Summer Internship (During 3 Year) | 0 | 0 | 0 | 3 | --- | 50 | 50 |
| | | | | | **Total Credits** | **23** | **180** | **520** | **700** |
| **9** | | **Honors/Minor Courses** | **3** | **1** | **0** | **4** | **30** | **70** | **100** |

**Theory: OEC-2, PEC-3, HSMEC-1 Practical: SC-1, SI-1,**

**Honors/Minor Courses-1**

**SEMESTER-VIII (IV-II)**

| S. No. | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | |
| 1 | 20EE8P01 | Project Work/ Internship in Industry | 0 | 0 | 0 | 12 | 60 | 140 | 200 |
| | | | | | **Total Credits** | **12** | **60** | **140** | **200** |
| 2 | | **Honors/Minor Courses (**MOOCS-I) | - | - | - | 2 | - | - | - |
| 3 | | **Honors/Minor Courses** (MOOCS-II) | - | - | - | 2 | - | - | - |

**Practical: PROJ-1,**

**Honors/Minor Courses-2**

**MOOCS-I & II***

(*– Equivalent grades will be given by BOS)

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE
**LIST OF PROFESSIONAL ELECTIVE COURSES**

Track 1: Electrical Power System

Track 2: Power Electronics & Drives

Track 3: Control and Instrumentation

Track 4: Electronics and Communication Engineering

Track 5: Computer Science and Engineering

| | | |
|---|---|---|
| **Elective-I (Semester V) (III-I)** | | |
| Track 1 | 20EE5E01 | Industrial Electrical Systems and Energy Utilization |
| Track 2 | 20EE5E02 | Special Electrical Machines |
| Track 3 | 20EE5E03 | Advanced Control System |
| Track 4 | 20EC5E05 | Analog and Digital Communication |
| Track 5 | 20IT5E05 | Operating System |
| **Elective-II (Semester VI) (III-II)** | | |
| Track 1 | 20EE6E01 | Electrical Distribution System |
| Track 2 | 20EE6E02 | Line Commutated and Active Rectifiers |
| Track 3 | 20EE6E03 | Instrumentation Engineering |
| Track 4 | 20EC6E05 | Digital Signal Processing and Applications |
| Track 5 | 20IT6E06 | Database Management System |
| **Elective-III (Semester VII) (IV-I)** | | |
| Track 1 | 20EE7E01 | Power System Operation and Control |
| Track 2 | 20EE7E02 | DC Drives |
| Track 3 | 20EE7E03 | Bio-Medical Engineering |
| Track 4 | 20EC7E05 | VLSI System |
| Track 5 | 20CS7E06 | Computer Networks |
| **Elective-IV (Semester VII) (IV-I)** | | |
| Track 1 | 20EE7E04 | Solar and Wind Energy Systems |
| Track 2 | 20EE7E05 | AC Drives |
| Track 3 | 20EE7E06 | Digital Control System |
| Track 4 | 20EC7E06 | Embedded Systems and Applications |
| Track 5 | 20IT7E06 | Principles of Software Engineering |
| **Elective-V (Semester VII) (IV-I)** | | |
| Track 1 | 20EE7E07 | FACTS: Flexible Alternating Current Transmission Systems |
| Track 2 | 20EE7E08 | Electrical and Hybrid Vehicles |
| Track 3 | 20EE7E09 | Industrial Automation |
| Track 4 | 20EC7E07 | Digital Image and Video Processing |
| Track 5 | 20IT7E07 | Big-Data |

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE

**LIST OF OPEN ELECTIVE COURSES**

| S. No. | Course Code | Course Title | Offering Dept. |
|---|---|---|---|
| 1 | 20CEXO01 | Elements of Civil Engineering | CE |
| 2 | 20CEXO02 | Disaster Management | |
| 3 | 20CEXO03 | Intelligent Transport Systems | |
| 4 | 20CEXO04 | Remote sensing & Geographical Information systems | |
| 5 | 20EEXO01 | Electrical Safety Management | EEE |
| 6 | 20EEXO02 | Non-conventional Energy sources | |
| 7 | 20EEXO03 | Electrical and Hybrid Vehicle | |
| 8 | 20EEXO04 | Electrical Energy Conservation and Auditing | |
| 9 | 20EEXO05 | Industrial Robotics | |
| 10 | 20MEXO01 | Optimization Techniques | ME |
| 11 | 20MEXO02 | Robotics | |
| 12 | 20MEXO03 | Industrial Management Sciences | |
| 13 | 20MEXO04 | Automation in Manufacturing | |
| 14 | 20ECXO01 | Principles of Communication | ECE |
| 15 | 20ECXO02 | Digital image Processing | |
| 16 | 20ECXO03 | Bio Medical Engineering | |
| 17 | 20ECXO04 | Design of IOT System (IOT) | |
| 18 | 20ECXO05 | MEMS | |
| 19 | 20ECXO06 | Mechatronics | |
| 20 | 20CSXO01 | Computer Graphics | CSE |
| 21 | 20CSXO02 | Cloud Computing | |
| 22 | 20CSXO03 | Computer Networks | |
| 23 | 20CSXO04 | Cryptography and Network Security | |
| 24 | 20ITXO01 | Data Base Management systems (DBMS) | IT |
| 25 | 20ITXO02 | Java Programming | |
| 26 | 20ITXO03 | Principle of software Engineering (PSE) | |
| 27 | 20ITXO04 | Introduction to Machine Learning | |
| 28 | 20CIXO01 | Python Programming | CAI |
| 29 | 20CIXO02 | Fundamentals of Artificial Intelligence | |
| 30 | 20CIXO03 | Human Computer Interaction | |
| 31 | 20CIXO04 | Applications of AI | |
| 32 | 20CDXO01 | Object Oriented Programming (C++) | CSD |
| 33 | 20CDXO02 | Data Structures | |
| 34 | 20CDXO03 | Data warehouse and Mining | |
| 35 | 20CDXO04 | Big Data Analysis | |

**HUMANITIES AND SOCIAL SCIENCE ELECTIVE**

| **S. No.** | Course Code | **Course Title** |
|---|---|---|
| 1 | 20SH7E01 | Entrepreneurship Development |
| 2 | 20SH7E02 | Business Environment |
| 3 | 20SH7E03 | Digital Marking |
| 4 | 20SH7E04 | Human Resource development and OB |

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE
**LIST OF HONORS COURSES**

| **Year/Sem: II-II (Pool-1)** | | |
|---|---|---|
| S. No | Course Code | Course Name |
| 1 | 20EE4H01 | Design of Electrical Apparatus-I |
| 2 | 20EE4H02 | Advanced Circuits |
| 3 | 20EE4H03 | Electromagnetic waves and transmission lines |
| 4 | 20EE4H04 | Electrical Installation and Estimation |
| **Year/Sem: III-I (Pool-2)** | | |
| 1 | 20EE5H01 | Design of Electrical Apparatus-II |
| 2 | 20EE5H02 | Power Plant Engineering |
| 3 | 20EE5H03 | Digital Logic Design (DLD) |
| 4 | 20EE5H04 | Advanced Measurements |
| **Year/Sem: III-II (Pool-3)** | | |
| 1 | 20EE6H01 | Principles of machine modeling and analysis |
| 2 | 20EE6H02 | Computer Methods in Power system (CMPS) |
| 3 | 20EE6H03 | Neural Networks and Fuzzy Logic |
| 4 | 20EE6H04 | Advanced power system protection |
| **Year/Sem: IV-I (Pool-4)** | | |
| 1 | 20EE7H01 | High voltage AC & DC Transmission |
| 2 | 20EE7H02 | Integrated Renewable Systems |
| 3 | 20EE7H03 | Power Systems dynamics and control |
| 4 | 20EE7H04 | Electric power quality |

ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE

**LIST OF MINORS COURSE (GENERAL)**

| S. No | Course Code | Course Name |
|---|---|---|
| 1 | 20EE4M01 | Electrical Circuit Analysis |
| 2 | 20EE5M01 | Electrical Measurements |
| 3 | 20EE6M01 | Basic Power System Engineering |
| 4 | 20EE7M01 | Basics of Power Electronics |
| 5 | 20EE7M02 | Utilization of Electrical Energy |

# KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

**(Autonomous)**

## DEPARTMENT OF CSE - DATA SCIENCE

**COURSE STRUCTURE & SYLLABUS**
**(Regulations – R20)**

**For B. Tech DEPARTMENT OF CSE - DATA SCIENCE**
**(Applicable for Batches admitted from 2020-2021)**


# KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

**(Autonomous)**



*(Accredited by NBA & NAAC with Grade "A" and Affiliated to JNTUK-Kakinada)*
Vinjanampadu, Vatticherukuru Mandal, Guntur-522017.
Andhra Pradesh. INDIA

## DEPARTMENT OF CSE - DATA SCIENCE
## COURSE STRUCTURE & SYLLABUS – R20

### SEMESTER - I

| S No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CS1T01 | Problem Solving and Programming Using C | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH1T04 | Applied Chemistry | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20SH1T06 | Differential Equations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20ME1T01 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 | 100 |
| 5 | 20EE1T02 | Basics of Electrical and Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20CS1L01 | Problem Solving and Programming Using C Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CS1L02 | IT Workshop | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20SH1L04 | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory:** BSC-2, ESC-3 **Practical:** BSC-1, ESC-2

### SEMESTER - II

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH2T01 | Communicative English | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20SH2T02 | Applied Physics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20SH2T07 | Linear Algebra & Vector Calculus | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20EC2T01 | Digital Logic Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS2T01 | Python Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE2M01 | Environmental Sciences | 2 | 0 | 0 | 0 | -- | -- | -- |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20SH2L01 | English Communicative Skills Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20SH2L02 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS2L01 | Python Programming Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| | | **Total Credits** | | | | **19.5** | **195** | **455** | **650** |

**Theory:** BSC-2, HSMC-1, ESC-2 **Practical:** BSC-1, HSMC-1, ESC-1 MC: 1

**DEPARTMENT OF CSE - DATA SCIENCE**
**COURSE STRUCTURE & SYLLABUS – R20**
**SEMESTER-III**

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH3T05 | Probability & Statistics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CS3T04 | Mathematical Foundations of Computer Science | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS3T05 | Data Structures & Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CD3T01 | Fundamentals of Data Science | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CS3T01 | Database Management Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE3M01 | Constitution of India | 2 | 0 | 0 | 0 | -- | -- | -- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CS3L03 | Data Structures & Algorithms Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CD3L01 | Fundamentals of Data Science Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS3L01 | Database Management Systems Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20CS3S01 | Mobile App Development | 1 | 0 | 2 | 2.0 | -- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |

**Theory:** BSC-01,PCC-3,ESC-01: **Practical:** PCC-3,SC-01,MC-01

**SEMESTER - IV**

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20SH4T03 | Numerical Methods & Transformations | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20IT4T01 | Object Oriented Programming Through Java | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS4T02 | Formal Languages and Automata Theory | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CD4T01 | Data warehousing and Mining | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20SH4T01 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20IT4L01 | Object Oriented Programming Through Java Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CD4L01 | Data Mining using Python Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS4L03 | R Programming Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CS4S01 | Mongo DB | 1 | 0 | 2 | 2.0 | -- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |

**Theory:** BSC-01, PCC-2,ESC-01,HSMC-01: **Practical:** PCC-03,SC-01

**DEPARTMENT OF CSE - DATA SCIENCE**

**COURSE STRUCTURE & SYLLABUS – R20**
**SEMESTER-V**

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20IT5T01 | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CI5T02 | Machine Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20IT5T02 | Operating Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20XX5O1X | **Open Elective-I** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CD5E1X | **Professional Elective-I**<br>1. Software Engineering<br>2. Object Oriented Analysis and Design<br>3. Principles of Programming Languages<br>**4.** Internet of Things | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE5M03 | Professional Ethics & Human values | 2 | 0 | 0 | 0 | -- | -- | -- |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CD5L01 | Operating Systems Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CI5L02 | Machine Learning Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CD5S01 | **Skill Oriented Course – III**<br>1. Animation course: Animation Design<br>2. Google Firebase | 1 | 0 | 2 | 2.0 | 15 | 35 | 50 |
| 10 | PR | **Summer Internship 2 Months (Mandatory) after second year ( to be evaluated during V Semester.** | 0 | 0 | 0 | 1.5 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **21.5** | **210** | **490** | **700** |

**Theory:** PCC-4,OE-01,HSMC-01: **Practical:** PCC-02,SC-01,PR-01

## COURSE STRUCTURE & SYLLABUS – R20
## SEMESTER - VI

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CD6T01 | Computer Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CD6T02 | Big Data Analytics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CD6T03 | Neural Networks And Deep Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20XX6O2X | **Open Elective- II** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CD6E2X | **Professional Elective- II**<br>1. Compiler Design<br>2. Software Project Management<br>3. Distributed Systems<br>4. Fundamentals of Robotics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE6M03 | IPR & Patents | 2 | 0 | 0 | 0 | | | |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CD6L01 | Computer Networks Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CD6L02 | Big Data & Hadoop Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CD6P01 | Mini Project with Seminar | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20CD6S01 | **Skilled Oriented Course - IV**<br>1. Amazon Web Services / DevNet<br>2. Continuous Integration and Continuous Delivery using DevOps | 1 | 0 | 2 | 2.0 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **21.5** | **210** | **490** | **700** |

**Theory:** PCC-4,OE-01, HSMC-01: **Practical:** PCC-02,PR-01, SC-01

**DEPARTMENT OF CSE - DATA SCIENCE**

**COURSE STRUCTURE & SYLLABUS – R20**
**SEMESTER-VII**

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CD7E3X | **Professional Elective- III**<br>1. Natural Language Processing<br>2. Cryptography and Network Security<br>3. Image and video processing<br>4. 4. Block Chain Technologies | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CD7E4X | **Professional Elective- IV**<br>1. Artificial Intelligence<br>2. Cloud Computing<br>3. Computer Vision<br>4. Human Computer Interaction | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CD7E5X | **Professional Elective- V**<br>1. Social Network Analysis<br>2. Recommender Systems<br>3. Data Visualization<br>**4.** Text Mining | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20XX7O3X | **Open Elective-III** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20XX7O4X | **Open Elective-IV/ Job Oriented** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20SH7T01 | Management Science | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 7 | 20CD7PR01 | **Industrial/Research Internship 2 months (Mandatory) after third year (to be evaluatedduring VII semester** | 0 | 0 | 0 | 3 | 15 | 35 | 50 |
| 8 | 20CD7S01 | **Skilled Oriented Course-V**<br>1. Soft Skills | 0 | 0 | 4 | 2.0 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **23.0** | **210** | **490** | **700** |

**Theory:** PCC-3,OE-02, HSMC-01: **Practical:**,PR-01, SC-01

**SEMESTER - VIII**

| S. No | Course Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CD8P01 | Major Project Work, Seminar, Internship | 0 | 0 | 0 | 12 | 60 | 140 | 200 |
| **Total Credits** | | | | | | 12 | | | |

| Open Electives Offered To Other Departments |
|---|
| 1. Object Oriented Programming (C++) |
| 2. Data Structures |
| 3. Data warehouse and Mining |
| 4. Big Data Analysis |

## CONSOLIDATE MARKS/CREDITS:

| SEM. | No. Theories | No. Practical's | Mini/ Final Project | MC/ MOOCS | Skill orient/ Advance | Internship | Credits | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 5 | 3 | - | - | - | - | 19.5 | 195 | 455 | 650 |
| II | 5 | 3 | - | 1 | - | - | 19.5 | 195 | 455 | 650 |
| III | 5 | 3 | - | 1 | 1 | - | 21.5 | 195 | 505 | 700 |
| IV | 5 | 3 | - | - | 1 | - | 21.5 | 195 | 505 | 700 |
| V | 5 | 2 | - | 1 | 1 | 1 | 21.5 | 210 | 490 | 700 |
| VI | 5 | 2 | 1 | 1 | 1 | - | 21.5 | 210 | 490 | 700 |
| VII | 6 | 0 | - | - | 1 | 1 | 23.0 | 210 | 490 | 700 |
| VIII | - | - | 1 | - | - | - | 12.0 | 60 | 140 | 200 |
| **Total** | **36** | **16** | **2** | **4** | **5** | **2** | **160** | **1470** | **3530** | **5000** |

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS1T01 | PROBLEM SOLVING AND PROGRAMMING USING C | 3 | 0 | 0 | 3 |

**Course Objectives:**

The objectives of Programming for Problem Solving Using C are

- To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C
- To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
- To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor
- To assimilate about File I/O and significance of functions

**Course Outcomes:**

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

CO1: Build algorithms and to draw flowcharts for solving problems
CO2: Convert flowcharts/algorithms to C Programs, compile and debug programs
CO3: Use different operators, data types and write programs that use two-way/ multi-way selection
CO4: Select the best loop construct for a given problem
CO5: Design and implement programs to analyze the different pointer applications
CO6: Decompose a problem into functions and to develop modular reusable code

**UNIT I**

Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Type Qualifiers. Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs.

**UNIT II**

Bitwise Operators: Exact Size Integer Types, Logical, Bitwise Operators, Shift Operators.
Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions. Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples.

**UNIT III**

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application.

**UNIT IV**

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application. Processor Commands: Processor Commands.

**UNIT V**

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Storage Classes, Scope, life time, Passing Array to Functions, Passing Pointers to Functions, Command Line Arguments, Recursion Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

**Text Books:**

1) Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE.
2) The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson.

**Reference Books:**

1) Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
2) Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
3) Computer Fundamentals and Programming in C, PradipDey, Manas Ghosh, OXFORD.

**E-Resources:**

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.programiz.com/c-programming
3. https://www.javatpoint.com/c-programming-language-tutorial
4. https://www.javatpoint.com/c-programming-language-tutorial

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH1T04 | APPLIED CHEMISTRY | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

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

**CO1** : Understand the importance of plastics and composites in various fields.
**CO2** : Apply corrosion control methods to protect metals.
**CO3** : Understand the importance of advanced materials in engineering.
**CO4** : Understand computational chemistry and importance of molecular machines.
**CO5** : Understand the use of non-conventional energy sources to produce power

**UNIT-I: POLYMER TECHNOLOGY**

*Polymerisation:* Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.

*Plastics:* Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

*Elastomers:* Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics-conducting polymers-biodegradable polymers.

**UNIT-II: ANALYTICAL TECHNIQUES AND CORROSION**

**PART A: ANALYTICAL TECHNIQUES**

Conductometric titrations – titrations between strong acid and strong base, strong acid and weak base. Potentiometric titrations (redox titrations). Complexometric titrations using EDTA

**PART B: CORROSION**

Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series - factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)- Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

**UNIT-III : MATERIAL CHEMISTRY**

**PART A:** Non-elemental semiconducting materials: Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation) - Semiconductor devices (p-n junction diode as rectifier, junction transistor).

*Insulators:* Electrical insulators- applications.

**PART B:** *Nano materials:* Introduction-sol-gel method- characterization by BET, SEM and TEM methods applications of graphene-carbon nanotubes and fullerenes: Types, preparation and applications Liquid crystals: Introduction-types-applications.
*Super conductors*: Type –I, Type II-characteristics and applications

**UNIT-IV: ADVANCED CONCEPTS/TOPICS IN CHEMISTRY**

*Computational chemistry:* Introduction, Ab Initio studies Molecular switches: characteristics of molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor

**UNIT-V: GREEN CHEMISTRY & NON CONVENTIONAL ENERGY SOURCES**

**PART A: GREEN CHEMISTRY**

*Green synthesis:* Principles –Applications - 3 or 4 methods of synthesis with examples – R4M4 principles.

**PART B: NON CONVENTIONAL ENERGY SOURCES**

Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower, geothermal power, ocean thermal energy conversion, tidal and wave power.

**TEXT BOOKS:**

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co.

**REFERENCE BOOKS:**

1. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 edition.
2. Engineering Chemistry by Bharathi kumari Yelamanchili, VGS series

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH1T06 | DIFFERENTIAL EQUATIONS | 3 | 0 | 0 | 3 |

**Course Outcomes:**
**At the end of the Course, the student will be able to**
**CO1 :** Solve the differential equations and apply differential equations related to various engineering fields
**CO2 :** Solve linear differential equations of second and higher order
**CO3 :** Calculate Jacobian, maxima and minima of functions of two Variables.
**CO4** : Solve first order partial differential equations
**CO5 :** Solve the higher order partial differential equations

**UNIT I: Differential equations of first order and first degree:**
Linear differential equations – Bernoulli equations – Exact equations andequations reducible to exact form. Applications: Newton's Law of cooling - Law of natural growth and decay - Orthogonal trajectories.

**UNIT II: Linear differential equations of higher order:**
Non-homogeneous equations of higher order with constant coefficients with RHS term of the type $e^{ax}$, sin ax, cos ax, polynomials in x, $e^{ax}$ V(x), $x^nV(x)$- Method of Variation of parameters. Applications: L-R circuit, C-R circuit and L-C-R circuit.

**UNIT III: Differential Calculus:**
Taylors and Mc Laurent's series for one & two variables – Functional dependence – Jacobian. Applications: Maxima and Minima of functions of two variables with constraints and without constraints.

**UNIT IV**: **First order Partial differential equations:**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations

**UNIT V: Higher order Partial differential equations:**
Solutions of Linear Partial differential equations with constant coefficients – RHS terms of the type eax+by , sin(ax+by), cos(ax+by), xmyn and Method of separation of Variables.

**Text Books:**
1. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley- India.
2. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.
3. Peter O'Neil, Advanced Engineering Mathematics, Cengage

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ME1T01 | ENGINEERING GRAPHICS | 1 | 0 | 4 | 3 |

**COURSE OUTCOMES:**

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

**CO1:** To illustrate the fundamental Engineering Drawing Standards and discuss about conics and scales.
**CO2:** Ability to draw the projection of points and straight lines.
**CO3:** Ability to draw the projection of planes
**CO4:** Understand the classification of solids and draw the projection of solids.
**CO5:** Ability to draw isometric and orthographic projections.

**UNIT-I**

*Introduction to Engineering graphics:* Conventions in drawing-lettering - BIS conventions.
Polygons: Constructing regular Polygon by general methods.
*Curves:* Conic sections in general method and Cycloid, Involutes tangent and normal for the curves
*Scales:* Plain scales, Diagonal scales and vernier scale.

**UNIT-II**

Introduction to Orthographic Projections; Projections of Points in various quadrants, Projections of Straight Lines parallel to both planes Projections of Straight Lines-Parallel to one and inclined to other plane
Projections of Straight Lines inclined to both planes, determination of true lengths, angle of inclinations and traces.

**UNIT-III**

Projections of Planes
Regular Planes Perpendicular / parallel to one Reference Plane and inclined to other Reference Plane, Planes inclined to both the Reference Planes.

**UNIT-IV**

Projections of solids: Projections of Prisms, Cylinders, with the axis inclined to one Reference Plane. Projections of Pyramids and Cones with the axis inclined to one Reference Plane

**UNIT-V**

Conversion of isometric views to orthographic views. Conversion of orthographic views to isometric views.

**TEXT BOOKS :**

1. Elementary Engineering Drawing By N.D.Bhatt, Charotar Publishing House
2. Engineering Drawing, Agarwal & Agarwal, Tata McGraw Hill Publishers.
3. Engineering Drawing, K.L.Narayana& P. Kannaiah, Scitech Publishers.

**REFERENCE BOOKS**

1. A Text Book of Engineering Graphics By P.J.Shah S.Chand & Company Ltd., New Delhi
2. Engineering Graphics I and II By Arunoday Kumar Tech Max Publication, Pune
3. A text book of Engineering Drawing By P.S.Gill S.K.Kataria & sons, Delhi

**DEPARTMENT OF CSE - DATA SCIENCE**

**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EE1T02 | BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

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

**CO1** : Recognize the fundamentals of solar energy, simple DC and AC circuits.

**CO2** : Demonstrate the construction, working principles and operating characteristics of DC machines and transformer

**CO3** : Demonstrate the construction, working principles and operating characteristics of AC rotating machines.

**CO4** : Demonstrate the working principles and operations of diode rectifiers and transistors

**CO5** : Comprehend the concept of working principles and operations of operational amplifiers and CRO.

**UNIT-I : DC & AC Fundamentals**

Electrical Circuit Elements (R, L and C)-Voltage and Current Sources - Ohms Laws - Kirchoff's Laws - Series-Parallel- Series and Parallel Combination (Only Resistances)-Problems in Simple Circuits with DC Excitation - Representation of Sinusoidal Waveforms - Cycle, Time Period, Frequency, Instantaneous Value, Peak, Average and RMS Values- Phase Angle, Power Factor, Real Power, Reactive Power and Apparent Power (Definition and Simple Problems).

**UNIT-II: DC Machines & Transformers**

DC Machines: Principle of Operation of DC Generator – EMF Equation – Types of DC Machine – Torque Equation of DC Motor – Applications – Three-Point Starter, Speed Control Methods – OCC Of DC Generator Transformers: Principle of Operation of Single-Phase Transformers – EMF Equation – Losses – Efficiency and Regulation.

**UNIT-III : AC Rotating Machines**

Principle of Operation of Alternators – Regulation by Synchronous Impedance Method – Principle of Operation Of 3- Phase Induction Motor – Slip-Torque Characteristics - Efficiency – Applications.

**UNIT-IV : Rectifiers and Transistors & Concept of Uninterrupted Power Supply (UPS)**

PN Junction Diodes – Diode Applications (Half, Full Wave and Bridge Rectifiers) - Zener Diode-Applications (Voltage Regulator) – LED - Photo Diode – SCR- UJT (Principle of Operation)- BJT FET (Types & Principle of Operation)- Concept of UPS-Introduction-Types-Block diagram-applications-Advantages

**UNIT-V : Operational Amplifiers and CRO.**

Characteristics of Operation Amplifiers (OP-AMP) – Application Of OP-Amps (Inverting, Non-Inverting, Integrator & Differentiator)- Simple Problems on Operation Amplifiers - Cathode Ray Oscilloscope –Construction and Operation.

**TEXT BOOKS:**

1. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 4th ed., Tata McGraw-Hill, 2019.
2. J. Millman, C. Halkias, Electronic Devices and Circuits, 2nd ed., Tata Mc-Graw-Hill,2008
3. D. Roy Choudhury and Shail B. Jain, Linear Integrated Circuits, 2nd ed., New Age International (p) Ltd, 2004.

**REFERENCE BOOKS:**

1. P. V. Prasad, S. Sivanagaraju, K. R. Varmah, and Chikku Abraham, Basic Electrical Engineering, 1st ed., Cengage India, 2018.
2. D.C. Kulshreshtha, Basic Electrical Engineering, 1st ed., Revised, Tata McGraw-Hill, 2012.
3. V K Mehta & Rohit Mehta, Principles of Electrical Engineering and Electronics, 3rd ed.,S Chand Publishers, 2019.
4. S. Salivahanan, N. Suresh Kumar, Electronic Devices and Circuits, Tata Mc-Graw Hill Education, 2018.
5. S. Salivahanan, V.S. Kanchana Bhaaskaran, Linear Integrated Circuits, 3rd ed., McGraw-Hill Education, 2018

**e-Resources :**

1. https://www.slideshare.net/GautamMishra5/ups-uninterrupted-power-supply.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS1L01 | PROBLEM SOLVING AND PROGRAMMING USING C LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations, preprocessor commands.

**Course Outcomes:**

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

CO 1:Gains Knowledge on various concepts of a C language.
CO 2: Draw flowcharts and write algorithms.
CO 3:Design and development of C problem solving skills.
CO 4:Design and develop modular programming skills.
CO 5:Trace and debug a program

**Exercise 1:**

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

**Exercise 2:**

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r and s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

**Exercise 3:**

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

**Exercise 4:**

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

**Exercise 5:**

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

**Exercise 6:**

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

**Exercise 7:**

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

**Exercise 8:**

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

**Exercise 9:**

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

**Exercise 10:**

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

**Exercise 11:**

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

**Exercise 12:**

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

**Exercise 13:**

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

**Exercise 14:**

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

**Exercise 15:**

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

**Exercise 16:**

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS1L02 | IT WORKSHOP | 0 | 0 | 3 | 1.5 |

**Course Objectives:**
The objective of IT Workshop is to

- Explain the internal parts of a computer, peripherals, I/O ports, connecting cables
- Demonstrate basic command line interface commands on Linux
- Teach the usage of Internet for productivity and self paced lifelong learning
- Demonstrate Office Tools such as Word processors, Spreadsheets and Presentation tools

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

**CO1:** Describe evolution of computers, storage devices, networking devices, transmission media and peripherals of a computer .

**CO2:** Configure, evaluate and select hardware platforms for the implementation and execution of computer applications, services and systems

**CO3:** Construct a fully functional virtual machine, Summarize various Linux operating system commands.

**CO4:** Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML, LaTex .

**COMPUTER HARDWARE:**
**Experiment 1:**
**Identification of peripherals of a PC, Laptop, Server and Smart Phones:** Prepare a report containing the block diagram along with the configuration of each component and its functionality, Input/ Output devices, I/O ports and interfaces, main memory, cache memory and secondary storage technologies, digital storage basics, networking components and speeds.

**OPERATING SYSTEMS:**
**Experiment 2: Virtual Machine setup:**

- Setting up and configuring a new Virtual Machine
- Setting up and configuring an existing Virtual Machine
- Exporting and packaging an existing Virtual Machine into a portable format

**Experiment 3: Operating System installation:**

- Installing an Operating System such as Linux on Computer hardware.

**Experiment 4:Linux Operating System Commands**

- General command syntax, Basic help commands, Basic File system commands, Date and Time
- Basic Filters and Text processing, Basic File compression commands
- Miscellaneous: apt-get, vi editor

**NETWORKING AND INTERNET**

**Experiment 5: Networking Commands**

ping, ssh, ifconfig, scp, netstat, ipstat, nslookup, traceroute, telnet, host, ftp, arp.

**INTERNET SERVICES:**

**Experiment 6:**

- Web Browser usage and advanced settings like LAN, proxy, content, privacy, security, cookies, extensions/ plugins
- Antivirus installation, configuring a firewall, blocking pop-ups
- Email creation and usage, Creating a Digital Profile on LinkedIn

**PRODUCTIVITY TOOLS:**

**OFFICE TOOLS**

**Experiment 7:**

Demonstration and Practice on Text Editors like Notepad++, Sublime Text, Atom, Brackets, Visual code, etc

**Experiment 8:**

Demonstration and practice on Microsoft Word, Power Point

**Experiment 9:**

Demonstration and practice on Microsoft Excel.

**Experiment 10:**

Demonstration and practice on LaTeX and produce professional PDF documents.

**Experiment 11:**

**Internet of Things (IoT)**: IoT fundamentals, applications, protocols, Architecture, IoT Devices communication models.

**INTRODUCTION TO HTML:**

**Experiment 12:**

Understanding HTML tags and creation of simple web pages.

**Assignment**: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

**TEXT BOOKS:**

1. Computer Fundamentals, Anita Goel, Pearson Education, 2017
2. PC Hardware Trouble Shooting Made Easy, TMH
3. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr.N.B.Vekateswarlu, S.Chand.
4. HTML & CSS ,The Completee Reference , Fifth Edition , Thomas A. powell
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.

**REFERENCE TEXT BOOKS:**

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance", 2nd edition, Tata McGraw-Hill, 2002
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. Bigelows, "Trouble shooting, Maintaining& Repairing PCs", TMH.
5. Excel Functions and Formulas, Bernd held, Theodor Richardson, Third Edition

**E-Resources:**

1. https://explorersposts.grc.nasa.gov/post631/20062007/computer_basics/ComputerPorts.doc
2. https://explorersposts.grc.nasa.gov/post631/2006-2007/bitsnbyte/Digital_Storage_Basics.doc
3. https://www.thegeekstuff.com/2009/07/linux-ls-command-examples
4. https://www.pcsuggest.com/basic-linux-commands/
5. https://www.vmware.com/pdf/VMwarePlayerManual10.pdf
6. https://gsuite.google.com/learning-center/products/#!/
7. https://www.raspberrypi.org

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH1L04 | APPLIED CHEMISTRY LAB | 0 | 0 | 3 | 1.5 |

**COURSE OUTCOMES:**

**After successful completion of this course, students should be able to**

CO1 : Estimate unknown solutions by using volumetric titration method.
CO2 : Analyze the quality of water.
CO3 : Determine the $p^H$ of liquid samples.
CO4 : Measure the strength of acids by conduct t to metric and potentiometric titrations.
CO5 : Estimate the acid content in fruit juices and soft drinks.

**LIST OF EXPERIMENTS**

1. 1.Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis
2. Estimation of HCl using standard $Na_2CO_3$ solution.
3. Estimation of alkalinity of a sample containing $Na_2CO_3$ and NaOH.
4. Estimation of total hardness of water using standard EDTA solution.
5. Estimation of copper using standard EDTA solution.
6. Estimation of zinc using standard EDTA solution.
7. Estimation of Ferrous iron using standard $K_2Cr_2O7$ solution.
8. Estimation of $KMnO_4$ using standard Oxalic acid solution.
9. Estimation of pH of the given sample solution using pH meter.
10. Conduct to metric Titrations between strong acid and strong base.
11. Conduct o metric Titrations between strong acid and Weak base.
12. Preparation of Bakelite.
13. Estimation of acid content in soft drinks.
14. Potentiometric Titrations between ferrous iron with potassium dichromate.
15. Estimation of copper (II) using standard hypo solution.
16. Estimation of iron (III) by colorimetric method

The above experiments at least 10 assessment experiments should be completed in a semester.

**Outcomes**: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

**Reference Books**

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Dr.Bharathi Kumari Yelamanchili - Laboratory Manual of Engineering Chemistry, VGS Techno Series

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH2T01 | COMMUNICATIVE ENGLISH | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**CO1** : Recall life in one's past which had fine balancing act.
**CO2** : Decide the qualities required to take up a promising career.
**CO3** : Evaluate the obstacles hinder of student's progress & find the ways to overcome them.
**CO4** : Explain the environment activism and empowerment of women
**CO5** : Interpret the efforts of successful persons to keep idealistic approach in achieving goals.

**UNIT-I: A Drawer full of happiness**

*Speaking:* Asking and answering general questions on familiar topics such as home, family, work, Study and interests. Self introduction and introduce others.
*Vocabulary:* Technical vocabulary from a cross technical branches, GRE Vocabulary (Antonyms and Synonyms, Word applications).
*Grammar*: 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.
Writing: Note Making and Note Taking.
Employability Skills: Teamwork

**UNIT-II**: **Nehru's letter to daughter Indira on her Birthday**

*Speaking:* Discussion in pairs, small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.
*Vocabulary*: Technical vocabulary from across technical branches. GRE Vocabulary, Analogies (Antonyms and Synonyms, Word applications)
*Grammar*: Use of articles and zero article; prepositions.
*Writing:* Resume, Cover Letter.
*Employability Skills:* Time Management

**UNIT-III**: **Stephen Hawking-Positivity 'Benchmark'**

*Speaking*: Discussing specific topics in pairs or in small groups and reporting what is discussed. Functional English: Complaining and Apologizing.
*Reading*: Reading a text in detail by making basic inferences-recognizing and interpreting Specific context clues; strategies to use text clues for comprehension. Criticalreading.
*Vocabulary*: Technical vocabulary from a cross technical branches,GREVocabulary(Antonyms and Synonyms, Word applications) Association, sequencing of words –
*Grammar*: Verbs– Tenses; subject-verb agreement.
*Writing:* Letter Writing: -Formal, Business, Editorial, Complaints, Applications, Permissions.
*Employability Skills:* Leadership skills.

**UNIT-IV: Like a Tree, Unbowed: Wangari Maathai-biography**

*Reading*: Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicative process or display complicated data.
*Reading for Writing*: Information transfer; describe, compare, contrast, identify significance / trends based on information provided in figures/charts/graphs/tables.
*Vocabulary*: Technical vocabulary from across technical branches, GRE Vocabulary,(Antonyms and Synonyms, Word applications) Cloze Encounters.
*Writing*: Essay Writings: - Paragraph Writing, Precis Writing,
*Employability Skills*: Management skills.

**UNIT-V: Stay Hungry-Stay Foolish**

*Reading*: RAP Strategy Intensive reading and Extensive reading techniques.
*Reading for Writing*: Writing academic proposals- writing research articles: format and style.
*Vocabulary*: Technical vocabulary from across technical branches, GRE Vocabulary (Antonyms and Synonyms, Word applications) Coherence, matching emotions.
*Grammar*: Editing short texts–identifying and correcting common errors in grammar and usage (Articles, prepositions, tenses, subject verb agreement)
*Writing*: E- Mail, Reports, Reporting to media.
*Employability Skills*: Creative Thinking.

**TEXT BOOKS:**

1. "Infotech English", Maruthi Publications.

**REFERENCE BOOKS:**

1. Bailey, Stephen.Academicwriting:Ahandbookforinternationalstudents.Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. SkillfulLevel2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin.Cambridge Academic English (B2).CUP,2012.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH2T02 | APPLIED PHYSICS | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

After successful completion of this course, students should be able to

**CO1**: Explain the need of coherent sources and the conditions for sustained interference.
**CO2**: Understand the basic concepts of LASER light Sources
**CO3**: Analyze the physical significance of wave function.
**CO4**: Identify the type of semiconductor using Hall effect.
**CO5**: Apply the concept of magnetism to magnetic devices

**UNIT-I : WAVE OPTICS**

INTERFERENCE: Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications -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 - N-slits(Qualitative) – Grating - Dispersive power and resolving power of Grating(Qualitative).

POLARIZATION: Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

**UNIT-II LASERS & FIBER OPTICS**

LASERs: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation- Einstein's coefficients – Population inversion –Lasing action- Pumping mechanisms – Ruby 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 - Applications.

**UNIT-III MAGNETISM & DIELECTRICS**

MAGNETISM: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr magneton- Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism – Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

DIELECTRICS: Introduction - Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

**UNIT-IV : QUANTUM MECHANICS , FREE ELECTRON THEORY & BAND THEORY OF SOLIDS**

Introduction – matter waves – de Broglie's hypothesis, Heisenberg's Uncertainty Principle Schrödinger time independent and time dependent wave equations – physical significance of Schrödinger wave function – Particle in a potential box (determination of energy).

FREE ELECTRON THEORY: Introduction - Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory- Equation for electrical conductivity based on quantum free electron theory-Fermi-Dirac distribution- Density of states (3D) – Fermi energy

BAND THEORY OF SOLIDS:

Introduction - Bloch thorem, krong-Penney model, E vsK diagram, effective mass of electron, classification of c solids –concept of hole.

**UNIT – V : SEMICONDUCTOR PHYSICS**

Introduction – Intrinsic semiconductors - density of charge carriers – Electrical conductivity - Fermi level - extrinsic semiconductors - P-type & N-type - Density of charge carriers - Dependence of Fermi energy on carrier concentration and temperature- Drift and Diffusion currents - Einstein's equation. Hall effect- Hall coefficient - Applications of Hall effect.

**TEXT BOOKS:**

1. B. K. Pandey, S. Chaturvedi .,"Engineering Physics" - Cengage Publications, 2012
2. M.N. Avadhanulu, P.G.Kshirsagar., "A Text book of Engineering Physics" - S.Chand, 2017.
3. D.K.Bhattacharya and Poonam Tandon., "Engineering Physics", Oxford press (2015).
4. R.K Gaur. and S.L Gupta., "Engineering Physics" - Dhanpat Rai publishers, 2012.

**REFERENCE BOOKS:**

1. M.R.Srinivasan, "Engineering Physics", New Age international publishers (2009).
2. Ajoy Ghatak "Optics", 6th Edition McGraw Hill Education, 2017.
3. A.J.Dekker "Solid State Physics", Mc Millan Publishers (2011).

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH2T07 | LINEAR ALGEBRA & VECTOR CALCULUS | 3 | 0 | 0 | 3 |

**Course Outcomes:**

**At the end of the Course, Student will be able to:**

**CO 1 :** Solve simultaneous linear equations numerically using various matrix methods.
**CO 2 :** Find the Eigen values and Eigen vectors of a given matrix and nature of quadratic form.
**CO 3 :** Determine double integral over a region and triple integral over a volume.
**CO 4 :** Calculate gradient of a scalar function, divergence and curl of a vector function.
**CO5 :** Determine line, surface and volume integrals and apply Green, Stokes and Gauss divergence theorems to calculate line, surface and volume integrals.

**UNIT I: Linear systems of equations:**

Rank - Echelon form – Normal form – Solving system of homogeneous and Non– Homogeneous equations – Gauss elimination – Gauss Jordon. Applications: Finding the current in electrical circuits.

**UNIT II: Eigen values - Eigen vectors and Quadratic forms:**

Eigen values – Eigen vectors– Properties (without proof) – Clayey-Hamilton theorem (Without of proof) – Inverse and powers of a matrix by using Clayey-Hamilton theorem– Diagonalisation – Reduction of quadratic form to canonical form by Orthogonalisation – Rank – Positive, negative and semi definite – Index – Signature.

**UNIT III: Multiple integrals:**

Double and Triple integrals – Change of order of integration – Change of variables. Applications: Finding Areas.

**UNIT IV: Vector Differentiation:**

Gradient– Directional derivative – Divergence – Curl – Scalar Potential – Laplacian and second order operators -Vector identities.

**UNIT V: Vector Integration**

Line integral – Work done – Potential function – Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) .

**Text Books:**

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw HillEducation.

**Reference Books:**

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Dass H.K., Rajnish Verma. Er.,** Higher Engineering Mathematics, S. Chand Co.Pvt. Ltd, Delhi

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20EC2T01 | DIGITAL LOGIC DESIGN | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

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

**CO1** : Define different number systems and recognize various applications of it.
**CO2** : Select the concept of Boolean algebra in minimization and identify the solution of switching functions.
**CO3** : Execute different types of combinational logiccircuits.
**CO4** : Execute the PLA logic for different applications
**CO5** : Use knowledge of flip-flops in operation of Registers andcounters

**UNIT-I**: **NUMBER SYSTEMS & CODES:**
Review of number systems, conversions, r's and r-1's complements of signed numbers, arithmetic addition and subtraction, Gray code, 4-bit codes, Error detection and correction codes.

**UNIT-II**: **BOOLEAN THEOREMS &MINIMIZATION TECHNIQUES**
Boolean theorems, representations of Boolean functions, logic gates, NAND-NAND and NOR-NOR realizations, Minimization of switching functions using Boolean theorems, K-map (up to 5 variables) and tabular method, with & without Don't-care conditions.

**UNIT-III**: **COMBINATIONAL LOGIC CIRCUIT DESIGN**
Analysis and design procedure of combinational logic circuits: Half-adder, Full-adder, Half-subtractor, Full-subtractor, 4-bit adder-subtractor, Decoders, Encoders, Multiplexers, De-Multiplexers, comparator, code converts.

**UNIT-IV**: **INTRODUCTION OF PROGRAMMABLE LOGIC DEVICES**
PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table, memory types

**UNIT-V**: **SEQUENTIAL LOGIC CIRCUIT DESIGN**
Introduction to Sequential Circuits, Storage Elements: Latches, Flip-Flops: RS, JK, D and T flip-flops truth and excitation tables, conversion of flip-flops. Registers, shift registers, Counters: synchronous and asynchronous.

**TEXT BOOKS:**

1. M.Morris Mano, Digital Design, 4th Edition, PHI Publication, 2008.
2. A. Anand Kumar, Fundamentals of digital circuits, 4th Edition, PHI Publication, 2016.

**REFERENCE BOOKS:**

1. Norman Balabanian and Bradley Carlson, Digital Logic Design Principles 1st Edition,Wiley Publisher, 2010
2. John P.Hayes, Introduction to Digital Logic Design, 1st Edition, Pearson Publication,1993.
3. AlamMansaf and Alam Bashir, Digital Logic Design, PHI Publication, 2015.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS2T01 | PYTHON PROGRAMMING | 3 | 0 | 0 | 3 |

**Course Objectives:**
The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops &functions
- To be familiarized with general coding techniques and object-oriented programming

**Course Outcomes**:
**At the end of the Course, the student will be able to**
**CO1:** Develop essential programming skills in computer programming concepts like data types, containers
**CO2:** Apply the basics of programming in the Python language
**CO3:** Solve coding tasks related conditional execution, loops
**CO4:** Solve coding tasks related to the fundamental notions and techniques used in object-oriented programming.

**UNIT I**
**Introduction:** Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.
**Data Types, and Expression:** Strings Assignment, and Comment, Numeric Data Types and Character Sets.
**Decision Structures and Boolean Logic:** if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.
**Programming:** Introduction to Programming Concepts with Scratch.

**UNIT II**
**Repetition Structures:** Introduction, while loop, for loop, Nested Loops.
**Control Statement:** Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop
**Strings and Text Files:** Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods TextFiles, string pattern matching. Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

**UNIT III**

**List and Dictionaries:** Lists, tuple, Dictionaries and sets, frozen sets.

**Design with Function:** Defining Simple Functions, Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Managing a Program's Namespace, Higher Order Function.

**Modules:** Modules, Standard Modules, Packages.

**UNIT IV**

**Object Oriented Programming:** Concept of class, object and instances, Constructor, class attributes and destructors, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support.

**Design with Classes:** Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism.

**UNIT V**

**Errors and Exceptions**: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

**Graphical User Interfaces:** The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUIResources, Turtle Graphics

**Testing**: Basics of testing? unit testing in python, writing test cases, running tests.

**Text Books**

1) Fundamentals of Python First Programs, Kenneth. A. Lambert,Cengage.
2) Python Programming: A Modern Approach, VamsiKurama,Pearson.
3) ReemaThareja, Python Programming using problem solving Approach, Oxford University Press 2017
4) R. NageswaraRao core python Programming second Edition.

**Reference Books:**

1) Introduction to Python Programming, Gowrishankar.S, VeenaA, CRC Press.
2) Introduction to Programming Using Python, Y. Daniel Liang,Pearson.

***E - Resources:***

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf
2. https://bugs.python.org/file47781/Tutorial_EDIT.pdf

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH2L01 | ENGLISH COMMUNICATIVE SKILL LAB | 0 | 0 | 3 | 1.5 |

**Module - I:**

Introduction to Phonetics.

a) Brief Introduction to Consonants
b) Brief Introduction to Vowels & Diphthongs

**Module - II:**

Listening Comprehension

a) Comprehending Spoken material in British English.
b) Comprehending Spoken material in American English.
c) Intelligent Listening in Situations.

**Module -III:**

Role – Play / Dialogue Writing

a) Introducing one and others.
b) Asking for and giving information.
c) Asking for and responding to give directions.
d) Seeking permission, requests.
e) Apologizing.

**Module - IV:**

Communication Skills

a) Verbal and Non – verbal communications
b) Barriers of communication.
c) Body Language – Voluntary and Involuntary.

**Module - V:**

Presentation Skills.

a) Extempore
b) JAM Sessions
c) Paper Presentation

**Module - VI:**

a) Group Discussions: Dos and Don'ts- Types, Modalities

Resume Preparation

**References:**

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
8. Technical Communication- Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
9. Technical Communication- Gajendrea Singh Chauhan, SmitaKashiramka, Cengage Publications.

**DEPARTMENT OF CSE - DATA SCIENCE**

**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH2L02 | APPLIED PHYSICS LAB | 0 | 0 | 3 | 1.5 |

**COURSE OUTCOMES:**

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

CO1 : **Memorize** the conditions for sustained Interference and Diffraction.

CO2 : **Understand** the basic concepts of LASER.

CO3 : **Identify** the properties of various materials.

CO4 : **Apply** the concept of dielectrics on the materials.

CO5 : **Analyze** the acoustic properties of sound.

**List of Experiments :**

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
4. Energy Band gap of a Semiconductor p - n junction
5. Characteristics of Thermistor – Temperature Coefficients
6. Determination of dielectric constant.
7. LASER - Determination of wavelength by plane diffraction grating
8. Rigidity modulus of material by wire-dynamic method (Torsional pendulum)
9. Verification of laws of vibrations in a stretched string – Sonometer
10. LASER - Determination of particle size using laser.
11. Determination of moment of inertia of a fly wheel.
12. Melde's Experiment – Transverse and longitudinal waves
13. Determination of time constant – C- R Circuit.
14. I/V Characteristics of ZENAR diode.
15. Determination of Young's Modules of the given Beam – Cantilever.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS2L01 | PYTHON PROGRAMMING LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

The aim of Python Programming Lab is

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python
- To develop the skill of designing Graphical user Interfaces in Python
- To develop the ability to write database applications in Python

**Course Outcomes*:***

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

**CO 1**: Write, Test and Debug Python Programs

**CO 2**: Use Conditionals and Loops for Python Programs

**CO 3:** Use functions and represent Compound data using Lists, Tuples and Dictionaries

**CO 4:** Use various applications using python

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86,89.
4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5) Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

```
*
**
***
****
```

6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7) Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not closeotherwise.
8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*
10) Write a program that asks the user for a large integer and inserts commas into it according

to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be1,000,000.

11) Write a program that generates a list of 20 random numbers between 1 and100.
12) Print the list.
13) Print the average of the elements in the list.
14) Print the largest and smallest values in the list.
15) Print the second largest and second smallest entries in the list
16) Print how many even numbers are in the list.
17) Write a program to use split and join methods in the given string and store them in a dictionary data structure.
18) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].
19) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometres. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, it is much shorter with lists and it is also easier to add new conversions if you use lists.
20) Write a function called *sum_digits*that is given an integer num and returns the sum of the digits of num.
21) Write a function called *first_diff*that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return-1.
22) Write a function called *number_of_factors*that takes an integer and returns how many factors the number has.
23) Write a function called *is_sorted*that is given a list and returns True if the list is sorted and False otherwise.
24) Write a function called root that is given a number x and an integer n and returns x1/n. In the function definition, set the default value of n to 2.
25) Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
    (a)Do this using the sort method. (b) Do this without using the sort method
26) Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.
27) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
28) Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file calledftemps.txt.
29) Write a class called Product. The class should have fields called name, amount, and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price*that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10

and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase*that receives the number of items to be bought and decreases amount by thatmuch.

30) Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes*that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours*that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
31) Write a Python class to implement pow(x,n).
32) Write a Python class to reverse a string word byword.
33) Write a program to demonstrate Try/except/else.
34) Write a function nearly _equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
35) Write a python program to create wheel using turtle graphics.
36) Write a python program on GUI to create a Registration form.
37) Write a python program to check whether a string starts and ends with the same character or not (using Regular Expression re module).

**Text Books**

1) Fundamentals of Python First Programs, Kenneth. A. Lambert,Cengage.
2) Python Programming: A Modern Approach, VamsiKurama,Pearson.
3) ReemaThareja, Python Programming using problem solving Approach, Oxford University Press 2017
4) R. NageswaraRao core python Programming second Edition.

**Reference Books:**

1) Introduction to Python Programming, Gowrishankar.S, VeenaA, CRC Press.
2) Introduction to Programming Using Python, Y. Daniel Liang,Pearson.

**E-Resources:**

1) https://www.tutorialspoint.com/python3/python_tutorial.pdf
2) https://bugs.python.org/file47781/Tutorial_EDIT.pdf

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE2M01 | ENVIRONMENTAL SCIENCES | 2 | 0 | 0 | 0 |

**COURSE OUTCOMES:**

**After successful completion of this course, students will be able to**

CO1 : Identify the fundamental concepts and the first global initiatives towards sustainable development and the possible means to combat the challenges

CO2 : Examine the natural resources, their availability for the sustenance of the life and recognize the need to promote the green technologies to conserve the natural resources

CO3 : Assess the concepts of the ecosystem, its function in the environment and the need for protecting various ecosystems
Discuss the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity

CO4 : Explain various attributes of the pollution and their impacts and measures to control the pollution along with waste management practices

CO5 : Outline the social issues including the environmental legislations of India and environmental assessment and also to investigate the industrial, urban and rural conditions in the surroundings.

**UNIT I: Scope and Importance of Environmental Studies**

Definition and components of environment, Scope and Importance: Sustainability: Stockholm and Rio Summit: Global Environmental Challenges: Global warming and climate change- Acid rains, Ozone layer depletion, Population Explosion and effects, Role of IT in environmental protection and human health.

**UNIT-II: Natural Resources and associated problems**

Forest resources – Use and over – exploitation, deforestation – 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.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems,

Energy resources: Growing energy needs, renewable and non-renewable energy sources

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification.

**UNIT-III: Ecosystems and Biodiversity and its conservation**

Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem –Bio geo chemical cycles-Ecological succession. – Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

Green Campus and Green Energy. Identification of species by involving in activities like plantation inside or outside the campus.

**Biodiversity and its conservation:** Definition: genetic, species and ecosystem diversity - classification - Value of biodiversity: consumptive use, productive use, social- India as a mega-diversity nation - Hot-spots of biodiversity- Threats to biodiversity: habitat loss, man-wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity.

**UNIT-IV: Environmental Pollution**

Definition, Cause, effects and control measures of **Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards**. Role of an individual in prevention of pollution. - Pollution case studies,

**Solid Waste Management:** Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management. Industrial Disasters and Pollution Case studies: -Bhopal Disaster, Chernobyl accident, Love canal Disaster.

**UNIT-V: Environmental Legislation and the Environmental Management**

Environmental 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

Impact Assessment and its significance-various stages of EIA, preparation of EMP and EIS, Eco-tourism.

Visit to an Industry / Urban/Rural/Agricultural Ecosystem and submit a report individually on any issues or Documentation of Plants and Animals (Field work Equal to 3 lecture hours).

**TEXT BOOKS:**

1. Environment Studies, Fourth Edition, Anubha Kaushik, C P Kaushik, New Age International Publishers.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi.
3. Fundamentals of Environment Studies, MahuaBasu and S.Xavier, Cambridge Publishers, 2014.
4. Textbook of Environmental Science, M. Anji Reddy, B S Publications, Hyderabad

**REFERENCE BOOKS:**

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, NewDelhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, NewDelhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New AgeInternational Publishers,2014

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH3T05 | PROBABILITY & STATISTICS | 3 | 0 | 0 | 3 |

**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

**Course Outcomes:**

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

**CO1 :** Determine the mean and variance of discrete and continuous random variables.

**CO2 :** Calculate probabilities using normal distribution and construct sampling distribution of means.

**CO3 :** Estimate the confidence interval for the mean of a population and test a hypothesis concerning means.

**CO4:** Estimate the confidence intervals, test a hypothesis concerning variances and proportions.

**CO5 :** Calculate correlation coefficient and determine line a regression for bivariate data.

**Unit I:**

**Random Variables**: Random variables, types of random variables, probability distribution function, probability density function, mean and variance of a random variable

**Unit II:**

**Probability Distributions and Sampling Distributions:**

Normal distribution: calculating normal probabilities, normal approximation to the Binomial distribution. Sampling distributions: population and sample, sampling distribution of the mean (known), sampling distribution of the mean (unknown).

**Unit III:**

**Estimation and Test of Hypothesis of Means :**

Point estimation, interval estimation, introduction to test of hypothesis, hypotheses is concerning one mean, hypothesis concerning two means, matched pair comparisons.

**Unit IV:**

**Estimation, Test of Hypothesis of Variances and Proportions** Estimation of variance, hypothesis concerning one variance, hypothesis concerning two variances, estimation of proportion, hypothecs is concerning one proportion, hypotheses is concerning several proportions.

**Unit V:**

**Regression analysis:**

The method of least squares, curvilinear regression, multiple regression, correlation (excluding causation).

**Text book:**

1. Richard A. Johnson,"*Miller & Freund's Probability and Statistics for Engineers*", 8th edition, PHIL earning India Private Limited, 2011.

**Reference Books:**

1) S.Ross,"*A First Coursein Probability*", Pearson Education India, 2002.
2) W. Feller, "*An Introduction to Probability Theory and its Applications*", 1st edition, Wiley,1968.
3) Gilbert Strang, "*Introduction to Linear Algebra*", 5thedition, Wellesely- Cambridge Press, 2016.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS3T04 | MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE | 3 | 0 | 0 | 3 |

## Course Objectives:

This course is designed to:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science

## Course Outcomes:

**At the end of the course student will be able to**

**CO1 :** Demonstrate skills in solving mathematical problems.
**CO2:** Comprehend mathematical principles and logic.
**CO3:** Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software.
**CO4:** Manipulate and analyze data numerically and/or graphically using appropriate Software.
**CO5:** Communicate effectively mathematical ideas/results verbally or in writing.

**UNIT I**

Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

**UNIT II**

Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hassie Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures:Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.

**UNIT III**

Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems.

**UNIT IV**

Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations.

**UNIT V**

Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

**Text Books:**

1) Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P.Manohar, Tata McGraw Hill.
2) Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra,3rdEdition, Tata McGraw Hill.

**Reference Books:**

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P.Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
3. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

**E-Resources:**

1) https://nptel.ac.in/courses/106/106/106106094/

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS3T05 | DATA STRUCTURES & ALGORITHMS | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

**At the end of the Course the student shall be able to**

**CO 1:** Analyse algorithms and Describe searching, sorting and hashing techniques.
**CO 2:** Describe the concepts of stacks and queues.
**CO 3:** Apply the concepts of linked lists.
**CO 4:** Describe the concepts of trees.
**CO 5:** Explain the concepts of graphs

**UNIT-I**: **Analysis of Algorithms:** Efficiency of algorithms, A priori Analysis, Asymptotic notations, Time complexity of algorithms using Onotation, Polynomial Vs Exponential algorithms, Average, Best, Worst case complexities, Analysing recursive programs.
**Searching:** Introduction, Linear Search, Binary Search, Fibonacci Search.
**Internal Sorting:** Introduction, Bubble Sort, Insertion Sort, Selection Sort.
**Hashing** : Introduction, Hash Table Structure, Hash Functions

**UNIT-II**: Stacks: Introduction, Stack operations, Applications.
**Queues :** Introduction, Operations on queues, circular queues, Priority queues, Applications

**UNIT-III**
**Linked Lists:** Introduction, Singly linked lists, Circular linked lists, Doubly linked lists, Multiple linked lists, Applications.
**Linked Stacks and Linked Queues:** Introduction, Operations on linked stacks and linked queues, Dynamic memory management, Implementation of linked representations, Applications

**UNIT-IV: Trees and Binary Trees:** Introduction, Trees: Definition and Basic Terminologies, Representation of trees. Binary trees: Basic terminologies and types, representation of binary trees, binary tree traversals, applications.
**Binary Search Trees and AVL Trees :** Introduction, Binary search trees: Definition and operations, AVL Trees: Definition and operations, Applications

**UNIT-V**
**Graphs:** Introduction, Definitions and basic terminologies, Representations of graphs, Graph traversals and applications.

**TEXT BOOKS:**

1. Data Struct & Algorithm Analysis in C | Second Edition | Mark Allen Weiss |by Pearson
2. Data Structures using C |Second Edition| by Reema Thareja| Oxford

**REFERENCES:**

1. G.A.V. PAI, *Data Structures and Algorithms, Concepts, Techniques and Applications*,Volume1,1st Edition , TataMcGraw-Hill,2008.
2. Richard F. Gilberg & Behrouz A. Forouzan, *Data Structures, Pseudo code Approach withC*,2nd Edition, CengageLearningIndiaEdition,2007.
3. angsam,M.J.Augenstein,A.M.Tanenbaum,*Data structure susing C and C++*, 2nd Edition, PHIE ducation, 2008.
4. Sartaj Sahni, Ellis Horowitz, *Fundamentals of Data Structures in C*, 2nd Edition, Orient blacks wan, 2010.

**E- REFERENCES:**

1. https://www.javatpoint.com/data-structure-tutorial

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD3T01 | FUNDAMENTALS OF DATA SCIENCE | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To provide a comprehensive knowledge of data science using Python.
- To learn the essential concepts of data analytics and data visualization

**Course Outcomes:**

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

**CO1 :** Apply principles of NumPy and Pandas to the analysis of data.
**CO2 :** Make use of various file formats in loading and storage of data.
**CO3 :** Identify and apply the need and importance of pre-processing techniques.
**CO4 :** Show the results and present them in a pictorial format.

**UNIT I**

**Data science:** definition, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process.

**NumPy Basics**: The NumPy ndarray: A Multidimensional Array Object, Creating nd arrays ,Data Types for nd arrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

**UNIT II**

**Getting Started with pandas:** Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, Data Frame, Index Objects, Essential Functionality Re indexing, Dropping entries from an axis, Indexing, selection, and filtering),Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

**UNIT III**

**Data Loading, Storage, and File Formats :** Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in MongoDB

**UNIT IV**

**Data Wrangling:** Combining and Merging Data Sets, Database style Data Frame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.

**UNIT V**

**Plotting and Visualization:** A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File,Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

**Text Books :**

1. Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013

**Reference Books:**

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
2. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS3T01 | DATABASE MANAGEMENT SYSTEMS | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To introduce about database management systems
- To give a good formal foundation on the relational model of data and usage of Relational Algebra
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptualdesign, logical design through normalization
- To provide an overview of physical design of a database system, by discussing Database indexingtechniques and storage techniques

**Course Outcomes:**

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

**CO1 :** Describe a relational database and object-oriented database
**CO2 :** Create, maintain and manipulate a relational database using SQL
**CO3:** Describe ER model and normalization for database design
**CO4 :** Examine issues in data storage and query processing and can formulate appropriate solutions
**CO5**: Outline the role and issues in management of data such as efficiency, privacy, security, ethicalresponsibility, and strategic advantage

**UNIT I**

**Introduction:** Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure.

**UNIT II**

**Relational Model**: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance **BASIC SQL**: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

**UNIT III**

**Entity Relationship Model**: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. **SQL**: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

**UNIT IV**

**Schema Refinement (Normalization)**:Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).

**UNIT V**

**Transaction Concept:** Introduction of Transaction Processing, DBMS Buffers, Concurrency control, Types of Failures, Transaction states and Operations, System log, Transaction Properties, Schedules and Types of Schedules.

**Indexing Techniques**: File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing: Tree base Indexing, Comparison of File Organizations.

**Text Books:**

1) Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
2) Database System Concepts,5/e, Silberschatz, Korth, TMH

**Reference Books:**

1) Introduction to Database Systems, 8/e C J Date, PEA.
2) Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA
3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel,Steven Morris, Peter Robb, Cengage Learning.

**e-Resources:**

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://www.geeksforgeeks.org/introduction-to-nosql/

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD3L01 | FUNDAMENTALS OF DATA SCIENCE LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**
The main objective of the course is to inculcate the basic understanding of Data Science and it's practicalimplementation using Python.

**Course Outcomes:**
**At the end of the Course, the student will be able to**
**CO1 :**Perform various operations on numpy arrays
**CO2 :**Importing data from different file formats using pandas
**CO3 :**Draw different types of charts using matplotlib

**List of Experiments :**
1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly spaced ndarray

2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array

3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays

4. Indexing and Slicing of NumPy Array
   a. Slicing 1-D NumPy arrays
   b. Slicing 2-D NumPy arrays
   c. Slicing 3-D NumPy arrays
   d. Negative slicing of NumPy arrays

5. Stacking and Concatenating Numpy Arrays
   a. Stacking ndarrays
   b. Concatenating ndarrays
   c. Broadcasting in Numpy Arrays

6. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column

7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting based on column values
   c. groupby()

8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files

9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
   a. Feature Scaling
   b. Feature Standardization
   c. Label Encoding
   d. One Hot Encoding

12. Perform following visualizations using matplotlib
   a. Bar Graph
   b. Pie Chart
   c. Box Plot
   d. Histogram
   e. Line Chart and Subplots
   f. Scatter Plot

**Web References:**

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration- python/

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS3L03 | DATA STRUCTURES & ALGORITHMS LAB | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**
**At the end of the Course the student shall be able to**
**CO1**:Apply recursive and iterative methodologies to solve complex engineering problems.
**CO2**: Solve searching and sorting techniques and evaluate time & space complexities.
**CO3**: Develop solutions to create and implement operations of linear and nonlinear data structures.
**CO 4**:Identify and apply suitable data structure for a given real time problem

**List of Experiments:**
**Exercise 1:**
a) Write a recursive C program to calculate Factorial of an integer.
b) Write a recursive C program which computes the $n^{th}$ Fibonacci number, for appropriate values of n.

**Exercise 2:**
a) Write a recursive C program to calculate GCD (n, m).
b) Write a recursive C program for Towers of Hanoi: N disks are to be transferred from peg S to peg D with Peg I as the intermediate peg.

**Exercise 3:**
a) Write a C program that implements Selection sort, to sort a given list of integers in ascending order.
b) Write a C program that implements Insertion sort, to sort a given list of integers in ascending order.

**Exercise 4:**
a) Write a C program that implements Quick sort, to sort a given list of integers in ascending order.
b) Write a C program that implements Radix sort, to sort a given list of integers in ascending order.
c) Write a C program that implements Merge sort, to sort a given list of integers in ascending order.

**Exercise 5:**
a) Write a C program that implements Stack (its operations) using arrays.
b) Write a C program that uses Stack operations to convert infix expression into postfix expression

**Exercise 6:**

a) Write a C program that implements Queue (its operations) using arrays.
b) Write a C program that implements Circular Queue (its operations) using arrays.

**Exercise 7:**

a) Write a C program that uses functions to create a singly linked list and its operations(insert, delete, search).
b) Write a C program to reverse elements of a singly linked list.

**Exercise 8:**

a) Write a C program that implements Stack (its operations) using Linked list.
b) Write a C program that implements Queue (its operations) using Linked list.

**Exercise 9:**

a) Write a C program to create a Circular Linked list and its operations(insert, delete, search).
a) Write a C program to create a Doubly Linked list and its operations( insert, delete, search).

**Exercise 10:**

a) Write a C program to create a Binary Search Tree and its operations.
b) Write a recursive C program for traversing a Binary Search Tree in preorder, inorder and postorder.

**Exercise 11:**

a) Write a C program to perform BFS traversal on given graph.
b) Write a C program to perform DFS traversal on given graph.

**TEXT BOOKS:**

1. Richard F, Gilberg, Forouzan, Data Structures, 2nd edition, Cengage
2. Aaron M. Tenenbaum, YedidyahLangsam, Moshe J Augenstein, Data Structures usingC, Pearson.
3. Mark Allen Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson Education. Ltd.

**REFERENCE BOOKS:**

1. Jean-Paul Tremblay Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd edition, Mc Graw Hill Higher Education
2. Seymour Lipschutz, Data Structure with C, TMH
3. ReemaThareja, Data Structures using C, 2nd edition, Oxford

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS3L01 | DATABASE MANAGEMENT SYSTEMS LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

**Course Outcomes:**

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

**CO1** : Utilize SQL to execute queries for creating database and performing data manipulation Operations.

**CO2** : Examine integrity constraints to build efficient databases

**CO3** : Apply Queries using Advanced Concepts of SQL

**CO4** : Build PL/SQL programs including stored procedures, functions, cursors and triggers

**List of Exercises:**

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creatingtables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example: Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5. 
   i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printedfor those who secured first class and an exception can be raised if no records were found)
   ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression.The program can be extended using the NULLIF and COALESCE functions
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION

ERROR.

8. Programs development using creation of procedures, passing parameters IN And OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements andwrite complex functions
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERECURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexingtechniques.

**Text Books/Suggested Reading:**

1) Oracle: The Complete Reference by Oracle Press
2) Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3) Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER – III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS3S01 | MOBILE APP DEVELOPMENT | 1 | 0 | 2 | 2 |

**Course Objectives:**

- To understand the components and structure of mobile application development frameworks forAndroid and windows OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.

**Course Outcomes:**

**At the end of this course, students will be able to:**

**CO1**: Identify various concepts of mobile programming that make it unique from programming for other Platforms.

**CO2:** Critique mobile applications on their design pros and cons

**CO3:** Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,

**CO4**: Program mobile applications for the Android operating system that use basic and advanced phone features and Deploy applications to the Android marketplace for distribution.

**LIST OF EXPERIMENTS:**

1. Introduction to mobile technologies and devices , Android platform and applications overview
2. Setting Android development environments
3. Writing Android applications, Understanding anatomy of an Android application
4. Develop an application that uses GUI components, Font and Colours
5. Develop an application that uses Layout Managers and event listeners.
6. Write an application that draws basic graphical primitives on the screen.
7. Develop an application that makes use of databases.
8. Develop an application that makes use of Notification Manager
9. Implement an application that uses Multi-threading
10. Develop a native application that uses GPS location information
11. Implement an application that writes data to the SD card.
12. Implement an application that creates an alert upon receiving a message
13. Write a mobile application that makes use of RSS feed
14. Develop a mobile application to send an email.
15. Develop a Mobile application for simple needs (Mini Project)

**References:**

1. Android Programming unleashed , B.M. Harwani, Pearson, 2013.
2. Android Programming (Big Nerd Ranch Guide), by Bill Phillips, Chris Stewart, Brian Hardy, Kristin Marsicano, Pearson, 2016
3. Android Programming – Pushing the limits by Hellman by Erik Hellman, WILEY, 2013

**Web References:**

1. The Complete Android N Developer Course –Udemy https://www.udemy.com/course/complete-android-n-developer-course/?altsc=428526
2. Android Development Courses on Google developers training https://developers.google.com/training/android/
3. Mobile Computing - Video course- NPTEL https://nptel.ac.in/courses/106/106/106106147/#
4. Android Tutorial – Tutorial Point https://www.tutorialspoint.com/android/index.htm

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE3M01 | CONSTITUTION OF INDIA | 2 | 0 | 0 | 0 |

***Course Objectives:***

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court andhigh court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative

**Course Outcomes:**

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

**CO1 :** Understand historical background of the constitution making and its importance for building a democratic India.

**CO2** : Understand the functioning of three wings of the government ie., executive, legislative and judiciary

**CO3:** Understand the value of the fundamental rights and duties for becoming good citizen of India.

**CO4 :** Analyze the decentralization of power between central, state and local self-government.

**CO5 :** Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

1. Know the sources, features and principles of Indian Constitution.
2. Learn about Union Government, State government and its administration.
3. Get acquainted with Local administration and Pachayati Raj.
4. Be aware of basic concepts and developments of Human Rights.
5. Gain knowledge on roles and functioning of Election Commission

**Unit I**

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning outcomes: After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

**Unit II**

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

Learning outcomes: After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

**Unit III**

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Learning outcomes: After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

**Unit IV**

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level, Role of Elected and Appointed officials - Importance of grass root democracy Learning outcomes:-After completion of this unit

- student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

**Unit V**

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes: After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate

***References:***

1) Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt.Ltd.
2) SubashKashyap, Indian Constitution, National Book Trust
3) J.A. Siwach, Dynamics of Indian Government & Politics
4) D.C. Gupta, Indian Government and Politics
5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal LawPublication)
6) J.C. Johari, Indian Government andPolitics Hans
7) J. Raj IndianGovernment and Politics
8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law,Prentice – Hall of India Pvt. Ltd.. New Delhi
9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

***e-Resources:***

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
   www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution
5) https://www.javatpoint.com/html-tutorial
6) https://www.javatpoint.com/css-tutorial

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH4T03 | NUMERICAL METHODS & TRANSFORMATIONS | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced levelby handling various real world applications.

**Course Outcomes:**

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

**CO1**: Evaluate approximating the roots of polynomial and transcendental equations

**CO2**: Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals.

**CO3**: Apply different algorithms for approximating the solutions of ordinary Differential equations toits analytical computations .

**CO4**: Apply the Laplace transform for solving differential equations.

**CO5**: Find or compute the Fourier series of periodic signals and apply integral Expressions for the forwards and inverse Fourier transform to a range of non- periodic waveforms.

**UNIT I : Iterative methods:**

Introduction – Bisection method – Iteration method – Newton-Raphson method (One variable) – Jacobi and Gauss-Seidel methods for solving system of equations.

**UNIT II: Interpolation:**

Introduction – Finite differences – Forward differences – Backward differences – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula.

**UNIT III: Numerical integration and solution of ordinary differential equations**

Trapezoidal rule – Simpson's 1/3rd and 3/8th rule – Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

**UNIT-IV: Laplace Transform :**

Laplace transforms of standard functions-Shifting Theorems, Transforms of derivatives and integrals , Inverse Laplace transforms– Convolution theorem (with out proof).Application : Solutions of ordinary differential equations using Laplace transforms

**UNIT V: Fourier Series:**

Introduction- Periodic functions – Fourier series of -periodic function - Dirichlet's conditions– Even and odd functions –Change of interval– Half-range sine and cosine series. **Fourier Transforms**: Fourier integral theorem (without proof) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

***Text Books:***

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley-India.
2. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT4T01 | OBJECT ORIENTED PROGRAMMING THROUGH JAVA | 3 | 0 | 0 | 3 |

**Course Objectives:**

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes,invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exceptionhandling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

**Course Outcomes:**

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

**CO1**: Able to realize the concept of Object Oriented Programming & Java Programming Constructs

**CO2**: Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages,Enumeration and various keywords.

**CO3**: Apply the concept of exception handling and Input/ Output operations

**CO4**: Able to design the applications of Java & Java applet

**CO5**: Able to Analyse & Design the concept of Event Handling and Abstract Window Toolkit

**UNIT I**

**Program Structure in Java:** Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

**Data Types**, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator ( = ), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

**Control Statements:** Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

**UNIT II**

**Classes and Objects:** Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

**Methods:** Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

**UNIT III**

**Arrays:** Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

**Inheritance**: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

**Interfaces**: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

**UNIT IV**

**Packages** and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. time. Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

**Exception Handling** :Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

**UNIT V**

**String Handling in Java**: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.

**Multithreaded Programming**: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

**Java Database Connectivity**: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface, Creating JDBC Application, JDBC Batch Processing, JDBC Transaction Management

**Text Books:**

1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2) The complete Reference Java, 8th edition, Herbert Schildt, TMH

**References Books:**

1) Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
2) Murach's Java Programming, Joel Murach

**E-Resources:**

1) https://nptel.ac.in/courses/106/105/106105191/
2) https://www.w3schools.com/java/java_data_types.asp

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD4T01 | DATA WAREHOUSING AND MINING | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand and implement classical models and algorithms in data warehousing and data mining.
- To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
- To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

**Course Outcomes:**

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

**CO1** : Summarize the architecture of data warehouse
**CO2** : Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.
**CO3** : Construct a decision tree and resolve the problem of model over fitting
**CO4** : Compare Apriori and FP-growth association rule mining algorithms for frequent item set generation
**CO5** : Apply suitable clustering algorithm for the given data set

**UNIT- I**

**Data Warehouse and OLAP Technology:** An Overview: What Is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber).

**UNIT- II**

**Data Mining:** Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.
Data Pre-processing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan &Vipin).

**UNIT -III**

**Classification:** Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction.
**Model Over fitting:** Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan &Vipin)

**UNIT -IV**

**Association Analysis:** Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, A priori Principle, A priori Algorithm, Rule Generation, Compact Representation of Frequent Item sets, FP- Growth Algorithm. (Tan & Vipin)

**UNIT -V**

**Cluster Analysis:** Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin).

**Text Books :**

1. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression,Pearson, 2015.
2. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

**Reference Books:**

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
2. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
3. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
4. Data Mining Techniques, Arun K Pujari, Universities Press, 2001

**Web Resources:**

NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS4T02 | FORMAL LANGUAGES AND AUTOMATA THEORY | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To learn fundamentals of Regular and Context Free Grammars and Languages
- To understand the relation between Regular Language and Finite Automata and machines
- To learn how to design Automata's and machines as Acceptors, Verifiers and Translators
- To understand the relation between Contexts free Languages, PDA and TM
- To learn how to design PDA as acceptor and TM as Calculators

**Course Outcomes:**

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

**CO1**: Classify machines by their power to recognize languages.
**CO2**: Summarize language classes & grammars relationship among them with the help of Chomskyhierarchy
**CO3**: Employ finite state machines to solve problems in computing
**CO4**: Illustrate deterministic and non-deterministic machines
**CO5**: Quote the hierarchy of problems arising in the computer science

**UNIT I**

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

**UNIT II**

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

**UNIT III**

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Є-Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

**UNIT IV**

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

**UNIT V**

Turning Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

**Text Books:**

1) Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008
2) Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007

**Reference Books:**

1) Elements of Theory of Computation, Lewis H.P. &Papadimition C.H., Pearson /PHI
2) Theory of Computation, V. Kulkarni, Oxford University Press, 2013
3) Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014

**e-Resources:**

1) https://nptel.ac.in/courses/106/104/106104028/

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH4T01 | MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS | 3 | 0 | 0 | 3 |

**Course Objectives:**

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals

**Course Outcomes:**

**CO1**: The Learner is equipped with the knowledge of estimating the Demand and demand elasticity's for aproduct.

**CO2**: The knowledge of understanding of the Input-Output-Cost relationships and estimation of the leastcost combination of inputs.

**CO3**: The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.

**CO4**: The Learner is able to prepare Financial Statements and the usage of various Accounting tools forAnalysis.

**CO5**: The Learner can able to evaluate various investment project proposals with the help of capitalbudgeting techniques for decision making.

**UNIT I**

**Introduction to Managerial Economics and demand Analysis:** Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

**UNIT II**

**Theories of Production and Cost Analyses:** Theories of Production function- Law of Variable proportions- Isoquants and Iso costs and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

**UNIT III**

**Introduction to Markets, Theories of the Firm & Pricing Policies:** : Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features– Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features –Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State / Public Enterprises and their forms.

**UNIT IV**

**Introduction to Accounting & Financing Analysis**: Introduction to Accounting & Financing Analysis: Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements - Analysis and Interpretation of Financial Statements - Ratio Analysis.

**UNIT V**

**Capital and Capital Budgeting**: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (Pay-Back Period, Accounting Rate of Return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

**Text Books:**

1) A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

**Reference Books:**

1) Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd.
2) JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition
3) N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd.
4) MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5) I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6) V. Maheswari, Managerial Economics, S. Chand & Company Ltd.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT4L01 | OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

The aim of this lab is to

- Practice programming in the Java
- Gain knowledge of object-oriented paradigm in the Java programming language
- Learn use of Java in a variety of technologies and on different platforms

**Course Outcomes:**

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

**CO1**: Evaluate default value of all primitive data type, Operations, Expressions, Control-flow, Strings

**CO2**: Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism.

**CO3**: Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism

**CO4**: Construct Threads, Event Handling, implement packages, developing applets

**Exercise - 1** (Basics)

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers

**Exercise - 2** (Operations, Expressions, Control-flow, Strings)

a) Write a JAVA program to search for an element in a given list of elements using binary searchmechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program to sort for an element in a given list of elements using merge sort.

d) Write a JAVA program using String Buffer to delete, remove character

**Exercise - 3** (Class, Objects)

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.

b) Write a JAVA program to implement constructor

**Exercise - 4** (Methods)

a) Write a JAVA program to implement constructor overloading.

b) Write a JAVA program implement method overloading

**Exercise - 5** (Inheritance)

a) Write a JAVA program to implement Single Inheritance
b) Write a JAVA program to implement multi level Inheritance
c) Write a java program for abstract class to find areas of different shapes

**Exercise - 6** (Inheritance - Continued)

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

**Exercise - 7** (Exception)

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses

**Exercise – 8 (**Runtime Polymorphism)

a) Write a JAVA program that implements Runtime polymorphism
b) Write a Case study on run time polymorphism, inheritance that implements in above problem

**Exercise – 9** (User defined Exception)

a) Write a JAVA program for creation of Illustrating throw
b) Write a JAVA program for creation of Illustrating finally
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of User Defined Exception

**Exercise – 10** (Threads)

a) Write a JAVA program that creates threads by extending Thread class .First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds ,(Repeat the same by implementing Runnable)
b) Write a program illustrating **isAlive** and **join ()**
c) Write a Program illustrating Daemon Threads.

**Exercise - 11** (Threads continuity)

a) Write a JAVA program Producer Consumer Problem
b) Write a case study on thread Synchronization after solving the above producer consumer problem

**Exercise – 12** (Packages)

a) Write a JAVA program illustrate class path
b) Write a case study on including in class path in your os environment of your package.
c) Write a JAVA program that import and use the defined your package in the previous Problem

**Exercise - 13** (Applet)

a) Write a JAVA program to paint like paint brush in applet.
b) Write a JAVA program to display analog clock using Applet.
c) Write a JAVA program to create different shapes and fill colors using Applet.

**Exercise - 14** (Event Handling)

a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.
b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet

**TEXT BOOKS:**

1. Herbert schildt and Dale skrien, Java Fundamentals- A Comprehensive introduction, TMH.
2. P.J.Dietel and H.M.Dietel, Java: How to Program , PHI.

**REFERENCE BOOKS:**

1. P.Radha Krishna, Object Oriented Programming through java, Universities Press.
2. Bruce Eckel, Thinking in Java, Pearson Education.
3. S.Malhotra and S.Choudhary, Programming in Java, Oxford University Press

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD4L01 | DATA MINING USING PYTHON LAB | 0 | 0 | 3 | 1.5 |

**Course Outcomes:**

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

**CO1:** Apply pre-processing techniques on real world datasets

**CO2:** Apply a priori algorithm to generate frequent item sets.

**CO3**: Apply Classification and clustering algorithms on different datasets.

**Note:** Use python library scikit-learn wherever necessary

1. Demonstrate the following data preprocessing tasks using python libraries.
   a) Loading the dataset
   b) Identifying the dependent and independent variables
   c) Dealing with missing data

2. Demonstrate the following data pre processing tasks using python libraries.
   a) Dealing with categorical data
   b) Scaling the features
   c) Splitting dataset into Training and Testing Sets

3. Demonstrate the following Similarity and Dissimilarity Measures using python
   a) Pearson's Correlation
   b) Cosine Similarity
   c) Jaccard Similarity
   d) Euclidean Distance
   e) Manhattan Distance

4. Build a model using linear regression algorithm on any dataset.

5. Build a classification model using Decision Tree algorithm on iris dataset

6. Apply Naïve Bayes Classification algorithm on any dataset

7. Generate frequent itemsets using Apriori Algorithm in python and also generate association rules forany market basket data

8. Apply K- Means clustering algorithm on any dataset.

9. Apply Hierarchical Clustering algorithm on any dataset.

10. Apply DBSCAN clustering algorithm on any dataset.

**Web Resources:**

1. https://analyticsindiamag.com/data-pre-processing-in-python/
2. https://towardsdatascience.com/decision-tree-in-python-b433ae57fb93
3. https://towardsdatascience.com/calculate-similarity-the-most-relevant-metrics-in-a-nutshell-9a43564f533e
4. https://www.springboard.com/blog/data-mining-python-tutorial/
5. https://medium.com/analytics-vidhya/association-analysis-in-python-2b955d0180c
6. https://www.datacamp.com/community/tutorials/naive-bayes-scikit-learn
7. https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/
8. https://towardsdatascience.com/dbscan-algorithm-complete-guide-and-application-with-python-scikit-learn- d690cbae4c5d

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS4L03 | R PROGRAMMING LAB | 0 | 0 | 3 | 1.5 |

**Course Objective:**

In this course student will learn about the fundamentals of R programming, standard R libraries, solid understanding of R functions, write programs using the R and gain skills in R programming Language, get acquaintances with Arrays, Files, Strings, Packages, and distributions using R.

**Course Outcomes:**

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

**CO1**: Implement basic concepts of R programming, and its different module that includes conditional,looping, lists, Strings, Functions, Frames, Arrays, and File programming.
**CO2**: Implement the concepts of R Script to extract the data from data frames and file operations.
**CO3**: Implement the various statistical techniques using R.
**CO4**: Extend the functionality of R by using add-on packages
**CO5**: Use R Graphics and Tables to visualize results of various statistical operations on data

**List of Lab Experiments:**

**Week 1:**

a) Installing R and RStudio
b) Basic functionality of R, variable, data types in R

**Week 2:**

a) Implement R script to show the usage of various operators available in R language.
b) Implement R script to read person's age from keyboard and display whether he is eligible for voting or not.
c) Implement R script to find biggest number between two numbers.
d) Implement R script to check the given year is leap year ornot

**Week 3:**

a) Implement R Script to create a list.
b) Implement R Script to access elements in the list.
c) Implement R Script to merge two or more lists. Implement R Script to perform matrix operation

**Week 4:**

Implement R script to perform following operations:

a) various operations on vectors
b) Finding the sum and average of given numbers using arrays.
c) To display elements of list in reverse order.
d) Finding the minimum and maximum elements in the array.

**Week 9*:***

a) Implement R Script to perform Normal, Binomial distributions.
b) Implement R Script to perform correlation, Linear and multiple regression.

**Week 10:**

a) Introduction to Non-Tabular Data Types: Time series, spatial data, Network data. Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding

**Week 5:**

a) Implement R Script to perform various operations on matrices
b) Implement R Script to extract the data from dataframes.
c) Write R script to display file contents.
d) Write R script to copy file contents from one file to another

**Week 6 :**

a) Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcar s& cars datasets.
b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset

**Week 7:**

a) Reading different types of data sets (.txt, .csv) from Web or disk and writing in file in specific disklocation.
b) Reading Excel data sheet in R.
c) Reading XML dataset in R

**Week 8:**

a) Implement R Script to create a Pie chart, Bar Chart, scatter plot and Histogram (Introduction toggplot2 graphics)
b) Implement R Script to perform mean, median, mode, range, summary, variance, standard deviation operations.

**Week 11:**

a) Introduction Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates,outliers, spelling

**Week 12:**

a) Data sources: SQLite examples for relational databases, Loading SPSS and SAS files, Reading fromGoogle Spreadsheets, API and web scraping examples

**References:**

1. R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications
2. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications
3. R Programming For Dummies by JorisMeysAndrie de Vries, Wiley Publications
4. Hands-On Programming with R by Grolemund, O Reilly Publications
5. Statistical Programming in R by KG Srinivas G.M. Siddesh, ChetanShetty&Sowmya B.J. - 2017edition
6. R Fundamentals and Programming Techniques, ThomasLumely.
7. R for Everyone Advanced Analytics and Graphics, Jared P. Lander- Addison WesleySeries
8. The Art of R Programming, Norman Matloff, CengageLearning
9. Maria DoloresUgarte,AnaF.Militino,AlanT.Arnholt—ProbabilityandStatisticswithR||2nd Edition on, CRC Press,2016.
10. R-programming for Data science, RogerD.Peng.
11. An Introduction to statistical learning-with applications in R, Trevor Hastie and Rob Tibshirani

**E-Resources:**

1. URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf ( Online Resources)
2. http://nptel.ac.in/courses/106104135/48
3. http://nptel.ac.in/courses/110106064/

**SOFTWARE requirements:**

1. The R statistical software program. Available from: https://www.r-project.org/
2. RStudio an Integrated Development Environment (IDE) for R. Available from: https://www.rstudio.com/

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD4S01 | MONGO DB | 1 | 0 | 2 | 2 |

**Course Outcomes:**

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

**CO1** :Installing and configuring mongoDB in windows

**CO2 :**Perform all database operations using mongoDB

**CO3**: Develop applications by integrating mongoDB with java/PHP.

**List of Experiments:**

1. MongoDB installation and configuration in windows.
2. Demonstrate how to create and drop a database in MongoDB.
3. Creating the Collection in MongoDB on the fly
4. Creating collection with options before inserting the documents and drop the collection created.
5. MongoDB insert document
   a) Insert single document
   b) Insert multiple documents in collection
6. Querying all the documents in json format and Querying based on the criteria.
7. MongoDB update document
   a) Using update() method.
   b) Using save() method.
8. MongoDB delete document from a collection.
   a) Using remove() method.
   b) Remove only one document matching your criteria
   c) Remove all documents
9. MongoDB Projection
10. limit() ,skip(), sort() methods in MongoDB
11. MongoDB indexing
    a) Create index in MongoDB
    b) Finding the indexes in a collection
    c) Drop indexes in a collection
    d) Drop all the indexes
12. MongoDB with java and PHP
    a) Create a simple application that uses MongoDB with Java
    b) Create a simple application that uses MongoDB with PHP

**Web References:**

1. https://beginnersbook.com/2017/09/mongodb-tutorial/

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT5T01 | DESIGN AND ANALYSIS OF ALGORITHMS | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms
2. To introduce the different algorithmic approaches for problem solving through numerous example problems
3. To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

**Course Outcomes:**

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

1. Describe asymptotic notation used for denoting performance of algorithms
2. Analyze the performance of a given algorithm and denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms
3. List and describe various algorithmic approaches
4. Solve problems using divide and conquer, greedy, dynamic programming, backtracking and branch and bound algorithmic approaches
5. Apply graph search algorithms to real world problems
6. Demonstrate an understanding of NP- Completeness theory and lower bound theory.

**UNIT I**

**Introduction:** Algorithm Definition, Algorithm Specification, performance Analysis, Pseudo code for expressing the algorithm, asymptotic notation.
**Sets & Disjoint set union**: introduction, union and find operations.
**Basic Traversal & Search Techniques**: Techniques for Graphs, connected components and Spanning Trees, Bi-connected components and DFS.

**UNIT II**

**Divide and Conquer**: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort.
**The Greedy Method:** The general Method, container loading, knapsack problem, Job sequencing with deadlines, minimum-cost spanning Trees.

**UNIT III**

**Dynamic Programming**: The general method, multistage graphs, All pairs-shortest paths, single- source shortest paths: general weights, optimal Binary search trees, 0/1 knapsack, reliability Design, The traveling salesperson problem.

**UNIT IV**

**Backtracking**: The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles.
**Branch and Bound**: FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack problem, Traveling salesperson problem.

**UNIT V**

P,NP, NP-Hard and NP-Complete problems: Basic concepts, Cook's Theorem.

String Matching: Introduction, String Matching-Meaning and Application, NaÏve String Matching Algorithm, Rabin-Karp Algorithm, Knuth-Morris-Pratt Automata.

**Text Books:**

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
2. Harsh Bhasin, " Algorithms Design & Analysis", Oxford University Press.

**Reference Books:**

1. Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Edition, Golgotha Publications, 2008.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press

**e-Resources:**

1)http://nptel.ac.in/courses/106101060/

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI5T02 | MACHINE LEARNING | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

1. Acquire theoretical Knowledge on setting hypothesis for pattern recognition.
2. Apply suitable machine learning techniques for data handling and to gain knowledge from it.
3. Evaluate the performance of algorithms and to provide solution for various real world applications.

**COURSE OUTCOMES:**

At the end of the Course, the student will be able to

1. Recognize the characteristics of Machine Learning techniques that enable to solve real world problems
2. Recognize the characteristics of machine learning strategies
3. Apply various supervised learning methods to appropriate problems
4. Identify and integrate more than one techniques to enhance the performance of learning
5. Create probabilistic and unsupervised learning models for handling unknown pattern
6. Analyze the co-occurrence of data to find interesting frequent patterns

**UNIT I**

Introduction to Machine Learning

Introduction ,Components of Learning , Learning Models , Geometric Models, Probabilistic Models, Logic Models, Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised, Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension.

**UNIT II**

Supervised and Unsupervised Learning

Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perception, Multilayer Perception, Support Vector Machines: Linear and Non-Linear, Kernel Functions, K Nearest Neighbours.

Introduction to clustering, K-means clustering, K-Mode Clustering

**UNIT III**

Ensemble and Probabilistic Learning

Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking.

Gaussian mixture models - The Expectation-Maximization (EM) Algorithm, Information Criteria, Nearest neighbour methods - Nearest Neighbour Smoothing, Efficient Distance Computations: the KD-Tree, Distance Measures.

**UNIT IV**

Reinforcement Learning and Evaluating Hypotheses

Introduction, Learning Task, Q Learning, Non deterministic Rewards and actions, temporal-difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in reinforcement learning.

Motivation, Basics of Sampling Theory: Error Estimation and Estimating Binomial Proportions, The Binomial Distribution, Estimators, Bias, and Variance.

**UNIT V**

Genetic Algorithms: Motivation, Genetic Algorithms: Representing Hypotheses, Genetic Operator, Fitness Function and Selection, An Illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning: Lamarkian Evolution, Baldwin Effect, Parallelizing Genetic Algorithms.

**TEXT BOOKS:**

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar " Foundations of Machine Learning", MIT Press,2012.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rdEdition, 1997.
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.

**REFERENCE BOOKS:**

1. CharuC.Aggarwal,"DataClassificationAlgorithmsandApplications",CRCPress,2014.
2. Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press,
3. 2014.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012
5. Jiawei Han and Micheline Kambers and JianPei, "Data Mining Concepts andTechniques",3rd edition, Morgan Kaufman Publications, 2012.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT5T02 | OPERATING SYSTEM | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

1. Understand main concepts of OS and to analyze the different CPU scheduling policies.
2. Understand process synchronization and deadlock management.
3. Understand memory management and virtual memory techniques.
4. Appreciate the concepts of storage and file management.
5. Study OS protection and security concepts

**Course Outcomes:**

At the end of the course, the student will be able to

1. Explain different functions and types of operating system and implement various process management concepts for maximization of CPU throughput
2. Analyse synchronization problems and design a deadlock management scheme.
3. Optimize memory management for improved system performance.
4. Demonstrate disk management, implement disk scheduling and file system interface
5. Describe and frame protection and security policy for OS.

**UNIT I**

**Operating Systems Overview**: Operating system functions, Operating system structure, Operating systems operations, Open-Source Operating Systems.
System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls.

**UNIT II**

**Process Concept**: Process scheduling, Operations on processes, Inter-process communication. Multithreaded Programming: Multithreading models, Thread libraries, threading issues.
Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling.
**Inter-process Communication**: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Classical IPC Problems - Dining philosopher's problem.

**UNIT III**

**Memory-Management Strategies**: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation.
**Virtual Memory Management**: Introduction, Demand paging, Page replacement Algorithms.

**UNIT IV**

**Deadlocks**: Resources, Conditions for resource deadlocks, Deadlock detection and recovery, File Systems: Files, Directories, File system implementation.
Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling.

**UNIT V**

**System Protection**: Goals of protection, Principles and domain of protection, Access control. System Security: Introduction, Program threats, System and network threats, Cryptography for security, User authentication, implementing security defenses, Firewalling to protect systems and networks. Case Studies: Linux, Microsoft Windows

**TEXT BOOKS:**

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Inter process Communication and File systems.)

**REFERENCE BOOKS:**

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

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD5E11 | SOFTWARE ENGINEERING<br>Professional Elective – 1 | 3 | 0 | 0 | 3 |

**Course Outcomes:**
At the end of the Course the Student will be able to:
CO1: Explain about appropriate software process models for software project/product.
CO2: Interpret the functional, non–functional requirements and requirement Engineering Process.
CO3: Choose the Architecture for a given software application.
CO4: Identify appropriate test strategies that can be applied to a given software application.
CO5: Analyze various Risk Management and Quality Management Techniques.

**UNIT-I**
**INTRODUCTION TO SOFTWARE ENGINEERING:** Software, The Nature of Software, Software Myths, The Software Process, A Generic Process Model, CMMI.
**PROCESS MODELS**: Prescriptive Process Models- The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models. Specialized Process Models. The Unified Process.

**UNIT-II**
**SOFTWARE REQUIREMENTS**: Introduction of Requirement, User Requirements, System requirements, Functional and Non-functional Requirements, The Requirement Engineering Process, **Requirements Elicitation**: Fact finding Techniques, Data/system Analyst, **Requirement Analysis**: Structured Analysis, Data oriented Analysis, Object oriented Analysis, Prototype. **Requirement Specification**: SRS, Characteristics and Components of SRS, Requirements Validation, Requirements Management.

**UNIT-III**
**DESIGN ENGINEERING**: The Design Process, Design Concepts, the Design Model. **ARCHITECTURAL DESIGN**: Software Architecture, Architectural Styles, Architectural Design, Architectural Mapping using Data Flow.

**UNIT-IV**
***SOFTWARE TESTING STRATEGIES:***
A Strategic Approach to Software Testing, Test Strategies for Conventional Software and Object Oriented Software, Validation Testing, White- Box Testing, Basis Path Testing, Black-Box Testing, System Testing.

**UNIT-V**
**RISK MANAGEMENT:**
Reactive versus Proactive Risk Strategies, Risk Identification, Risk Projection, Risk Refinement, RMMM, RMMM Plan.
**QUALITY MANAGEMENT**:
Software Quality, Informal Reviews, Formal Technical Reviews, Statistical Software Quality Assurance, Software Reliability.

***TEXTBOOKS:***

1. Roger S.Pressman, *Software Engineering a Practitioner's Approach*, 7thEdition, TMH,2010.
2. Sommerville, *Software Engineering*, 9th Edition, Pearson Education, 2011.

**REFERENCES:**

1. K.K.Agarwal & Yogesh Singh, *Software Engineering*, 3rdEdition, New Age International Publishers, 2008.
2. PankajJalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa PublishingHouse,2011.

***E- REFERENCES:***

1. https://nptel.ac.in/Courses/SoftwareEngineering
2. https://www.Coursera.org/Courses?query=software engineering
3. https://www.udemy.com/Courses/development/software-engineering

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD5E12 | OBJECT ORIENTED ANALYSIS AND DESIGN<br>Professional Elective – 1 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To understand how to solve complex problems
2. Analyse and design solutions to problems using object oriented approach
3. Study the notations of Unified Modelling Language

**Course Outcomes:**

1. Ability to find solutions to the complex problems using object oriented approach
2. Represent classes, responsibilities and states using UML notation
3. Identify classes and responsibilities of the problem domain
4. Evaluate the behaviour system.
5. Build solutions to the complex problems using OOAD and UML notations

**UNIT I**

**Introduction**: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems, Evolution of Object Model, Foundation of Object Model, Elements of Object Model, Applying the Object Model.

**UNIT II**

**Classes and Objects**: Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.

**UNIT III**

**Introduction to UML**: Why we model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams

**UNIT IV**

**Basic Behavioral Modeling**: Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.

**UNIT V**

**Advanced Behavioral Modeling**: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

**Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams

**Text Books:**

1. "Object- Oriented Analysis And Design with Applications", Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, 3rd edition, 2013, PEARSON.
2. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON

**Reference Books:**

1. "Object-oriented analysis and design using UML", Mahesh P. Matha, PHI
2. "Head first object-oriented analysis and design", Brett D. McLaughlin, Gary Pollice, Dave West, O"Reilly
3. "Object-oriented analysis and design with the Unified process", John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning
4. The Unified modeling language Reference manual", James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD5E13 | PRINCIPLES OF PROGRAMMING LANGUAGES<br>Professional Elective – 1 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To understand and describe syntax and semantics of programming languages.
2. To understand data, data types, and basic statements.
3. To understand call-return architecture and ways of implementing them.
4. To understand object-orientation, concurrency, and event handling in programming
5. Languages.
6. To develop programs in non-procedural programming paradigms

**Course Outcomes:**

1. Describe syntax and semantics of programming languages.
2. Explain data, data types, and basic statements of programming languages.
3. Design and implement subprogram constructs, Apply object - oriented, concurrency, and event.
4. Handling programming constructs. Develop programs in Scheme, ML, and Prolog.
5. Understand and adopt new programming languages

**UNIT I**

**Syntax and Semantics:** Evolution of Programming Languages, Describing Syntax, Context, Free Grammars, Attribute Grammars, Describing Semantics, Lexical Analysis, Parsing, Recursive - Decent Bottom - Up Parsing.

**UNIT II**

**Data, Data Types, and Basic Statements**: Names, Variables, Binding, Type Checking, Scope, Scope Rules, Lifetime and Garbage Collection, Primitive Data Types, Strings, Array Types, Associative Arrays, Record Types, Union Types, Pointers and References, Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Assignment Statements, Mixed Mode Assignments, Control Structures – Selection, Iterations, Branching, Guarded Statements.

**UNIT III**

**Sub Programs and Implementations**: Subprograms, Design Issues, Local Referencing, Parameter Passing, Overloaded Methods, Generic Methods, Design Issues for Functions, Semantics of Call and Return, Implementing Simple Subprograms, Stack and Dynamic Local Variables, Nested Subprograms, Blocks, Dynamic Scoping.

**UNIT IV**

**Object- Orientation, Concurrency, and Event Handling**: Object – Orientation, Design Issues for OOP Languages, Implementation of Object, Oriented Constructs, Concurrency, Semaphores, Monitors, Message Passing, Threads, Statement Level Concurrency, Exception Handling, Event Handling.

**UNIT V**

Functional Programming Languages: Introduction to Lambda Calculus, Fundamentals of Functional Programming Languages, Programming with Scheme, – Programming with ML.

**Logic Programming Languages**: Introduction to Logic and Logic Programming, Programming with Prolog, Multi - Paradigm Languages.

**Text Books:**

1. Robert W. Sebesta, "Concepts of Programming Languages", Tenth Edition, Addison Wesley,2012.
2. Programming Langugaes, Principles & Paradigms, 2ed, Allen B Tucker, RobertENoonan,TMH.

**References:**

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition,MIT Press,2009.
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Prentice Hall,1998.Richard A. O'Keefe, "The craft of Prolog", MITPress,2009.
3. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition.

**E-Resources:**

https://nptel.ac.in/courses/106102067

**DEPARTMENT OF CSE - DATA SCIENCE**

**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD5E13 | INTERNET OF THINGS<br>Professional Elective – 1 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Understand the basic characteristics of IoT system
2. Realize the different IoT Protocols and architectures
3. Analyze the cloud interface and security concerns of IoT devices
4. Introduce programming in various real-time hardware platforms
5. Design a complete IoT ecosystem for various smart applications

**Course Outcomes:**

1. Ability to learn characteristics, applications, components and challenges of Internet of Things (IOT)
2. Create understanding of IOT networking concepts – terminologies, stack components , infrastructure and data protocols
3. Create understanding of the concept of Cloud based IOT technologies, cloud service providers and security aspects
4. Develop skills in understanding and programming the Arduino and Raspberry Pi hardware platforms
5. Make the student understand the requirements, components ,challenges and develop various application areas - smart homes, smart grids, smart health care, smart cities and industrial IOT

**UNIT I**

**Introduction to IOT**: Characteristics of IOT, Applications of IOT, IOT Categories, IOT Enablers and Connectivity Layers, Sensors, Actuators, IOT Components & Implementation, Challenges for IOT

**UNIT II**

**IOT Networking & Connectivity Technologies**: Connectivity terminologies-IOT Node, LAN,WAN, Gateway, IOT protocol Stack vs. Web Stack, IOT Identification and Data Protocols-IPV4,IPV6,HTTP,MQTT,COAP,AMQP,DDS Connectivity Technologies – Zigbee, Bluetooth, LoRa
.

**UNIT III**

**Cloud for IOT:** IOT with Cloud-Challenges, Cloud service providers for IOT-Overview, Cloud service model, Cloud Computing – Security aspects, Case Study, Fog computing, Edge computing

**UNIT IV**

**Hardware Platforms**: Programming with Arduino-Features of Arduino, Components of Arduino Board, Arduino IDE, Program Elements, Raspberry Pi – Introduction, Architecture, PIN Configuration, Implementation of IOT with Raspberry Pi

**UNIT V**

**IOT Applications** : Smart Homes-Smart Home Origin, Technologies, Implementation, Smart Grids-Characteristics, Benefits, Architecture, Components, Smart Cities-Characteristics, Frameworks, Challenges, Industrial IOT-Requirements, Design Considerations, Applications

**Text Books:**

1. Internet of Things, Jeeva Jose, Khanna Publishing, 2018
2. Internet of Things, Abhishek S Nagarajan, RMD Sundaram, Shriram K Vasudevan, Wiley, 2019

**Reference Books:**

1. The Internet of Things, Michael Miller, Pearson Education Limited, 2015
2. IoT Applications, Security Threats, and Countermeasures, Padmalaya Nayak, Niranjan Ray, P. Ravichandran, Taylor &Francis,2021
3. Internet of Things: Architecture, Implementation and Security, MayurRamgir, Pearson Education Limited, 2019
4. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry,Pearson Education Limted, 2017.
5. Beginning LoRa Radio Networks with Arduino, Pradeeka Seneviratne, Apress, 2019

**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE5M03 | Intellectual Property Rights and Patents (IPR & PATENTS) | 2 | 0 | 0 | 0 |

**Course Objectives:**

1. Understand the basic characteristics of IoT system
2. Realize the different IoT Protocols and architectures
3. Analyze the cloud interface and security concerns of IoT devices
4. Introduce programming in various real-time hardware platforms
5. Design a complete IoT ecosystem for various smart applications

**Course Outcomes:**

1. Ability to learn characteristics, applications, components and challenges of Internet of Things (IOT)
2. Create understanding of IOT networking concepts – terminologies, stack components , infrastructure and data protocols
3. Create understanding of the concept of Cloud based IOT technologies, cloud service providers and security aspects
4. Develop skills in understanding and programming the Arduino and Raspberry Pi hardware platforms
5. Make the student understand the requirements, components ,challenges and develop various application areas - smart homes, smart grids, smart health care, smart cities and industrial IOT

**UNIT I : Introduction to Intellectual property**

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT II : Law of Copyrights**

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**UNIT III : Law of Patents**

Foundation of patent law, patent searching process, ownership rights and transfer. Patent litigation. Dilution of patent rights.

**UNIT IV : Trade Marks**

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter (strength and categories of trade marks), selecting, and evaluating trade mark, trade mark registration processes.

**UNIT - V: Trade Secrets**:

Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation.
Real time examples must be added to the concepts requires.

**REFERENCES:**

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddha ganguli, Tata Mc Graw Hill Publishing Company Ltd.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD5L01 | OPERATING SYSTEMS LAB | 1 | 0 | 2 | 2 |

**Course Outcomes:**

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

1. Evaluate the performance of different types of CPU scheduling algorithms
2. Implement producer-consumer problem, reader-writers problem and Dining philosophers' problem using semaphores.
3. Simulate Banker's algorithm for deadlock avoidance
4. Implement paging techniques and page replacement policies, memory allocation techniques in memory management.
5. Implement disk scheduling techniques and file allocation strategies .

**TASK 1**

Practice the following commands in UNIX environment

a) cp b) rm c) mv d) chmod e) ps f) kill

**TASK 2**

Write a program that makes a copy of a file using standard I/O and system calls

**TASK 3**

Simulate the following Scheduling algorithms.

a) FCFS b)SJF c)Priority d)Round Robin

**TASK 4**

Simulate the Producer Consumer problem using semaphores

**TASK 5**

Simulate the Readers – Writers problem using semaphores.

**TASK 6**

Simulate the Dining Philosophers problem using semaphores

**TASK 7**

Simulate Bankers Algorithm for Deadlock Avoidance.

**TASK 8**

Simulate First Fit and Best Fit algorithms for Memory Management.

**TASK 9**

Simulate paging technique of memory management.

**TASK 10**

Simulate page replacement Algorithms.

a)FIFO b)LRU

**TASK 11**

Simulate following Disk Scheduling algorithms.

a) FCFS b) SSTF c) SCAN d) C-SCAN
e) LOOK f) C-LOOK

**TASK 12**

Simulate file allocation strategies.

a) Sequential b) Indexed c) Linked

**Text Books/ References:**

1. Operating System Concepts- Abraham Silberchatz , Peter B. Galvin, Greg Gagne 7th Edition,JohnWiley.

2. Operating Systems– Internal and Design Principles Stallings, Fifth Edition–2005, Pearsoneducation/PHI.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - V**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI5L02 | MACHINE LEARNING AB | 0 | 0 | 3 | 1.5 |

***Course Outcomes:***

At the end of the course, the students will be able to:

1. Understand the implementation procedures for the machine learning algorithms
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms
4. Identify and apply Machine Learning algorithms to solve real world problems

**TASKS :**

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 Backpropagation 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

**Reference Books:**

1. Python Machine Learning by Sebastian Raschka, Oreilly Publishers
2. Machine Learning – Tom M. Mitchell, -MGH
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6T01 | COMPUTER NETWORKS | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Learn various Network topologies and Network models and transmission media..
2. Describe error detection, Flow control mechanisms and Multiple access protocols.
3. Understand different Routing technologies involved to route packets
4. Distinguish the standard Internet Protocol (IP), Transport Control Protocol (TCP) andUser Datagram Protocol for Internet.
5. Analyse and understand application layer protocols.

**Course Outcomes:**

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

1. Define basic terminologies of Computer Networks and to apply various networking configurations and transmission media to build a network for an organization.
2. Summarize error correction and detection techniques and MAC Protocols for specific networks.
3. Illustrate various routing algorithms and outline their applications.
4. Distinguish TCP and UDP protocols.
5. Make use of various application layer protocols in Internet based Applications

**UNIT I**

**Computer Networks**: Uses of Computer Networks, Network Hardware, Network Software, Types of networks, Network topologies, Layered architecture. Reference Models: OSI, TCP/IP, ARPANET, Internet, and ATM header, Reference model, QoS.

**Physical Layer:** Guided Transmission Media, Wireless Transmission Media, Communication Satellites. Switching and Multiplexing, Mobile Telephone Network, GSM

**UNIT II**

**Data link layer**: Design Issues, Framing, Error Detection, Elementary Data Link Protocol and Sliding Window Protocols.

**Medium Access sub layer**: Static vs. Dynamic, Multiple Access Protocols: ALOHA, CSMA and Collision Free Protocols. Ethernet (IEEE 802.3).

**UNIT III**

**The Network Layer**: Network Layer Design Issues, Routing Algorithms-Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast routing, multicast routing, Congestion control algorithms, Quality of Service Application Requirements, Traffic Shaping, Packet Scheduling, Internetworking, The Network Layer in the Internet-The IP version 4.0 protocol, IP Addresses, IP Version 6.0, Internet Control Protocols.

**UNIT IV**

**The Transport Layer**: The Transport Service-Services Provided to the Upper Layers, Transport Service Primitives, Elements of Transport Protocols –Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Congestion control-Desirable Bandwidth allocation, Regulating the sending rate, The Internet Transport Protocols: Introduction to UDP, Remote procedure call, Real-Time transport protocols, Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

**UNIT V**

**The Application Layer**: DNS- The Domain Name System, Electronic mail, world wide web. FTP, HTTP, TELNET.

**Text Books:**

1. Computer Networks - Andrew S Tanenbaum, 4th Edition, PearsonEducation/PHI
2. Data Communications and Networking-Behrouz A. Forouzan,Third EditionTMH

**Reference Books:**

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, PearsonEducation.
2. Understanding communications and Networks- 3rd Edition, W.A. Shay,Thomson
3. Computer Networks – Dr.G.S.Bapiraju, 2nd Edition GRIETPublications

**DEPARTMENT OF CSE - DATA SCIENCE**

**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6T02 | BIG DATA ANALYTICS | 3 | 0 | 0 | 3 |

**Pre- Requisites:**
Students should have knowledge of one Programming Language (Java preferably), Practiceof SQL (queries and sub queries), exposure to Linux Environment.

**Course Objectives:**

1. Describe Big Data and its use cases from selected business domains.
2. Provide an overview of HDFS Architecture and its daemon services.
3. Perform Map Reduce analytics with YARN using Hadoop.
4. Understand the working of data ingestion tools and PIG Latin.
5. Use Hadoop related tools such as Hive and HBase for big data analytics.

**Course Outcomes:**

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

1. Understand the concepts of Big Data and navigation of the Hadoop Ecosystem.
2. Illustrate the HDFS Architecture and the coordination service of Hadoop.
3. Implement distributed processing Map Reduce Paradigm with YARN.
4. Analyze importing and exporting data from Hadoop using Sqoop, Flume and workingwith PIG.
5. Examine the data stores - Hive and HBase on Hadoop

**UNIT I**

**Introduction to Big Data and Hadoop:**
Challenges of Traditional Decision Making, Solution with Big Data Analytics, Classification of Digital Data, Definition of Big Data, Characteristics of Big Data, Definition of Big Data Analytics, Features of Hadoop, History of Hadoop, RDBMS Vs. Hadoop, Hadoop Distributors, Ecosystems of Hadoop.

**UNIT II**

**HDFS and Zoo Keeper:**
**HDFS:** Concepts – Blocks, HDFS Components, Block Caching, Characteristics of HDFS, HDFS High Availability Architecture and its types, HDFS Command Line, Data Flow – Anatomy of File read and File write operations.
**Zoo Keeper:** Characteristics of Zoo Keeper, Zoo keeper Services, Zoo keeper Data Model.

**UNIT III**

**Map Reduce and YARN**
**YARN:** Elements of YARN Architecture, Map Reduce: Characteristics of Map Reduce, Phasesof Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Built - in Countersof MR, Joins in MR,

**UNIT IV**

**Data Ingestion Tools and PIG**

Data Ingestion Tools: Data Ingestion, Big Data Ingestion Tools, SQOOP - Benefits of SQOOP, SQOOP Connectors, Importing and Exporting to and from Hadoop using SQOOP, Limitationsof SQOOP, FLUME – Apache Flume, Data Sources for FLUME, Components of FLUME Architecture.

**PIG:** Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

**UNIT V**

**HIVE and HBASE**

**HIVE:** Features of HIVE, HIVE Architecture, HIVE Meta store, Data types in HIVE,HIVEQL, Tables, File Format Types – Text, Sequence, AVRO, Parquet, Querying Data.

**HBASE:** NOSQL Database, Types of NOSQL Database, Characteristics of HBASE,Architecture, HBaseVs. RDBMS, HBASE Shell Commands.

**Text Books:**

1. Tom White "Hadoop: The Definitive Guide" 4thedition, O'reily Media,2012.
2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley2015

**Reference Books:**

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer,2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRCpress(2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw- Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets",Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons,2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons,2007
7. Pete Warden, "Big Data Glossary", O'Reily,2011.
8. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics:Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game",MC Press,2012
10. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles, David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ",Tata McGraw Hill Publications,2012.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6T03 | NEURAL NETWORKS AND DEEP LEARNING | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Comprehend the math required for building deep learning networks.
2. Understand the basic building blocks of artificial neural networks (ANNs).
3. Acquire knowledge of supervised/unsupervised learning in neural networks.
4. Explore the methods to develop optimized deep learning networks considering hyper parameters of convolution networks, recurrent neural networks.
5. Model solutions for real life problems using optimized deep learning networks.

**Course Outcomes:**

1. Understand the basic math required for neural network.
2. Explain working of artificial neural networks.
3. Categorize between supervised and unsupervised learning mechanisms.
4. Analyze the real world problem and identify required hyper parameters to be considered for a deep learning network.
5. Design optimized deep learning applications for small problems using algorithms learnt in the course.

**UNIT I**

**Artificial Neural Networks:** Introduction Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks

**UNIT II**

**Unsupervised Learning Network**- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks

**UNIT III**

**Introduction to Deep Learning**: Historical Trends in Deep learning, Deep Feed – forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back- Propagation and Other Differentiation Algorithms

**UNIT IV**

**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 Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

**UNIT V**

**Optimization for Train Deep Models**: Challenges in Neural Network Optimization,Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second- Order Methods, Optimization Strategies and Meta-Algorithms **Applications**: Large-Scale Deep Learning, Computer Vision, image classification, Speech Recognition, Natural Language Processing

**Text Books:**

1. Deep Learning –Ian Good fellow, Yoshua Bengio, AaronCourville—MIT Press book-ISBN-13: 978-0262035613,
2. Neural Networks a Comprehensive Foundations, Simon Haykin, PHIedition

**Reference Books:**

1. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd2005
2. Neural Networks in Computer Intelligence, Li Mm Fu TMH2003
3. Deep Learning Fundamentals: An Introduction for Beginners by Chao Pan , AI Sciences Publisher.
4. Pattern Recognition and Machine Learning - Christopher M. Bishop -Information
5. Science and Statistics. ISBN-13:978-1493938438

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6E21 | COMPILER DESIGN<br>Professional Elective – 2 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Use the knowledge of Finite Automata and able to represent the language in form of Regular Expressions, Grammar and convert NFA to DFA and vice versa.
2. Understand different phases of the compiler, Lexical analyser and Top down parsing.
3. Demonstrate Bottom up parsing technique.
4. Illustrate memory management techniques during different phases.
5. Identify the effectiveness of optimization and differences between machine dependentand independent translation

**Course Outcomes:**

1. Acquire knowledge in different phases and passes of Compiler, and specifying different
2. types of tokens by lexical analyzer, and also able to use the Compiler tools like LEX.
3. Parser and its types i.e. Top-down and Bottom-up parsers.
4. Construction of SLR, CLR and LALR parse table.
5. Syntax directed translation, synthesized and inherited attributes.
6. Techniques for code optimization.

**UNIT I**

**Language Processors**: Introduction Language Processing, Structure of a compiler, Boot strapping. **Lexical Analysis**-: The role of lexical analysis, Input buffing, specification of tokens. Recognitions of tokens, the lexical analyzer generator LEX tool.

**UNIT II**

**Syntax Analysis -:** The Role of a parser, Context free Grammar, Top-Down Parsing - Recursive and Non recursive top down parsers, Bottom-Up Parsing - Shift Reduce parser, Using Ambiguous Grammars.

**UNIT III**

**Introduction to LR parsers** -SLR, CLR and LALR. Syntax Directed Transactions Definition, Evolution order of SDTS Application of SDTS. Syntax Directed Translation Schemes.

**UNIT IV**

**Intermediate-Code Generation**: Variants of Syntax Trees, DAG, Three-Address Code, Control Flow, Back patching. **Run-Time Environments**: Storage organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection.

**UNIT V**

**Code optimization**: Machine-Independent Optimizations, **Code generation – Issues** in design of code generation, Code generation algorithm, Machine dependent optimizations, Register Allocation and Assignment, Basic blocks and Flow graphs..

**Text Books:**

1. Compilers, Principles Techniques and Tools.Alfred V Aho, Monical S. Lam, Ravi Sethi
2. Jeffery D. Ullman,2nd edition,pearson,2007
3. Compiler Design K.Muneeswaran, OXFORD
4. Principles of compiler design,2nd edition,Nandhini Prasad,Elsebier.

**Reference Books:**

1. Modern Compiler Construction in C , Andrew W.Appel Cambridge University Press.
2. Compiler Construction ,LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V.Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L.Torczon, ELSEVIER.
6. Introduction to Formal Languages and Automata Theory and Computation - Kamala Krithivasan and RamaR, Pearson.
7. Modern Compiler Design, D. Grune and others,Wiley-India.
8. A Text book on Automata Theory, S. F. B. Nasir, P. K. Srimani, Cambridge Univ. Press.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6E22 | SOFTWARE PROJECT MANAGEMENT<br>Professional Elective – 2 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2. To compare and differentiate organization structures and project structures
3. To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

**Course Outcomes:**

1. Apply the process to be followed in the software development life-cycle models.
2. Apply the concepts of project management & planning.
3. Implement the project plans through managing people, communications and change
4. Conduct activities necessary to successfully complete and close the Software projects
5. Implement communication, modelling, and construction & deployment practices in software development.

**UNIT I**

**Conventional Software Management**: The waterfall model, conventional software Management performance.

**Evolution of Software Economics**: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections

**UNIT II**

**The Old Way and The New**: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

**Life Cycle Phases**: Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of The Process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

**UNIT III**

**Model Based Software Architectures:** A Management perspective and technical perspective.

**Work Flows of the Process**: Software process workflows, Iteration workflows.

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

**UNIT IV**

**Iterative Process Planning**: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

**UNIT V**

**Process Automation**: Automation Building blocks, The Project Environment. Project Control and **Process Instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2).

**Text Books:**

1. Software Project Management, Walker Royce, Pearson Education, 2005.
2. Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH

**Reference Books:**

1. Software Project Management, Joel Henry, Pearson Education.
2. Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005.
3. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6E23 | DISTRIBUTED SYSTEMS<br>Professional Elective – 2 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission, IPC mechanisms in distributed systems, Remote procedure calls.
2. Expose students to current technology used to build architectures to enhance distributed Computing infrastructures with various computing principles

**Course Outcomes:**

1. Develop a familiarity with distributed file systems.
2. Describe important characteristics of distributed systems and the salient architectural features of such systems.
3. Describe the features and applications of important standard protocols which are used in distributed systems.
4. Gaining practical experience of inter-process communication in a distributed environment

**UNIT I**

**Characterization of Distributed Systems:** Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. **System Models:** Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

**UNIT II**

**Interprocess Communication:** Introduction, The API for the Internet Protocols- The Characteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCP Stream Communication; **External Data Representation and Marshalling**; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast

**UNIT III**

**Distributed Objects and Remote Invocation:** Introduction, Communication between Distributed Objects- Object Model, Distributed Object Modal, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

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**UNIT IV**

**Operating System Support:** Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

**UNIT V**

**Distributed File Systems:** Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays. **Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication

**Text Books:**

1. Ajay D Kshemkalyani, MukeshSighal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication

**Reference Books:**

1. Distributed-Systems-Principles-Paradigms-Tanenbaum PHI

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6E24 | FUNDAMENTALS OF ROBOTICS<br>Professional Elective – 2 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Understanding basic concepts of robots and their development.
2. Knowledge of various configuration of robots used in industry, role of robots in industrial automation.
3. Analyze the forces acting on gripper and selection and design of grippers, actuators and sensors.
4. Transformation of motion of robot end effector with Denavit and Hartenberg parameters.
5. Apply Euler-Lagrange and Newton-Euler equations of motion are used for finding force and torque required at each of the joint actuators.

**Course Outcomes:**

1. Configure various robots with the help of given or required motions.
2. Apply motion of end effector and calculate the forward kinematics and inverse kinematics of serial and parallel robots.
3. Knowledge and analysis skills associated with trajectory planning.
4. Familiarized with the kinematic motions of robot and robot dynamics
5. Apply robot for various applications in manufacturing

**UNIT I**

**Introduction, Automation and Robotics**: An overview of Robotics-classification by coordinate system and control systems.

**Components of the Industrial Robotics**: Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General Consideration on gripper selection and design, Robot actuators and sensors, RPA architecture.

**UNIT II**

**Motion Analysis**: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and axis – Homogeneous transformation – Problems.

**Manipulator Kinematics**: D-H notations – joint coordinates and world coordinates – Forward and inverse kinematics – problems.

**UNIT III**

**Differential Kinematics**: Differential Kinematics of planar and spherical manipulators – Jacobians – problems.

**Robot Dynamics**: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

**UNIT IV**

**Trajectory Planning**: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – **Types of motion: Slew motion** – joint interpolated motion – straight line motion – problems. Robot actuators and Feedback components: Actuators: Pneumatic.

**UNIT V**

**Robot Application in Manufacturing**: Material handling – Assembly and Inspection-Work cell design, work volume, Robot screen

**Text Books:**

1. M.P. Groover, "Industrial Robotics", PearsonEdu.
2. Introduction to Robotic Mechanics and Control / JJ Craig / Pearson / 3rdedition

**Reference Books:**

1. Robotics / Fu K S / McGrawHill.
2. Robotics Engineering / Richard D. Klaftez / PrenticeHall.
3. Robot Analysis and intelligence / Asada and Slotine / Wiley InterScience.
4. Robot Dynamics & Control / Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pvt. Ltd.
5. Robotics and Control / Mittal R K & Nagrath I J /TMH.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE6C03 | INTELLECTUAL PROPERTY RIGHTS AND PATENTS (IPR& P) | 2 | 0 | 0 | 0 |

**Course Objectives:**

1. To know the importance of Intellectual property rights, which plays a vital role in Advanced Technical and Scientific disciplines.
2. Imparting IPR protections and regulations for further advancement, so that the Students can familiarize with the latest developments

**Course Outcomes:**

1. Identify different types of intellectual property rights may be prescribed by an output with supporting agencies internationally.
2. Explain the ways to protect literary and artistic works of the authors
3. Illustrate the process of registering innovative products i.e., Patents.
4. Analyze the ways to maintain of Trade Marks.
5. Suggest the ways to protect trade secrets in the organizations Explain different laws available related to cybercrimes.

**UNIT – I: Introduction to Intellectual property**
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights

**UNIT – II: Law of Copyrights:**
Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

**UNIT – III: Law of Patents:**
Foundation of patent law, patent searching process, ownership rights and transfer. Patent litigation. Dilution of patent rights, patent registration.

**UNIT – IV: Trade Marks:**
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter (strength and categories of trade marks), selecting, and evaluating trade mark, trade mark registration processes.

**UNIT - V: Trade Secrets and Cyber law:**
Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation. Introduction to Cyber Law – Information Technology Act 2000 & Cyber Crimes & its types.
**Real time examples must be added to the concepts requires.**

## REFERENCES:

1. Intellectual property right, Deborah, E. Bouchoux, Cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc- Graw Hill Publishing Company Ltd.
3. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4. Cyber Law - Texts & Cases, South-Western's Special Topics Collections

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6L01 | COMPUTER NETWORKS LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

• Understand and apply different network commands

• Analyze different networking functions and features for implementing optimal solutions Apply different networking concepts for implementing network solution

• Implement different network protocols

**Course Outcomes:**

CO-1: Apply the basics of Physical layer in real time applications

CO-2: Apply data link layer concepts, design issues, and protocols

CO-3: Apply Network layer routing protocols and IP addressing

CO-4:Implement the functions of Application layer and Presentation layer paradigms and Protocols

**Experiments:**

1) Implement the data link layer framing methods such as character stuffing and bit stuffing.

2) Write a C program to develop a DNS client server to resolve the given hostname.

3) Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16 and CRC-CCIP.

4) Implement Dijkstra's algorithm to compute the Shortest path in a graph.

5) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

6) Take an example subnet of hosts. Obtain broadcast tree for it.

7) Write a client-server application for chat using UDP

8) Implement programs using raw sockets (like packet capturing and filtering)

9) Write a C program to perform sliding window protocol.

10) Get the MAC or Physical address of the system using Address Resolution Protocol.

11) Simulate the Implementing Routing Protocols using border gateway protocol(BGP)

12) Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6L02 | BIG DATA & HADOOP LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. Provide the knowledge to setup a Hadoop Cluster.
2. Impart knowledge to develop programs using MapReduce.
3. Discuss Pig, PigLatin and HiveQL to process bigdata.
4. Present latest big data frameworks and applications using Spark
5. Integrate Hadoop with R (RHadoop) to process and visualize.

**Course Outcomes:**

1. Understand Hadoop working environment.
2. Apply Map Reduce programs for real world problems.
3. Implement scripts using Pig to solve real world problems.
4. Analyze queries using Hive to analyze the datasets
5. Understand spark working environment and integration with R

**TASK 1**: a) Understanding and using basic HDFS commands
b) Run a basic word count Map Reduce program to understand Map Reduce Paradigm.
**TASK 2:** Write a Map Reduce program that mines weather data
**TASK 3:** Implement matrix multiplication with Hadoop Map Reduce.
**TASK 4**: Working with files in Hadoop file system: Reading, Writing and Copying
**TASK-5**: Write Pig Latin scripts sort, group, join, project, and filter your data.
**TASK 6**: Run the Pig Latin Scripts to find Word Count and max. temp for each and every year.
**TASK-7**: Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
**TASK-8**: Working with Hive QL, Use Hive to create, alter, and drop databases, tables, views, functions, and indexes
**TASK 9**: Writing User Defined Functions in Hive
**TASK 10:** Understanding the processing of large dataset on Spark framework.
**TASK 11**: Ingesting structured and unstructured data using Sqoop, Flume
**TASK 12**: Integrating Hadoop with other data analytic framework like R

**Text Books:**

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Inc,2015.
2. Tanmay Deshpande, "Hadoop Real-World Solutions Cookbook", 2ndEdition, Packt Publishing, 2016

**Reference Books:**

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Inc,2012.
2. Vignesh Prajapati, "Big data Analytics with R and Hadoop", Packt Publishing,2013

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E31 | NATURAL LANGUAGE PROCESSING<br>Professional Elective – 3 | 3 | 0 | 0 | 3 |

**Prerequisites:**
Students are expected to have knowledge in Formal Languages and Automata Theory, Compiler Design

**Course Objectives:**
1. Role of natural language processing and language modelling.
2. The analysis of text at word level, syntactic level and semantic level.
3. Discourse processing of the text.
4. Knowledge in automated natural language generation and machine translation.
5. Explanation of information retrieval systems and usage of Lexical resources.

**Course Outcomes:**
1. Summarize the role of natural language processing in various applications and explain language modeling.
2. Apply word level analysis, syntactic analysis and semantic analysis on natural language processing.
3. Discuss discourse processing of text.
4. Illustrate the automation of natural language generation and machine translation of Indian languages.
5. Infer information retrieval systems and utilize lexical resources for processing natural language text.

**UNIT I**
**Overview:** Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval.
**Language Modeling**: Introduction, Various Grammar-based Language Models, Statistical Language Model.

**UNIT II**
**Information Retrieval**: Introduction, Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, Evaluation
**Lexical Resources**: Introduction, WordNet, Frame Net, Stemmers, POS Tagger, Research Corpora

**UNIT III**

**Word Level Analysis**: Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part of Speech Tagging, TF, IDF

**Syntactic Analysis**: Introduction, Context-free Grammar, Constituency, Parsing, Probabilistic Parsing.

**UNIT IV**

**Semantic Analysis**: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.

**Discourse Processing**: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure.

**UNIT V**

**Natural Language Generation**: Introduction, Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG.

**Machine Translation**: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages

**Text Books:**

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

**Reference Books:**

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition",Prentice Hall, 2nd Edition,2008.
2. James Allen, Bejamin/cummings, "Natural Language Understanding", 2ndedition,1995.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E32 | CRYPTOGRAPHY AND NETWORK SECURITY<br>Professional Elective – 3 | 3 | 0 | 0 | 3 |

**Pre Requisites:**

Students should have good knowledge in Computer Networks

**Course Objectives:**

1. Importance and applications of confidentiality, integrity, authentication, availability.
2. Develop various cryptographic algorithms, related to conventional and asymmetric encryption.
3. Familiarize how to generate and distribute PGP key pair and use the PGP package to send and encrypted E-mail message.
4. Understand the public-key cryptosystem and enhancements made to IPV4 by IPSec.
5. Understand with intrusion and intrusion detection / web security and Firewalls

**Course Outcomes:**

1. Work and check the applications defined with confidentiality, integrity, and authentication.
2. Work with various public key and private key cryptographic algorithms.
3. Examine the issues and structure of Authentication Service and Electronic Mail Security.
4. Understand the IP Security Architecture, Web Security and Key Management techniques.
5. Understand intrusion and intrusion detection, Web security and firewalls

**UNIT I**

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) Security Mechanisms, a model for Internetwork security.

Conventional Encryption Principles, substitution ciphers, transposition ciphers.

**UNIT II**

Conventional encryption algorithms (DES, Blowfish, Idea), cipher block modes of operation, location of encryption devices, key distribution.

Public key cryptography principles, public key cryptography algorithms (RSA, Diffie- Hellman, ECC), digital signatures, digital certificates, certificate authority and key management.

**UNIT III**

Approaches of Message Authentication, Secure Hash Functions(MD-5,SHA-1) and HMAC. Kerberos, X.509 Directory Authentication Service.

Email privacy: Pretty Good Privacy (PGP), MIME,S/MIME.

**UNIT IV**

IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management, Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

**UNIT V**

Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3, Intruders, Viruses and related threats, firewall Design principles, Trusted System, Intrusion Detection Systems.

**Text Books:**

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and RyanPermeh, wiley Dreamtech

**Reference Books:**

1. Fundamentals of Network Security by Eric Maiwald (Dreamtechpress)
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner,Pearson/PHI.
3. Cryptography and network Security, Third edition, Stallings,PHI/Pearson
4. Principles of Information Security, Whitman,Thomson.
5. Network Security: The complete reference, Robert Bragg, MarkRhodes,TMH
6. Introduction to Cryptography, Buchmann,Springer.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E33 | IMAGE AND VIDEO PROCESSING<br>Professional Elective – 3 | 3 | 0 | 0 | 3 |

**Pre requisites:**
Students are expected to have knowledge in Analysis of algorithms and linear algebra. Programming experience.

**Course Objectives:**
1. Describe and explain basic principles of digital image processing.
2. Cover the basic analytical methods such as image enhancement ,restoration, segmentation
3. Learn image compression techniques
4. Learn and explain basic principles of digital image and video processing.
5. Cover the basic motion estimations used in video processing

**Course Outcomes:**

1. Describe the basic principles of Imaging.
2. Learn the knowledge of the images in transform domains and segmentation.
3. Apply image compression on images.
4. Understand and develop algorithms video processing.
5. Implement various video motion techniques

**UNIT I**
**Fundamentals of Image Processing and Image Transforms**: Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels

**UNIT II**
**Image Enhancement**: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.
**Image Segmentation**: Segmentation concepts, Point, Line and Edge Detection, Thres holding, Region based segmentation.

**UNIT III**
**Image Compression**: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy& Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

**UNIT IV**

**Basic Steps of Video Processing**: Analog Video, Digital Video. Time-Varying Image Formation models: Three Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, filtering operations.

**UNIT V**

**2-D Motion Estimation:** Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Application of motion estimation in Video coding.

**Text Books:**

1. Digital Image Processing – Gonzalez and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Oysterman and Ya–quin Zhang. 1st Ed., PHInt

**Reference Books:**

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRCPress,2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International
3. Digital Image Processing with MATLAB and Lab view – VipulaSingh,Elsevier
4. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed.,Elsevier

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E34 | BLOCK CHAIN TECHNOLOGIES<br>Professional Elective – 3 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
2. To securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from blockchain technology into their own projects.
5. Explaining design principles of Bitcoin and Ethereum and Nakamoto consensus

**Course Outcomes:**

1. Learn the Simplified Payment Verification protocol.
2. List and describe differences between proof-of-work and proof-of-stake consensus.
3. Interact with a blockchain system by sending and reading transactions.
4. Design, build, and deploy a distributed application.
5. Evaluate security, privacy, and efficiency of a given blockchain system

**UNIT I**

**Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

**UNIT II**

**Blockchain:** Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

**UNIT III**

**Distributed Consensus**: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

**UNIT IV**

**Cryptocurrency**: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

**UNIT V**

**Cryptocurrency Regulation**: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.

Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

**Tutorial & Practical:** Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles.

**Text Books:**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016)
2. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

**Reference Books:**

1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
2. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E41 | ARTIFICIAL INTELLIGENCE<br>Professional Elective – 4 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Understand both the achievements of AI and the theory underlying those achievements. Infer different searching strategies that are suitable for the problem to be solved
2. Recognize the ways to represent knowledge and infer resolution using prepositional and first order logic.
3. Understand the representation of uncertain knowledge and conditional distributions using Bayesian networks.
4. Comprehend the principles of temporal models, hidden markov models, decision trees.
5. Enable the student to apply artificial intelligence techniques in applications which involve perception, reasoning and learning.

**Course Outcomes:**

1. Select an appropriate searching strategy for developing intelligent agents to find solution in optimized way using building blocks of AI.
2. Apply prepositional and first order logic methods to resolve decisions for knowledge based agents.
3. Practice uncertain knowledge and reasoning handling using Bayesian networks
4. Analyze the working of temporal models, hidden Markova models, decision trees.
5. Write AI programs and construct small robots capable of performing perception and movement based on techniques learnt in the course.

**UNIT I**

**Introduction to AI**: Introduction, Foundation of AI, History of Intelligent Agents, Agents and environments, Concept of Rationality, Nature of environments & Structure of Agents, Problem solving agents and formulation, Searching For Solutions and Strategies, Uninformed search strategies BFS, DFS, Heuristic approach, Greedy best search, A* Search, Game Playing: Adversal search, Games, Min-Max algorithm, Optimal decisions in multiplayer games, Alpha Beta pruning.

**UNIT II**

**Knowledge Representation & Reasons**: Logical agents, Knowledge based agents, The Wumpus **world, Logic**: Proportional logic, Resolution patterns in proportional logics, Resolution: Forward and Backward chaining, First order logic: Inference in First order logic, Proportional vs first order inference, Unification & Lifting, forward chaining, Resolution, Practice problems.

**UNIT III**

**Uncertain Knowledge and Reasoning**: Uncertainty-Acting under uncertainty, Basic probability notion, the axioms of probability, inference using full joint distribution, Independence, Bayes' rule.

**Probabilistic Reasoning**: Representing Knowledge in uncertain domain, the semantics of Bayesian networks, efficient representations of conditional distributions, exact inference in Bayesian networks, approximate inference in Bayesian networks.

**UNIT IV**

**Probabilistic reasoning over time**: Time and uncertainty, inference in temporal model, Hidden Markov models.

**Learning:** Learning from observations: Forms of learning, inductive learning, learning decision trees, ensemble learning, why learning works.

**UNIT V**

**Perception:** Introduction, Early Image Processing operations- Edge detection, image segmentation. Object recognition, using vision for manipulation and navigation.

**Robotics:** Introduction, Robot hardware, robotic perception, planning to move, Robotic software architectures, application domains

**Text Books:**

1. Artificial Intelligence-A modern approach-by Staurt Russel, Peter Norvig, 2nd edition, PHI/Pearson.

**Reference Books:**

1. Artificial Intelligence – Riche &K.Night , 2ndeditionTMH.
2. Paradigms of Artificial intelligence programming, case studies in common lisp-Peter. Norvig, Morgan Kaufmann.ISBN-13:978-1558601918.
3. Robotics: Fundamental Concepts and Analysis –Ashitava Goshal, oxford.
4. A Textbook of Robotics 1-Basic Concepts-M. Shoham-Springer US

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E42 | CLOUD COMPUTING<br>Professional Elective – 4 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Understand the current trend and basics of cloud computing.
2. Learn cloud services from different providers.
3. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
4. Understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization
5. Learn basic concepts of MapReduce programming models for big data analysis on cloud

**Course Outcomes:**

6. Understand the features, advantages and challenges of cloud computing, compare their operation ,implementation and performance
7. Understand, Analyze and compare different types of clouds and cloud services.
8. Understanding and validating the financial and technological implications in selecting cloud computing paradigm for an organization.
9. Understand and Analyze the security challenges and risks involved in the cloud.
10. Create/Deploying of an application in cloud

**UNIT I**

**Understanding Cloud Computing**: Cloud Computing, Introduction to Cloud Computing ,Cloud Architecture and Cloud Services(IaaS, PaaS, SaaS) , Cloud models– Public vs Private, Cloud Technologies for Network-Based System , System Models for Distributed and Cloud Computing , NIST Cloud Computing Reference Architecture

**UNIT II**

**Virtualization**: Basics of Virtualization , Types of Virtualization , Implementation Levels of Virtualization , Virtualization Structures , Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices , Virtual Clusters and Resource management , Virtualization for Data-center Automation.

**UNIT III**

**Cloud Infrastructure**: Architectural Design of Compute and Storage Clouds , Layered Cloud Architecture Development , Design Challenges , Inter Cloud Resource Management , Resource Provisioning and Platform Deployment , Global Exchange of Cloud Resources.

**UNIT IV**

**Programming Model**: Parallel and Distributed Programming Paradigms , Map Reduce, Twister and Iterative Map Reduce , Hadoop Library from Apache , Mapping Applications , Programming Support ,Google App Engine, Amazon AWS , Cloud Software Environments, Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim

**UNIT V**

**Security in the Cloud:** Security Overview , Cloud Security Challenges and Risks , Software- as-a- Service Security , Security Governance , Risk Management , Security Monitoring , Security Architecture Design , Data Security , Application Security , Virtual Machine Security, Identity Management and Access Control , Autonomic Security.

**Text Books:**

2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud"O'Reilly.
3. Kumar Saurabh, " Cloud Computing , insights into New-Era Infrastructure", Wiley India,2011
4. RajkumarBuyya, Christian Vecchiola, S.TamaraiSelvi, 'Mastering Cloud Computing", TMGH,2013.

**Reference Books:**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press,2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH,2009.
4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security, A comprehensive Guide to Secure Cloud Computing", Wiley , India,2010.
5. Nick Antonopoulos, Cloud computing, Springer Publications, 2010

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E43 | COMPUTER VISION<br>Professional Elective – 4 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Understanding basic concepts of image processing and their development.
2. Knowledge of various configuration of image processing techniques used in industry, role in industry
3. To Know the application areas.
4. To implement fundamental image processing techniques required for computer vision
5. Understand Image formation process

**Course Outcomes:**

1. To perform shape analysis
2. Extract features form Images and do analysis of Images
3.Generate 3D model from images
4 To develop applications using computer vision techniques
5.Understand video processing, motion computation and 3D vision and geometr

**UNIT I**

Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

**UNIT II**

Image Formation Models : Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination. shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images.

**UNIT III**

Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multi resolution analysis.

**UNIT IV**

Object recognition : Hough transforms and other simple object recognition methods, Shape correspondence and shape matching Principal component analysis , Shape priors for recognition Image Understanding : Pattern recognition methods, HMM, GMM and EM.

**UNIT V**

Applications: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters –Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

**Text Books:**

1.Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

**Reference Books:**

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010
4. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
5. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
7. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E44 | HUMAN COMPUTER INTERACTION<br>Professional Elective – 4 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. The basic understanding of guidelines, principles, and theories influencing human computer interaction.
2. The knowledge of how a computer system may be modified to include human diversity.
3. The appropriate evaluation of human computer interaction system.
4. Select an effective style for a specific application.
5. The basic concepts of User Experience Design and the factors that influence the user experience.

**Course Outcomes:**

1. Learn the concepts of interaction design and how it relates to human computer interaction and other fields.
2. Design how technologies can be to change people's attitudes and behavior.
3. Apply the difference between qualitative and quantitative data and analysis.
4. Extract the social Mechanisms that are used by people to communicate and collaborate.
5. Explore the user Experience design and analyze the factors involved in design

**UNIT I**

**Introduction**: Importance of user Interface, definition, importance of good design. Benefits of good design, a brief history of Screen design.

**The graphical user interface**: popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user, Interface popularity, characteristics, Principles of user interface.

**UNIT II**

**Design process**: Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions

**UNIT III**

**Screen Designing** : Design goals, Screen planning and purpose, organizing screen elements, ordering of screen emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

**UNIT IV**

**Develop System Menus and Navigation Schemes**: Select the Proper Kinds of Windows, Select the Proper Device, Based Controls , Choose the Proper Screen Based Controls.

**Interaction Devices**: Keyboard and function keys, speech recognition digitization and generation, Image and video displays, drivers

**UNIT V**

**A Brief Introduction to User Experience (UX) Design**: Complexity and perception, What is User Experience (UX), What is a UX Designer

**What is Design Thinking and Why is it so Popular**: What is Design Thinking, Design Thinking's Phases

**The 7 factors that influence user experience**: Useful, Usable, An introduction to usability, Why does usability matter, The 5 Characteristics of usable products How to conduct user interviews, What is User Interview, Preparing for user interview, How to conduct a user interview, Reporting on user interview What is interaction design?-Understanding of Interaction design, The 5 Dimensions of interaction design.

**Text Books:**

1. The essential guide to user interface design, Wilbert O Galitz, WileyDreamaTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson EducationAsia.
3. The basics of User Experience design, Interaction designfoundation2002

**Reference Books :**

1. Human Computer Interaction. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Pearson.
2. Interaction Design PRECE, ROGERS, SHARPS. WileyDreamtech,
3. User Interface Design, SorenLauesen, PearsonEducation.
4. User Experience for Beginners, JoelMarsh.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E51 | SOCIAL NETWORK ANALYSIS<br>Professional Elective – 5 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Formalize different types of entities and relationships as nodes and edges and represent this information as relational data
2. Plan and execute network analytical computations
3. Use advanced network analysis software to generate visualizations and perform empirical investigations of network data
4. Interpret and synthesize the meaning of the results with respect to a question, goal, or task
5. Collect network data in different ways and from different sources while adhering to legal standards and ethics standards

**Course Outcomes:**

1. Know basic notation and terminology used in network science
2. Be able to visualize, summarize and compare networks
3. Illustrate basic principles behind network analysis algorithms
4. Develop practical skills of network analysis in R programming language
5. Be capable of analyzing real work networks

**UNIT I**

Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance and Homophily.

**UNIT II**

Random graph models**:** Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.

**UNIT III**

Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

**UNIT IV**

Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The ErdosRenyi Model, Clustering Models.

**UNIT V**

Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

**Text Books:**

1. S. Wasserman and K. Faust. "Social Network Analysis: Methods and Applications", Cambridge University Press.
2. 2) D. Easley and J. Kleinberg, "Networks, Crowds and Markets: Reasoning about a highly connected world" , Cambridge University Press, 1st edition,2010

**Reference Books:**

1. Maarten van Steen. "Graph Theory and Complex Networks. An Introduction", 2010.
2. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. "Social Media Mining: An Introduction". Cambridge University Press 2014.
3. Maksim Tsvetovat and Alexander Kouznetsov. "Social Network Analysis for Startups". O'Reilly Media, 2011.

**e-Resources:**

https://www.classcentral.com/course/edx-social-network-analysis-sna-9134
https://www.coursera.org/learn/social-network-analysis

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E52 | RECOMMENDER SYSTEMS<br>Professional Elective – 5 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering.
2. To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

**Course Outcomes:**

1. Design recommendation system for a particular application domain
2. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity

**UNIT I**

**Introduction:** Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

**UNIT II**

**Content-based Filtering**: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

**UNIT III**

**Collaborative Filtering**: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

**UNIT IV**

**Hybrid approaches**: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

**UNIT V**

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations. Types of Recommender Systems: Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

**References:**

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st ed.
3. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.
4. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E53 | DATA VISUALIZATION<br>Professional Elective – 5 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Understand the visualization process and visual representations of data.
2. Learn visualization techniques for various types of data.
3. Explore the visualization techniques for graphs, trees, Networks.
4. Understand the visualization of maps, GIS and collaborative visualizations.
5. Discuss the recent trends in perception and visualization techniques

**Course Outcomes:**

1. Apply the visualization process for creating visual representations.
2. Classify visualization techniques for different types of data.
3. Analyze visualization methods for graphs, trees, Networks.
4. Apply visualization techniques for GIS , maps and use collaborative visualization.
5. Summarize the recent trends in visualization techniques and their applications for real world problems.

**UNIT I**

Introduction to Visualization, Visualization process, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

**UNIT II**

Introduction to Tableau, Tableau Architecture, Tableau Server Architecture VizQL, Introduction to Tableau Prep, Tableau Prep Builder User Interface, Data Preparation techniques using Tableau Prep Builder tool, Features of Tableau Desktop Connect to data from File and Database, Types of Connections, Joins and Unions, Data Blending, Tableau Desktop User Interface.

**UNIT III**

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents. Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization.

**UNIT IV**

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations.

**UNIT V**

Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

**Text Books:**

1. Matthew Ward Georges Grinstein Daniel Keim , Interactive Data Visualization: Foundations, Techniques, and Applications. A K Peters, Ltd. Natick.
2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.
3. Joshua N. Milligan, Learning Tableau 2019 Tools for Business Intelligence, data prep, and visual analytics, Third edition.

**Reference Books:**

1. Data Visualization: A Handbook for Data Drive by AndyKirk
2. Hand book of data visualization ,chun-houh chen,wolfgang hardle,Antonyunwin

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD7E54 | TEXT MINING<br>Professional Elective – 5 | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To compare and contrast methods for sentence segmentation, tokenisation, part-of-speech tagging, syntactic parsing and semantic representation
2. To apply techniques such as named entity recognition, entity linking, relation and event extraction.
3. To extract information from text, while leveraging resources such as lexical and semantic resources (e.g. Framenet, VerbNet, WordNet), and terminological repositories.
4. To design and customise text annotation workflows, taking into consideration various annotation formats

**Course Outcomes:**

1. To explain how text mining supports the development of semantic search systems
2. To explain the distributional hypothesis, and to compare with each other (1) count-based and (2) compositional distributional semantics models
3. To apply various evaluation measures (e.g., Kappa, recall, precision and F-score)
4. To investigate methods for social media content analysis

**UNIT I**

**Introduction:**

Background, motivation, dealing with information overload and information overlook, unstructured vs. (semi-)structured data, evolving information needs and knowledge management issues, enhancing user experience of information provision and seeking, the business case for text mining.

**The text mining pipeline:** information retrieval, information extraction and data mining

**UNIT II**

**Fundamentals of natural language processing**: linguistic foundations, levels of linguistic analysis.

**Approaches to text mining**: rule-based vs. machine learning based vs. hybrid; generic vs. domain specific; domain adaptation.

**UNIT III**

**Dealing with real text**: text types, document formats and conversion, character encodings, markup, low-level processes (sentence splitting, tokenisation, part of speech tagging, chunking).

**Information extraction**: term extraction, named entity recognition, relation extraction, fact and event extraction; partial analysis vs. full analysis. Data mining and visualisation of results from text mining.

**UNIT IV**

**Evaluation of text mining systems**: evaluation measures, role of evaluation challenges, usability evaluation.

**Resources for text mining**: annotated corpora, computational lexica, ontologies, computational grammars; design, construction and use issues.

**UNIT V**

**Issues in large scale processing of text**: distributed text mining, scalable text mining systems. A sampler of text mining applications and services; **case studies.**

**Text Books:**

1. The text mining handbook : advanced approaches in analyzing unstructured data, Feldman, Ronen, 1962, Cambridge University Press, 2007.
2. Text mining for biology and biomedicine, 158053984X, Artech House, c2006.
3. Linked lexical knowledge bases : foundations and applications, Gurevych, Iryna author, Morgan & Claypool Publishers, 2016

**Reference Books:**

1. Handbook of linguistic annotation, Springer, 2017
2. Speech and language processing : an introduction to natural language processing, computational linguistics, and speech recognition, Jurafsky, Dan, 1962, Pearson/Prentice Hall, c2009.
3. An introduction to information retrieval, Manning, Christopher D., Cambridge University Press, 2008.
4. Text mining : classification, clustering, and applications, CRC, c2009.

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VII**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH7T01 | MANAGEMENT SCIENCE | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To familiarize with the process of management and to provide basic insight into organizational behaviour
2. To provide conceptual knowledge on functional management and project management

**Course Outcomes:**

1. After completion of the Course the student will acquire the knowledge on management functions, global leadership and organizational behaviour.
2. Will familiarize with the concepts of functional management project management and strategic management.

**UNIT I**

**Introduction to Management:** Concept –nature and importance of Management ––Generic Functions of Management- Administration vs. Management – Evolution of Management thought- Decision making process- organization structure: Principles of organization & its types.

**UNIT II**

**Operations Management**: production & its types, plant layout, Work study- method study and work measurement - Statistical Quality Control- Control charts -Simple problems
Material Management: Need for Inventory control- EOQ (simple problems), ABC analysis and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

**UNIT III**

**Planar and Dual Graphs**: Planar graphs, Different representations of planar graphs, Detection of Planarity, Geometric dual, Combinatorial dual.

**Matrix Representation of Graphs**: Incidence Matrix, Circuit Matrix, Fundamental Circuit Matrix and Rank, Cut-Set Matrix, Path Matrix, Adjacency Matrix.

**UNIT III:**

**Human Resource Management**: Concept of HRM, HRD - Functions of HR Manager- types of Wage payment plans – Job Evaluation and Merit Rating - Grievance & redressal mechanism ,
Marketing Management: Functions of Marketing – Marketing Mix-Marketing strategies based on product Life Cycle, Channels of distribution.

**UNIT-IV:**

**Project Management**: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).

**UNIT V:**

**Organisational behaviour:** Attitude & behaviour; Leadership styles; motivation- significance, theories; Perception-Perceptual process-Group Dynamics: Types of Groups, Stages of Group Development, Group Behaviour and Group Performance Factors.

**Text Books**

1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, Management Science' TMH 2011.
3. L. M. Prasad, 'Organisational Behavior' Sultan Chand Publications.

**References:**

1. Koontz & Weihrich: 'Essentials of management' TMH 2011
2. Anil Bhat& Arya Kumar : Principles of Management, Oxford University Press, New Delhi
3. Robbins: Organizational Behaviour, Pearson publications, 2011
4. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011
5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications
6. K. Aswatappa: 'Human Resource Management – text & cases', TMH.

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **Object Oriented Programming (C++)**<br>**Open Elective** | **3** | **0** | **0** | **3** |

**Course Objectives:**

1. Introduce to the student the fundamentals of C++ language.
2. To make the students understand the principles of data abstraction, inheritance and polymorphism
3. To create awareness about generic programming and exception handling
4. To make the students familiar with IO streams, STL.

**Course Outcomes:**

1. Differentiate POP and OOP and then use C++ fundamentals and various function modifiers to create and manipulate classes and objects.
2. Make use of the advantages of Compile time polymorphism and also develop reusable programs by applying inheritance.
3. Use runtime polymorphism, generic programming and exception handling techniques for developing efficient programs.
4. Demonstrate C++ streams, Name Spaces and STL

**UNIT I**

**An Overview of C++:** The Origins of C++, What is Object Oriented Programming, some C++ fundamentals, Old-Style Vs Modern C++, Introducing C++ Classes, Operator Overloading, Inheritance, Constructors and Destructors, The C++ Keywords, The General Form of a C++ Program

**Classes and Objects**: Classes, Structures and Classes, Unions and Classes are Related, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Destructors, Scope Resolution Operator, Nested Classes, Local Classes, Passing and Returning Objects, Object Assignment, arrays of objects.

**UNIT II**

**Function Overloading, Copy Constructors and Default Arguments**: Function Overloading, Constructors types of constructors. Default Arguments.

**Operator Overloading**: Creating Member Operator Function, Overloading Using a Friend Function, Overloading new delete, Overloading Special Operators & Comma Operator

**UNIT III**

**Inheritance**: Base-Class Access Control, Inheritance and protected members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.

**UNIT IV**

**Virtual Functions & Polymorphism**: Virtual Functions, The Virtual Attribute is inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early Vs Late Binding.

**Templates**: Generic Functions, Applying Generic Functions, Generic Classes, Typename and export Keywords, Power of Templates.

**UNIT V**

**Exception Handling**: Fundamentals, Derived-Class Exceptions, Options, Terminate() and unexpected(), uncaught_exception(), exception and bad_exception Classes, Applying Exception Handling.

**Text Books:**

1. The Complete Reference - C++ - Herbert Schieldt, 4/e, Tata McGraw Hill.

**Reference Books:**

1. Bjarne Stroustrup, "The C++ Programming Language", Special Edition, Pearson Education.
2. C++ - How to Program – Dietel & Dietel
3. Programming in C++ - Barkakati
4. Mastering C++ by Venugopal

**DEPARTMENT OF CSE - DATA SCIENCE**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **DATA WAREHOUSING AND MINING**<br>**Open Elective** | **3** | **0** | **0** | **3** |

**Course Objectives:**

1. To understand and implement classical models and algorithms in data warehousing and data mining.
2. To analyse the data, identify the problems, and choose the relevant models and algorithms to apply.
3. To assess the strengths and weaknesses of various methods and algorithms and to analyse their behaviour.

**Course Outcomes:**

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

**1** : Summarize the architecture of data warehouse
**2** : Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.
**3** : Construct a decision tree and resolve the problem of model over fitting
**4** : Compare A priori and FP-growth association rule mining algorithms for frequent item set generation
**5** : Apply suitable clustering algorithm for the given data set

**UNIT- I**

**Data Warehouse and OLAP Technology:** An Overview: What Is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber).

**UNIT- II**

**Data Mining:** Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.

Data Pre-processing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan &Vipin).

**UNIT -III**

**Classification:** Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction.

**Model Over fitting:** Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan &Vipin)

**UNIT -IV**

**Association Analysis:** Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, A priori Principle, A priori Algorithm, Rule Generation, Compact Representation of Frequent Item sets, FP- Growth Algorithm. (Tan & Vipin)

**UNIT -V**

**Cluster Analysis:** Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin).

**Text Books :**

3. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression,Pearson, 2015.
4. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

**Reference Books:**

5. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
6. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
7. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
8. Data Mining Techniques, Arun K Pujari, Universities Press, 2001

**Web Resources:**

NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview

**DEPARTMENT OF CSE - DATA SCIENCE**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **BIG DATA ANALYTICS OPEN ELECTIVE** | **3** | **0** | **0** | **3** |

**Pre- Requisites:**
Students should have knowledge of one Programming Language (Java preferably), Practiceof SQL (queries and sub queries), exposure to Linux Environment.

**Course Objectives:**
1. Describe Big Data and its use cases from selected business domains.
2. Provide an overview of HDFS Architecture and its daemon services.
3. Perform Map Reduce analytics with YARN using Hadoop.
4. Understand the working of data ingestion tools and PIG Latin.
5. Use Hadoop related tools such as Hive and HBase for big data analytics.

**Course Outcomes:**
**At the end of the Course, the student will be able to**
1. Understand the concepts of Big Data and navigation of the Hadoop Ecosystem.
2. Illustrate the HDFS Architecture and the coordination service of Hadoop.
3. Implement distributed processing Map Reduce Paradigm with YARN.
4. Analyze importing and exporting data from Hadoop using Sqoop, Flume and workingwith PIG.
5. Examine the data stores - Hive and HBase on Hadoop

**UNIT I**

**Introduction to Big Data and Hadoop:**
Challenges of Traditional Decision Making, Solution with Big Data Analytics, Classification of Digital Data, Definition of Big Data, Characteristics of Big Data, Definition of Big Data Analytics, Features of Hadoop, History of Hadoop, RDBMS Vs. Hadoop, Hadoop Distributors, Ecosystems of Hadoop.

**UNIT II**

**HDFS and Zoo Keeper:**
**HDFS:** Concepts – Blocks, HDFS Components, Block Caching, Characteristics of HDFS, HDFS High Availability Architecture and its types, HDFS Command Line, Data Flow – Anatomy of File read and File write operations.
**Zoo Keeper:** Characteristics of Zoo Keeper, Zoo keeper Services, Zoo keeper Data Model.

**UNIT III**

**Map Reduce and YARN**
**YARN:** Elements of YARN Architecture, Map Reduce: Characteristics of Map Reduce, Phasesof Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Built - in Countersof MR, Joins in MR,

**UNIT IV**

**Data Ingestion Tools and PIG**

Data Ingestion Tools: Data Ingestion, Big Data Ingestion Tools, SQOOP - Benefits of SQOOP, SQOOP Connectors, Importing and Exporting to and from Hadoop using SQOOP, Limitationsof SQOOP, FLUME – Apache Flume, Data Sources for FLUME, Components of FLUME Architecture.

**PIG:** Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

**UNIT V**

**HIVE and HBASE**

**HIVE:** Features of HIVE, HIVE Architecture, HIVE Meta store, Data types in HIVE,HIVEQL, Tables, File Format Types – Text, Sequence, AVRO, Parquet, Querying Data.

**HBASE:** NOSQL Database, Types of NOSQL Database, Characteristics of HBASE,Architecture, HBaseVs. RDBMS, HBASE Shell Commands.

**Text Books:**

1. Tom White "Hadoop: The Definitive Guide" 4thedition, O'reily Media,2012.
2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley2015

**Reference Books:**

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer,2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRCpress(2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw- Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets",Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons,2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons,2007
7. Pete Warden, "Big Data Glossary", O'Reily,2011.
8. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics:Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCE(AUTONOMOUS)
Department of Computer Science and Engineering

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6E01 | PROFESSIONAL ELECTIVE- II<br>1. CLOUD COMPUTING | 3 | 0 | 0 | 3 |

## Course Objectives:

- The student will learn about the cloud environment, building software systems and components that scale to millions of users in modern internet cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas, and developing cloud based software applications on top of cloud platforms.

## Course Outcomes:

**At the end of the course, students will be able to:**

**CO-1:** Understanding the key dimensions of the challenge of Cloud Computing

**CO-2:** Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization

**CO-3:** Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.

**CO-4:** Assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas.

**CO-5**: Outline the cloud resource management and scheduling policies.

## UNIT -I:

Systems modeling, Clustering and virtualization Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security And Energy Efficiency

## UNIT- II:

Virtual Machines and Virtualization of Clusters and Data Centers Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation.

## UNIT- III:

Cloud Platform Architecture Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

**UNIT -IV:**

Cloud Programming and Software Environments Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

**UNIT- V:**

Cloud Resource Management and Scheduling Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

**TEXT BOOKS:**

1) Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2) Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
3) Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press

**REFERNCE BOOKS:**

1) Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
2) Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

**E-Resources:**

1) https://archive.nptel.ac.in/courses/106/105/106105167/

**KKR & KSRINSTITUTE OF TECHNOLOGY AND SCIENCES**

**(Autonomous)**

Vinjanampadu, Vatticherukuru Mandal, Guntur, Andhra Pradesh 522017

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20ECXO04 | **Design of IoT Systems** | 3 | 0 | 0 | 3 |

ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE

## COURSE OUTCOMES:

**After successful completion of this course, students should be able to**

CO1 :Explain Internet of Things and its hardware.
CO2 :Explain Components of Internet of Things.
CO3 :Interface I/O Devices, Sensors, and Communication modules.
CO4 :Monitor data and control devices.
CO5 :Implement real time IoT based applications.

## SYLLABUS

### UNIT-I : Introduction to IoT

Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gate ways, Data management, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

### UNIT-II : Elements of IoT

Hardware Computing Components- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set.

### UNIT-III : IoT Application Development

Communication, IoT Applications, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth. Bluetooth Smart Connectivity, Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and

Component Overview.

**UNIT-IV : Solution framework for IoT applications**

Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

**UNIT-V : IoT Case Studies**

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

**TEXTBOOKS:**

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education,2017.
2. The Definitive Guide to the ARM Cortex-M0 by JosephYiu,2011
3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, "A Hands-on Approach", UniversityPress,2015

**REFERENCEBOOKS:**

1. Cypress Semiconductor/PSoC4 BLE (Bluetooth Low Energy) Product TrainingModules.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies,Platforms, and Use Cases", CRC Press,2017

**SEMESTER –VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20SH5M01 | **Mandatory Course**<br>**Professional Ethics and Human Values** | **2** | **0** | **0** | **0** |

**Course Objectives:**
- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of others
- To create awareness on assessment of safety and risk

**Course outcomes:**
Students will be able to:
CO-1: Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
CO-2: Identify the multiple ethical interests at stake in a real-world situation or practice and articulate what makes a particular course of action ethically defensible
CO-3: Assess their own ethical values and the social context of problems and Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
CO-4: Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
CO-5: Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

**UNIT I:**
**Human Values & Principles for Harmony**: Morals, Values and Ethics – Integrity – Work Ethics–Service Learning–Civic Virtue –Respect for others–Living Peacefully–Caring –Sharing–Honesty–Courage–Value Time –Co-operation–Commitment–Self-confidence–Spirituality-Character. Truthfulness–Customs and Traditions-Value Education –Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence.

**UNITII:**
**Engineering Ethics and Social Experimentation:** History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism ––Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory -Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments –– Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law -Role of Codes–Codes and Experimental Nature of Engineering.

**UNITIII:**
**Engineers' Responsibilities towards Safety and Risk:** Concept of Safety - Safety and Risk –

Types of Risks – Voluntary v/s Involuntary Risk –Consequences-RiskAssessment–Accountability–Liability-ReversibleEffects-ThresholdLevelsof Risk-Delayedv/s Immediate Risk-Safety andtheEngineer–DesigningforSafety–Risk-BenefitAnalysis-Accidents.

**UNIT IV:**

**Engineers'DutiesandRights:**ConceptofDuty-ProfessionalDuties–Collegiality-TechniquesforAchievingCollegiality – Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes –Industrial Espionage-Price Fixing-Whistle Blowing.

**UNITV:**

**GlobalIssues:**GlobalizationandMNCs–CrossCultureIssues-BusinessEthics–MediaEthics-Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics-Intellectual Property Rights.

**References:**

1. Professional Ethics, R .Subramaniam–Oxford Publications, New Delhi.
2. Ethics in Engineering Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill–2003.
3. Professional Ethics and Morals, A. R. Aryasri, Dharanikota Suyodhana – Maruthi Publications.
4. Engineering Ethics, Harris , Pritchardand Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics, S.B.Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values, M. Govindarajan,S. NatarajanandV.S.SenthilKumar-PHI Learning Pvt. Ltd–2009.
7. Professional Ethics and Human Values, A. Alavudeen, R. Kalil Rahman and M.Jayakumaran–niversity Science Press.
8. Professional Ethics and Human Values, D. R.Kiran-TataMcGraw-Hill-2013
9. Human Values andProfessionalEthics,JayshreeSureshandB.S.Raghavan,S.ChandPublications

**SEMESTER -VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6L01 | **CRYPTOGRAPHY AND NETWORK SECURITY LAB** | **0** | **0** | **3** | **1.5** |

## Course Objectives:

- 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.

## Course Outcomes:

- 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

## List of Experiments:

1) Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2) Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3) Write a Java program to perform encryption and decryption using the following algorithms:
   a. Ceaser cipher  b. Substitution cipher
4) Write a C/JAVA program to implement the DES algorithm logic.
5) Write a C/JAVA program to implement the Blowfish algorithm logic.
6) Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
7) Write a Java program to implement RSA algorithm.
8) Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
9) Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
10) Calculate the message digest of a text using the MD5 algorithm in JAVA.

## E-Resources:

1) https://www.geeksforgeeks.org/caesar-cipher-in-cryptography/
2) https://www.javatpoint.com/hill-cipher-program-in-java

**DEPARTMENT OF CSE - DATA SCIENCE**
**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6L02 | BIG DATA & HADOOP LAB | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. Provide the knowledge to setup a Hadoop Cluster.
2. Impart knowledge to develop programs using MapReduce.
3. Discuss Pig, PigLatin and HiveQL to process bigdata.
4. Present latest big data frameworks and applications using Spark
5. Integrate Hadoop with R (RHadoop) to process and visualize.

**Course Outcomes:**

1. Understand Hadoop working environment.
2. Apply Map Reduce programs for real world problems.
3. Implement scripts using Pig to solve real world problems.
4. Analyze queries using Hive to analyze the datasets
5. Understand spark working environment and integration with R

**TASK 1**: a) Understanding and using basic HDFS commands
b) Run a basic word count Map Reduce program to understand Map Reduce Paradigm.
**TASK 2:** Write a Map Reduce program that mines weather data
**TASK 3:** Implement matrix multiplication with Hadoop Map Reduce.
**TASK 4**: Working with files in Hadoop file system: Reading, Writing and Copying
**TASK-5**: Write Pig Latin scripts sort, group, join, project, and filter your data.
**TASK 6**: Run the Pig Latin Scripts to find Word Count and max. temp for each and every year.
**TASK-7**: Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
**TASK-8**: Working with Hive QL, Use Hive to create, alter, and drop databases, tables, views, functions, and indexes
**TASK 9**: Writing User Defined Functions in Hive
**TASK 10:** Understanding the processing of large dataset on Spark framework.
**TASK 11**: Ingesting structured and unstructured data using Sqoop, Flume

**Text Books:**

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Inc,2015.
2. Tanmay Deshpande, "Hadoop Real-World Solutions Cookbook", 2ndEdition, Packt Publishing, 2016

**Reference Books:**

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Inc,2012.
2. Vignesh Prajapati, "Big data Analytics with R and Hadoop", Packt Publishing,2013

**SEMESTER -VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT6L01 | **DATA MINING LAB** | **0** | **0** | **3** | **1.5** |

**Course Objectives:**

- To understand the mathematical basics quickly and covers each and every condition of data mining in order to prepare for real-world problems
- The various classes of algorithms will be covered to give a foundation to further apply knowledge to dive deeper into the different flavours of algorithms
- Students should aware of packages and libraries of R and also familiar with functions used in R for visualization
- To enable students to use R to conduct analytics on large real life datasets
- To familiarize students with how various statistics like mean median etc

**Course Outcomes:**

At the end of the course, student will be able to

CO 1. : Extend the functionality of R by using add-on packages

CO 2. : Examine data from files and other sources and perform various data manipulation tasks

CO 3. : Code statistical functions in R

CO 4. : Use R Graphics and Tables to visualize results of various statistical operations on data

CO 5. : Apply the knowledge of R gained to data Analytics for real life applications

**List of Experiments:**

1. Implement all basic R commands.
2. Interact data through .csv files (Import from and export to .csv files).
3. Get and Clean data using swirl exercises. (Use 'swirl' package, library and install that topic from swirl).
4. Visualize all Statistical measures (Mean, Mode, Median, Range, Inter Quartile Range etc., using Histograms, Boxplots and Scatter Plots).
5. Create a data frame with the following structure

.

| EMP ID | EMP NAME | SALARY | START DATE |
|---|---|---|---|
| 1 | Satish | 5000 | 01-11-2013 |
| 2 | Vani | 7500 | 05-06-2011 |
| 3 | Ramesh | 10000 | 21-09-1999 |
| 4 | Praveen | 9500 | 13-09-2005 |
| 5 | Pallavi | 4500 | 23-10-2000 |

a) Extract two column names using column name.

b) Extract the first two rows and then all columns.

c) Extract 3rd and 5th row with 2nd and 4th column.

6. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into

i) 0 to 1 range with min-max normalization.

ii) a value around 0 with z-score normalization.

Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.

8. Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best $R^2$ and plot the original values in 'green' and predicted values in 'red'.
9. Implement k-means clustering using R.
10. Implement k-medoids clustering using R.
11. implement density based clustering on iris dataset.
12. implement decision trees using 'readingSkills' dataset.
13. Implement decision trees using 'iris' dataset using package party and 'rpart'.
14. Use a Corpus() function to create a data corpus then Build a term Matrix and Reveal word frequencies.

**Text Books:**

1) R and Data Mining: Examples and Case Studies, 1st ed, Yanchang Zhao, Sprnger, 2012.
2) R for Everyone, Advanced Analytics and Graphics, 2nd ed, Jared Lander, Pearson, 2018.

**e-Resources:**

1) www.r-tutor.com

KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCE(AUTONOMOUS)
Department of Computer Science and Engineering

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CS6T01 | Cryptography and Network Security | 3 | 0 | 0 | 3 |

## Course Objectives:

- 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, and SSL/TLS and email.
- Concepts of cryptographic utilities and authentication mechanisms to design secure applications.

## Course Outcomes:

**At the end of the course, the students will be able to:**

**CO-1:** Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory

**CO-2:** Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication

**CO-3:** Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.

**CO-4:** Apply different digital signature algorithms to achieve authentication and create secure applications

**CO-5:** Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP

## UNIT I

**ClassicalEncryptionTechniques**: Classical EncryptionTechniques-Substitution techniques,Transposition techniques, Security Attacks, Services & Mechanisms, Symmetric Cipher Model, Cyber Threats, Phishing Attack, Web Based Attacks.

**Block Ciphers**: Traditional Block Cipher Structure, Block Cipher Design Principles.

**UNIT II**

**Symmetric Key Cryptography**: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Blowfish, IDEA, Block Cipher Modes of Operations.

**Number Theory**: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, the Chinese Remainder Theorem, Discrete Logarithms.

**UNIT III**

**Public Key Cryptography**: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. **CryptographicHashFunctions**: Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC.

**Digital Signatures**: NIST Digital Signature Algorithm, Key Management and Distribution.

**UNIT IV**

**User Authentication**: Remote User Authentication Principles, Kerberos. Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME.

**IP Security**: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

**UNIT V**

**Transport Level Security**: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Shell (SSH)

**Firewalls:**Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted Systems.

**Text Books:**

1) Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition.

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.

**E-Resources:**

1)https://nptel.ac.in/courses/106/105/106105031/lecture by Dr.DebdeepMukhopadhyay IIT Kharagpur [Video Lecture]

2) https://nptel.ac.in/courses/106/105/106105162/
lecture by Dr. Sourav Mukhopadhyay IIT Kharagpur [Video Lecture]

3)https://www.mitel.com/articles/web-communication-cryptography-and-network-security[web articles by Mitel Power Connections].

**DEPARTMENT OF CSE - DATA SCIENCE**

**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CD6T02 | BIG DATA ANALYTICS | 3 | 0 | 0 | 3 |

**Pre- Requisites:**
Students should have knowledge of one Programming Language (Java preferably), Practiceof SQL (queries and sub queries), exposure to Linux Environment.

**Course Objectives:**

1. Describe Big Data and its use cases from selected business domains.
2. Provide an overview of HDFS Architecture and its daemon services.
3. Perform Map Reduce analytics with YARN using Hadoop.
4. Understand the working of data ingestion tools and PIG Latin.
5. Use Hadoop related tools such as Hive and HBase for big data analytics.

**Course Outcomes:**

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

1. Understand the concepts of Big Data and navigation of the Hadoop Ecosystem.
2. Illustrate the HDFS Architecture and the coordination service of Hadoop.
3. Implement distributed processing Map Reduce Paradigm with YARN.
4. Analyze importing and exporting data from Hadoop using Sqoop, Flume and workingwith PIG.
5. Examine the data stores - Hive and HBase on Hadoop

**UNIT I**

**Introduction to Big Data and Hadoop:**
Challenges of Traditional Decision Making, Solution with Big Data Analytics, Classification of Digital Data, Definition of Big Data, Characteristics of Big Data, Definition of Big Data Analytics, Features of Hadoop, History of Hadoop, RDBMS Vs. Hadoop, Hadoop Distributors, Ecosystems of Hadoop.

**UNIT II**

**HDFS and Zoo Keeper:**
**HDFS:** Concepts – Blocks, HDFS Components, Block Caching, Characteristics of HDFS, HDFS High Availability Architecture and its types, HDFS Command Line, Data Flow – Anatomy of File read and File write operations.
**Zoo Keeper:** Characteristics of Zoo Keeper, Zoo keeper Services, Zoo keeper Data Model.

**UNIT III**

**Map Reduce and YARN**
**YARN:** Elements of YARN Architecture, Map Reduce: Characteristics of Map Reduce, Phasesof Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Built - in Countersof MR, Joins in MR,

**UNIT IV**

**Data Ingestion Tools and PIG**

Data Ingestion Tools: Data Ingestion, Big Data Ingestion Tools, SQOOP - Benefits of SQOOP, SQOOP Connectors, Importing and Exporting to and from Hadoop using SQOOP, Limitationsof SQOOP, FLUME – Apache Flume, Data Sources for FLUME, Components of FLUME Architecture.

**PIG:** Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

**UNIT V**

**HIVE and HBASE**

**HIVE:** Features of HIVE, HIVE Architecture, HIVE Meta store, Data types in HIVE,HIVEQL, Tables, File Format Types – Text, Sequence, AVRO, Parquet, Querying Data.

**HBASE:** NOSQL Database, Types of NOSQL Database, Characteristics of HBASE,Architecture, HBaseVs. RDBMS, HBASE Shell Commands.

**Text Books:**

1. Tom White "Hadoop: The Definitive Guide" 4thedition, O'reily Media,2012.
2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley2015

**Reference Books:**

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer,2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRCpress(2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw- Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets",Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons,2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons,2007
7. Pete Warden, "Big Data Glossary", O'Reily,2011.
8. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics:Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game",MC Press,2012
10. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles, David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ",Tata McGraw Hill Publications,2012.

**SEMESTER - VI**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT6T01 | DATA MINING | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools

**Course Outcomes:**

At the end of the course, the students will be able to:

**CO 1. :** Design a Data warehouse system and perform business analysis with OLAP tools

**CO 2. :** Apply suitable pre-processing and visualization techniques for data analysis

**CO 3. :** Apply frequent pattern and association rule mining techniques for data analysis

**CO 4. :** Apply appropriate classification techniques for data analysis

**CO 5. :** Apply appropriate clustering techniques for data analysis

**UNIT I**

Data Warehousing : Basic Concepts, Data Warehousing Components, Data Warehouse Architecture , Multidimensional Data Model, Data Warehouse Schemas, Concept Hierarchies, Characteristics of OLAP Systems, Typical OLAP Operations, OLAP vs OLTP.

**UNIT II**

Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues, applications, Data Objects and attribute types, Statistical description of data, Data Preprocessing Techniques, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III**

Association Analysis: Basic Concepts and Algorithms, Frequent Item set Generation, The Apriori Principle, Frequent Item set Generation in the Apriori, Algorithm, Candidate Generation and Pruning, Support Counting, Rule Generation, Confidence-Based Pruning, Rule Generation in Apriori, Algorithm, Compact Representation of Frequent Item sets, Maximal Frequent Item sets, Closed Frequent Item sets, FP-Growth Algorithm, FP-tee Representation, Frequent Item set Generation in FP-Growth Algorithm

**UNIT IV**

Classification: Basic Concepts, Decision Trees, and Model Evaluation , General Approach to Solving a Classification Problem, Decision Tree Induction, How a Decision Tree Works, How to Build a Decision Tree, Methods for Expressing Attribute Test Conditions, Measures for Selecting the Best Split, Algorithm for Decision Tree Induction, Model Overfitting, Overfitting Due to Presence of Noise, Overfitting Due to Lack of Representative Samples, Evaluating the Performance of a Classifier, Methods for Comparing Classifiers

**UNIT V**

Cluster Analysis: Basic Concepts and Algorithms: Overview: What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means

Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin).

**Text Books:**

1) Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2) Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson, 2016.

**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.

**e-Resources:**

1) https://www.saedsayad.com/data_mining_map.htm
2) https://nptel.ac.in/courses/106/105/106105174/
3) (NPTEL course by Prof.Pabitra Mitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview
4) (NPTEL course by Dr. Nandan Sudarshanam & Dr. Balaraman Ravindran) http://www.saedsayad.com/data_mining_map.htm