KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

**(Autonomous)**

# DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE

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

**For B. Tech DEPARTMENT OF CSE - ARTIFICIAL INTELLIGENCE**
**(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

**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** | | | | | | | | | |
| 8 | 20SH2L01 | Communicative English Skills Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20SH2L02 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 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

*Add on course "Fundamentals of Artificial Intelligence"

*Note: This course will complete through MOOCS

**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 | 20IT3T01 | Object Oriented Programming through Java | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20CI3T01 | Introduction to Artificial Intelligence | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20GE3M01 | Constitution of India | 2 | 0 | 0 | 0 | - | - | - |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20CS3L03 | Data Structures &Algorithms Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20IT3L01 | Object Oriented Programming through Java lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CI3L01 | Introduction to Artificial Intelligence 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 & TransformatioRens | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CI4T01 | Computer Organization | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CS4T01 | Database Management Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20CS4T02 | Formal Languages and Automata Theory | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20SH4T01 | Managerial Economics and Financial Accountancy | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 20CS4L01 | Database Management Systems Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 7 | 20CI4L01 | Web Application Development Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 8 | 20CS4L03 | R Programming Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CI4S01 | Fundamentals of Robotics | 1 | 0 | 2 | 2.0 | -- | 50 | 50 |
| **Total Credits** | | | | | | **21.5** | **195** | **505** | **700** |
| 10 | Minor | Introduction to Artificial Intelligence[$] | **3** | **0** | **2** | **4** | | | |

$ -Minor Course

**Theory:** BSC-01, PCC-2,ESC-01,HSMC-01: **Practical:** PCC-03,SC-01

## 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 | 20CI5E1X | **Professional Elective -1**<br>1. Software Engineering<br>2. Compiler Design<br>3. Data Visualization<br>4. Artificial Neural Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20XX5O1X | **Open Elective -1** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20CI5S01 | **Skill Oriented Course – III** | 0 | 0 | 4 | 2 | 15 | 35 | 50 |
| 7 | 20GE5C03 | Professional Ethics and Human Values | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | | **Summer Internship one Month (Mandatory) after second year(to be evaluated during V Semester** | 0 | 0 | 0 | 1.5 | 15 | 35 | 50 |
| **PRACTICAL** | | | | | | | | | |
| 9 | 20CI5L02 | Machine Learning Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20IT5L02 | Operating Systems Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **21.5** | **210** | **490** | **700** |
| | | | | | | | | | |
| 10 | Minor | Machine Learning$ | **3** | **0** | **2** | **4** | | | |

$ -Minor Course

**Theory :** PCC-3 ,PE-1,OE-1 **Practical:** PCC-2 **Other : 3**

**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 | 20CI6T01 | Deep Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CI6T02 | Expert Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 20CI6E2X | **Professional Elective -2**<br>1. Software Project Management<br>2. Distributed Systems<br>3. Internet of Things<br>4. Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5 | 20XX6O2X | **Open Elective-II** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | 20CI6S01 | **Skill Oriented Course – IV** | 0 | 0 | 4 | 2 | 15 | 35 | 50 |
| 7 | 20GE6M03 | Intellectual property rights and patents | 2 | 0 | 0 | 0 | | | |
| **PRACTICAL** | | | | | | | | | |
| 8 | 20CI6L01 | Deep Learning Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 9 | 20CI6L02 | Computer Networks Lab | 0 | 0 | 3 | 1.5 | 15 | 35 | 50 |
| 10 | 20CI6P01 | Mini Project with seminar | 1 | 0 | 2 | 1.5 | 15 | 35 | 50 |
| **Total Credits** | | | | | | **21.5** | **210** | **490** | **700** |
| | | | | | | | | | |
| 10 | Minor | Deep Learning$ | **3** | **0** | **2** | **4** | | | |

$ -Minor Course

**Theory :** PCC-3 ,PE-1,OE-1 **Practical:** PCC-2 **Other : 3**

**SEMESTER-VII**

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CI7E3X | **Professional Elective-III**<br>1.Reinforcement Learning<br>2.Soft Computing<br>3. Cryptography and Network Security<br>4. NOSQL Databases<br>5. Natural Language Processing | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2 | 20CI7E4X | **Professional Elective-IV**<br>1. Robotic Process Automation<br>2. Cloud Computing<br>3. Big Data Analytics<br>4. Block Chain Technologies<br>5. Image & Video Analytics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3 | 20CI7E5X | **Professional Elective-V**<br>1. Social Network Analysis<br>2. Recommender Systems<br>3. Computer vision<br>4. Mining Massive Data Sets<br>5. Semantic Web | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | 20XX | **Open Elective-III** | 3 | 0 | 0 | 3 | 30 | 70 | 10 |
| 5 | 20XX704X | **Open Elective - IV** | 3 | 0 | 0 | 3 | 30 | 70 | 10 |
| 6 | 20SH70XX | Management Science | 3 | 0 | 0 | 3 | 30 | 70 | 10 |
| 7 | 20CI7S01 | **Skill Oriented Course** -V | 0 | 0 | 4 | 2 | 15 | 35 | 50 |
| 8 | | **Industrial/Research Internship one months (Mandatory) after third year(to be evaluated during VII semester)** | 0 | 0 | 0 | 1.5 | 15 | 35 | 50 |
| **PRACTICAL** | | | | | | | | | |
| 10 | | MOOCS | 0 | 0 | 0 | 1.5 | -- | | |
| **Total Credits** | | | | | | **23** | **21** | **490** | **70** |
| | | | | | | | | | |
| 10 | Minor | Reinforcement Learning$ | **3** | **0** | **2** | **4** | | | |
| | | Minor courses through SWAYAM | **0** | **0** | **0** | **2** | | | |

$ -Minor Course

**Theory :** PE-3,OE-2 **Practical:** PW-1 **Other : 4**

**SEMESTER - VIII**

| S.No | Code | Course Title | L | T | P | C | IM | EM | TM |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1 | 20CI8P1 | Project work - Phase II | 0 | 0 | 0 | 12 | 60 | 140 | 150 |
| **Total Credits** | | | | | | **12** | **65** | **135** | **200** |

**Practical:** PW-1

## CONSOLIDATION

| 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 | - | 2 | 1 | 1 | 23.0 | 210 | 490 | 700 |
| VIII | - | - | 1 | - | - | - | 12.0 | 60 | 140 | 200 |
| **Total** | **36** | **17** | **1** | **4** | **5** | **2** | **160** | **1410** | **3590** | **5000** |

| OPEN ELECTIVES | | |
|---|---|---|
| **Open Elective – 1**<br>**( V Semester )**<br>Python Programming | **Open Elective -2**<br>**(VI Semester )**<br>Fundamentals of Artificial Intelligence | **Open Elective -3**<br>**(VII Semester)**<br>Human Computer Interaction |
| **Open Elective -4**<br>**(VII Semester)**<br>Applications of Artificial Intelligence | **Skill Oriented Course (Advanced)– IV**<br>**1. (**MEAN Stack Technologies - Module I- MongoDB, Express.js, Angular JS, Node.js and AJAX<br>2. Big Data : Apache Spark<br>3. DevOPS | |
| **PROFESSIONAL ELECTIVES** | | |
| **Professional Elective – 1**<br>**(V Semester )** | **Professional Elective – 2**<br>**( VI Semester)** | **Professional Elective – 3**<br>**(VII Semester )** |
| 1. Software Engineering<br>2. Compile Design<br>3. Data Visualization<br>4. Design and Analysis of Algorithms | 1. Software Project Management<br>2. Distributed Systems<br>3. Internet of Things<br>4. Data Where Housing and Data Mining | 1.Reinforcement Learning<br>2.Soft Computing<br>3. Cryptography and Network Security<br>4. NOSQL Databases<br>5. Natural Language Processing |
| **Professional Elective – 4**<br>**(VII Semester)** | **Professional Elective – 5**<br>**(VII Semester)** | |
| 1. Robotic Process Automation<br>2. Cloud Computing<br>3. Big Data Analytics<br>4. Block Chain Technologies<br>5. Image & Video Analytics | 1. Social Network Analysis<br>2. Recommender Systems<br>3. Computer vision<br>4. Object Oriented Analysis and Design<br>5. Semantic Web | |

## 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

**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.

*Learning Outcomes:* At the end of this unit, the students will be able to outline the properties of polymers and various additives added and different methods of forming plastic materials.

Explain the preparation, properties and applications of some plastic materials. Interpret the mechanism of conduction in conducting polymers.

Discuss natural and synthetic rubbers and their applications.

**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).

Learning Outcomes: At the end of this unit, the students will be able to understand the principles of different analytical instruments.

explain the different applications of analytical instruments.

Categorize the reasons for corrosion and study some methods of corrosion control

**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
*Learning Outcomes:* At the end of this unit, the students will be able to
Understand the importance of materials like nanomaterials and fullerenes and their uses. Understand liquid crystals and superconductors.
Understand the preparation of semiconductors

**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
*Learning Outcomes:* At the end of this unit, the students will be able to Obtain the knowledge of computational chemistry Understand importance molecular machines.

**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.
Learning Outcomes: At the end of this unit
The importance of green synthesis is well understood and how they are different from conventional methods is also explained.
The students will be able to understand power generation by different natural sources.

**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

**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, 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 and equations 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), $x^n$V(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

**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

**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 AgeInternational (p) Ltd, 2004.


**REFERENCE BOOKS:**


1. P. V. Prasad, S. Sivanagaraju, K. R. Varmah, and Chikku Abraham, *Basic ElectricalEngineering*, 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.

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

**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

**SEMESTER - I**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20SH1L04** | APPLIED CHEMISTRY LAB | **0** | **0** | **3** | **1.5** |

**COURSE OUTCOMES:**

At the end of the Course, the student will 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 conductometric 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 ometric Titrations between strong acid and strong base.
11. Conduc to metric Titrations between strong acid and Weak base.
12. Preparation of Bakelite.
13. Estimation of acid content in soft drinks.
14. Potenti ometric 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


**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20SH2T01** | COMMUNICATIVE ENGLISH | **3** | **0** | **0** | **3** |

**COURSE OUTCOMES:**

At the end of the Course, the student will be able to

**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. Critical reading.
*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. *Academic writing: A hand book for international students.* Routledge, 2014.
2. Chase, Becky Tarver. Pathways: *Listening, Speaking and Critical Thinking*. Heinley ELT;2nd Edition, 2018.
3. *Skillful Level2 Reading & Writing Student's Book Pack* (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge *Academic English* (B2).CUP,2012.


**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20SH2T02** | APPLIED PHYSICS | **3** | **0** | **0** | **3** |

**COURSE OUTCOMES:**
At the end of the Course, the student will 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).

**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 Hill Education.

**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


**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, 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 thePLA 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. Alam Mansaf and Alam Bashir, *Digital Logic Design*, PHI Publication, 2015.

**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

**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

**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20SH2L01** | COMMUNICATIVE ENGLISH SKILLS 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.

**SEMESTER - II**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20SH2L02** | APPLIED PHYSICS LAB | **0** | **0** | **3** | **1.5** |

**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 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.

**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 kilometers. 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

**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 are 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.

**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: 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, Sub group 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, 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/

**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:** Analyze 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, Apriori Analysis, Asymptotic notations, Time complexity of algorithms using Onotation, Polynomial Vs Exponential algorithms, Average, Best, Worstcase complexities, Analyzing recursive programs.
**Searching:** Introduction, Linear Search, Binary Search, Fibonacci Search.
**Internal Sorting:** Introduction, Bubble Sort, Insertion Sort, Selection Sort.

**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.
**Hashing** : Introduction, Hash Table Structure, Hash Functions

**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
3. *Data Structures&Algorithm Analysisin C++*|ThirdEdition| MarkAllen Weiss|byPearson

**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

**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20IT3T01** | **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:**

By the end of the course, the student will be

**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 Analyze & 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

**SEMESTER – III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI3T01** | **Introduction to Artificial Intelligence** | **3** | **0** | **0** | **3** |

***Course Objectives:***

- To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- To provide a basic exposition to the goals and methods of Artificial Intelligence.
- To apply the techniques in applications which involve perception, reasoning and learning?

***Course Outcomes:***

At the end of the Course, the student will be able to

**CO1 :** Enumerate the history and foundations of Artificial Intelligence

**CO2 :** Apply the basic principles of AI in problem solving

**CO3 :** Choose the appropriate Knowledge representation scheme

**CO4:** Solve the problems with uncertainty using probability

**CO5:** Examine the Scope of AI and its societal implications

**UNITI**

**Introduction:** What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

**UNITII**

**Problem Solving:** Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Non deterministic Actions.

**UNITIII**

**Knowledge Representation:** Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

**UNITIV**

**Uncertain Knowledge and Reasoning:** Acting under Uncertainty**,** Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, RepresentingKnowledgeinanUncertainDomain,TheSemanticsofBayesianNetworks.

**UNITV**

**AI present and Future:** Weak AI: Can Machines Act Intelligently?, Strong AI: Can Machines Really Think?, The Ethics and Risks of Developing Artificial Intelligence, Agent

Components, Agent Architectures, Are We Going in the Right Direction?, What If AIDoes Succeed?.

***Text Books:***

1) Stuart Russell and Peter Norvig, "*Artificial Intelligence: AModern Approach*", 3rd Edition, Pearson.
2) Elaine Rich and Kevin Knight, "*ArtificialIntel ligence*", Tata Mc Graw Hill

***Reference Books:***

1) Saroj Kaushik, "*Artificial Intelligence*", Cengage Learning India, 2011
2) David Poole and Alan Mack worth, "*Artificial Intelligence: Foundations for Computational Agents* ", Cambridge University Press 2010.
3) Trivedi,M.C., "*A Classical Approach to Artificial Intelligence*", Khanna Publishing House,Delhi.

***Web Resources:***

1) https://nptel.ac.in/courses/106105077
2) https://nptel.ac.in/courses/106106126
3) https://aima.cs.berkeley.edu
4) https://ai.berkeley,edu/project_overview.html

**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 and high 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 governmentie., 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 strengthen in gof the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

***UNITI***

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.

***UNITII***

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;

***UNITIII***

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

***UNITIV***

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 ZilaPanchayat: Block level Organizational Hierarchy-(Different departments), Village level Role of Elected and Appointed officials - Importance of grass root

UNITV

Election Commission: Election Commission – Role of Chief Election Commissioner and Election Commissione rate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

***References:***


1) Durga DasBasu, *Introduction to the Constitution of India, Prentice Hall of India* Pvt.Ltd.
2) Subash Kashyap, *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 Law Publication)
6) J.C.Johari*, Indian Government and Politics Hans*
7) J.Raj *Indian Government and Politics*
8) M.V.Pylee, *Indian Constitution Durga Das Basu, Human Rightsin Constitutional Law*, Prentice–HallofIndiaPvt.Ltd..NewDelhi


***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

**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 this course, students will 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 using C*, 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

**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20IT3L01** | **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:**

By the end of the course student will be able to write java program for

**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 StringBuffer 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

**SEMESTER - III**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI3L01** | **INTRODUCTION TO ARTIFICIAL INTELLIGENCE LAB** | **0** | **0** | **3** | **1.5** |

***Course Objectives:***

- To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- To provide a basic exposition to the goals and methods of Artificial Intelligence.
- To apply the techniques in applications which involve perception, reasoning and learning.

***Course Outcomes:***

At the end of the Course, the student will be able to

**CO1:** Apply the basic principles of AI in problem solving using LISP/PROLOG

**CO2:** Implement different algorithms using LISP/PROLOG

**CO3:** Develop an Expert System using JESS/PROLOG

***List of Experiments***

1. Implementation of DFS for water jug problem using LISP/PROLOG
2. Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java
3. Implementation of TSP using heuristic approach using Java/LISP/Prolog
4. Implementation of Simulated Annealing Algorithm using LISP/PROLOG
5. Implementation of Hill-climbing to solve 8-Puzzle Problem
6. Implementation of Monkey Banana Problem using LISP/PROLOG
7. Implementation of A* Algorithm using LISP/PROLOG
8. Implementation of Hill Climbing Algorithm using LISP/PROLOG
9. Implementation Expert System with forward chaining using JESS/CLIPS
10. Implementation Expert System with backward chaining using RVD/PROLOG

**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 for Android 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

**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.

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**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

**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI4T01 | COMPUTER ORGANIZATION | 3 | 0 | 0 | 3 |

***Course Objectives:***

The course objectives of Computer Organization are to discuss and make student familiar with

- Principles and the Implementation of Computer Arithmetic
- Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
- Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
- Memory System and I/O Organization
- Principles of Operation of Multi processor Systems and Pipelining

***Course Outcomes:***

At the end of the course, the student will be able to

**CO1:** Develop a detailed understanding of computer systems

**CO2:** Cite different number systems, binary addition and subtraction, standard, floating-point, and micro operations

**CO3:** Develop a detailed understanding of architecture and functionality of central processing unit

**CO4:** Exemplify in a better way the I/O and memory organization

**CO5:** Illustrate concepts of parallel processing, pipelining and inter processor communication

## UNITI

**Basic Structure of Computers**: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating, Point Representation. Other Binary Codes, Error Detection Codes.

**Computer Arithmetic**: Addition and Subtraction, Multiplication Algorithms, Division Algorithms.

## UNIT II

**Register Transfer Language and Micro operations**: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit.

**Basic Computer Organization and Design**: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory–Reference Instructions. Input–Output and Interrupt, Complete Computer Description.

## UNIT III

**Central Processing Unit**: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

**Micro programmed Control:** Control Memory, Address Sequencing, MicroProgram example, Design of Control Unit.

## UNIT IV

**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

## UNIT V

**Multi Processors:** Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.

**Pipeline:** Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

***Text Books:***


1) *Computer System Architecture*, M.Morris Mano,Third Edition, Pearson, 2008.
2) *Computer Organization*,Carl amacher,ZvonkoVranesic,SafwatZaky,5/e, McGrawHill,2002.


***Reference Books:***


1) *Computer Organization and Architecture*,WilliamStallings,6/e,Pearson, 2006.
2) *Structured Computer Organization*, AndrewS.Tanenbaum,4/e,Pearson,2005.
3) *Fundamentals of Computer Organization and Design*, Sivarama P. Dandamudi, Springer, 2006.


***WebResources:***

1) https://nptel.ac.in/courses/106/105/106105163/
2) http://www.cuc.ucc.ie/CS1101/David%20Tarnoff.pdf

**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CS4T01** | 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: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Failure Classification.

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/

**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. Ull man, 3rd Edition, Pearson, 2008
2) *Theory of Computer Science-Automata, Languages and Computation*, K. L. P. Mishra and N.Chandra sekharan, 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/

**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20SH4T01** | **MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY** | **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 Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and mplicit 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 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 – Preparation of Funds flow and cash flow analysis (Problems).

**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(payback 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, *An Introduction 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.

**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CS4L01** | 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 this course, students 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 OUTof 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

**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI4L01** | Web Application Development Lab | **0** | **0** | **3** | **1.5** |

***Course Objectives:***

- To develop the skill in Creating dynamic web pages with servlets
- To provide knowledge in connecting java programs with database using JDBC.
- To develop the skill in server side programming using JSP, node.js, React.js
- To provide knowledge about MERN stack
- Testing the application on an Application Server.
- Debugging Web applications locally and remotely

***Course Outcomes:***

At the end of the course, the student will be able to

**CO1:** Develop Single Page Applications

**CO2:** Develop Node JS & React JSRe usable Service

**CO3:** Store the data in MySQL

**CO4:** Get acquainted with the latest web application development trends in the IT industry

***List of Experiments:***

1. Authentication using Java Servlet
2. Authentication using JSP
3. Connect MySQL database using JSP
4. Design and development of Online Book Shop using JSP/Node.js & React.js
5. Design and development of Online Examination using JSP/Node.js & React.js
6. Design and development of online ticket reservation system using JSP/Node.js & React.js
7. Design and development of online library using JSP/Node.js & React.js
8. Design and development of online banking using JSP/Node.js & React.js
9. Design and development of online job portal using JSP/Node.js & React.js
10. Design and development of Online Auction using JSP/Node.js & React.js

**Note:** Students are encouraged to propose innovative ideas in the field of E-commerce as projects.

***References***

1. Jason Hunter, William Crawford, *Java Servlet Programming*, SecondEdition,,O'ReillyMedia
2. Hans Bergsten, *Java Server Pages*,O'Reilly
3. http://www.oracle.com/technetwork/java/index-jsp-135475.html
4. http://www.oracle.com/technetwork/java/javaee/jsp/index.html

**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 R Studio

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 onmtcar 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/

**SEMESTER - IV**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI4S01** | Fundamentals of Robotics | **1** | **0** | **2** | **2** |

**Course Objective:**

The objective of this course is to enlighten the students about the fundamentals of robotic systems.

- To understand the basics of robot, Robot Transformations and Sensors,
- To program them for functioning.

**Course Outcomes:**

At the end of the course, the student will be able to

**CO 1:** Specify the characteristics of robots used in different domains.
**CO 2:** Describe about the different types of grip per mechanisms
**CO 3:** Describe the use of sensor network sand quality control
**CO 4:** Discuss about the advanced methods for control of robot moments.
**CO 5:** Summarize the applications of automation and robotics.

List of Experiments:

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors
4. Determination of maximum and minimum position flinks
5. Verification of transformation (Position and orientation ) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution
7. Implement the following functionality in robot

A. Programming a simple Robot on Wheels.
B. Programming a Walking Robot.
C. Experiments based on Bipedal Robot.
D. Experiments based on Humanoid Robot-ROOBONOVA.
E. Pick and Place Application Programming with4DOF Robot Arm by Interfacing to PC.
F. Swap Application Programming with 4DOF Robot Arm by Interfacing to PC.

| Course Code | Course Name | L T P C |
|---|---|---|
| Minor | Introduction to Artificial Intelligence | 3 0 0 3 |

**Course Objectives:**

- To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- To provide a basic exposition to the goals and methods of Artificial Intelligence.
- To apply the techniques in applications which involve perception, reasoning and learning?

**Course Outcomes:**

At the end of the Course, the student will be able to

CO1 : Enumerate the history and foundations of Artificial Intelligence
CO2 : Apply the basic principles of AI in problem solving
CO3 : Choose the appropriate Knowledge representation scheme
CO4: Solve the problems with uncertainty using probability
CO5: Examine the Scope of AI and its societal implications

**UNIT I**

Introduction: What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments.

**UNIT II**

Problem Solving: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies.

**UNIT III**

Knowledge Representation: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects,

**UNIT IV**

Uncertain Knowledge and Reasoning: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use.

**UNIT V**

AI present and Future: Weak AI: Can Machines Act Intelligently?, Strong AI: Can Machines Really Think?, The Ethics and Risks of Developing Artificial Intelligence.

**Text Books:**

1) Stuart Russell and Peter Norvig, "Artificial Intelligence: AModern Approach", 3rd Edition, Pearson.
2) Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata Mc Graw Hill

**Reference Books:**

1) Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
2) David Poole and Alan Mack worth, "Artificial Intelligence: Foundations for Computational Agents ", Cambridge University Press 2010.
3) Trivedi,M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House,Delhi.

**Web Resources:**

1) https://nptel.ac.in/courses/106105077
2) https://nptel.ac.in/courses/106106126
3) https://aima.cs.berkeley.edu
4) https://ai.berkeley,edu/project_overview.html

## III Year I SEMESTER

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT5T01 | DESIGN AND ANALYSIS OF ALGORITHMS | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To provide an introduction to formalisms to understand, analyse 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:**

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
2. Solve problems using divide and conquer and greedy method algorithmic approaches
3. Solve problems using dynamic programming algorithmic approaches
4. Solve problems using backtracking and branch and bound algorithmic approaches
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/

**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI5T02 | Machine Learning | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- Acquire theoretical Knowledge on setting hypothesis for pattern recognition.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms and to provide solution for various real world applications.

**COURSE OUTCOMES:**

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.


**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20IT5T02** | **Operating Systems** | **3** | **0** | **0** | **3** |

**Course Objectives:**

The objectives of this course is 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:**

After learning, the course the students should be able to:

1. Describe various generations of Operating System and functions of Operating System
2. Describe the concept of program, process and thread and analyze various CPU Scheduling Algorithms and compare their performance
3. Solve Inter Process Communication problems using Mathematical Equations by various methods
4. Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques
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, Computing environments, Open-Source Operating Systems.

System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.

**UNIT II**

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems.

Multithreaded Programming: Multithreading models, Thread libraries, Threading issues.

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling.

Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

**UNIT III**

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation.
Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation.

**UNIT IV**

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.
File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

**UNIT V**

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.
System Security: Introduction, Program threats, System and network threats, Cryptography for security, User authentication, implementing security defenses, Firewalling to protect systems and networks, Computer security classification.
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. (forInterprocess 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.

**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI5E1X** | **Software Engineering**<br>(Professional Elective -1**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Identification and analysis of different Life cycle phases
- Prepare Good SRS for a Software project.

- Estimation of a Software Project
- Understand the process of Design engineering.
- Develop and Apply different testing techniques.

**Course Outcomes:**

At the end of the course, student will be able to

1. Understand business requirements and choose a relevant Process model for agiven software proposal
2. Analyze the requirements to prepare SRS
3. Estimate the Cost and Schedules of a Software Project.
4. Model various Functional and Object-Oriented design for a s/w project.
5. Develop various functional and structural test cases for a software module

**UNIT I**

**The Software Problem and Process**

Software development Process Models: Waterfall, Prototype, Iterative Development, Rational Unified Process, Time boxing Model, Extreme Programming and Agile Process, Unified Process Models, Software Management Process.

**UNIT II**

**Software Requirement Analysis and Specification**

Value of good SRS, Requirements Specification, and Functional specification with Use cases, other approaches for analysis, Data flow diagrams, Entity relationship Diagrams, Validation.

**UNIT III**

**Planning a Software Project**

Effort Estimation, Project Scheduling and Staffing, Quality Planning, Risk Management Planning, Project Monitoring Plan, Detailed Scheduling.

**UNIT IV**

**Design**

Design Concepts: Cohesion, Coupling, Functional oriented design: Structured chart, Structured design methodologies, Examples, Object Oriented Design: OO concepts, UML, Design Methodology, Examples, Detailed design: Logic/Algorithm Design, State Modelingof Classes, Verification, Metrics: Metrics for Object Oriented Design, Metrics for FunctionalOriented Design

**UNIT V**

**Software testing strategies:**

A strategic approach to software testing, strategic issues, test strategies for conventionalsoftware, validation testing, system testing.

**TEXTBOOKS**

Software Engineering a precise approach by Pankaj Jalote, Wiley Publications.

**REFERENCE BOOKS**

1 Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGrawHill International Edition.

2 Software Engineering- Sommerville, 7th edition, Pearson Education.

**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI5E1X** | **Artificial Neural Networks** (Professional Elective -1**)** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- Understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.
- Provide knowledge of supervised learning in neural networks
- Provide knowledge of computation and dynamical systems using neural networks
- Provide knowledge of reinforcement learning using neural networks.
- Provide knowledge of unsupervised learning using neural networks.
- Provide hands-on experience in selected applications

**OUTCOMES:**

At the end of the course, student will be able to

1. To identify the similarities and differences between biological and artificial neurons with their architectures along with different activation functions.
2. To understand the impact of Mathematics in ANN and different learning mechanisms for error correction.
3. To analyse the Structure and learning of single layer Perceptron along with bayes' classifier.
4. To understand Structure of Multi-layer feed forward networks and concept of Back propagation algorithm along with Functional approximation.
5. To identify Pattern seperability and interpolation using Radial Basis Function Networks.
6. To introduce the concept of Support Vector machines and it's applicability in modeling machine learning algorithms.

**UNIT-I: Introduction and ANN Structure.**

Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures.

**UNIT-II**

Mathematical Foundations and Learning mechanisms. Re-visiting vector and matrix algebra. State-space concepts. Concepts of optimization. Error-correction learning. Memory-based learning. Hebbian learning. Competitive learning.

**UNIT-III**

Single layer perceptrons. Structure and learning of perceptrons. Pattern classifier – introduction and Bayes' classifiers. Perceptron as a pattern classifier. Perceptron convergence. Limitations of a perceptrons.

**UNIT-IV: Feed forward ANN.**

Structures of Multi-layer feed forward networks. Back propagation algorithm. Back propagation - training and convergence. Functional approximation with back propagation. Practical and design issues of back propagation learning.

**UNIT-V: Radial Basis Function Networks.**

Pattern separability and interpolation. Regularization Theory. Regularization and RBF networks.RBF network design and training. Approximation properties of RBF. Linear separability and optimal hyperplane. Determination of optimal hyper plane. Optimal hyper plane for non separable patterns. Design of an SVM. Examples of SVM.

**TEXT BOOKS:**

1. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.

2. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

**REFERENCE BOOKS:**

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.

**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI5E1X** | **Data Visualization**<br>(Professional Elective -1**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Understand the visualization process and visual representations of data.
- Learn visualization techniques for various types of data.
- Explore the visualization techniques for graphs, trees, Networks.
- Understand the visualization of maps, GIS and collaborative visualizations.
- Discuss the recent trends in perception and visualization techniques.

**Course Outcomes:**

At the end of the course, student will be able to

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 forreal world problems.

**UNIT I**

Introduction to Visualization, Visualization process, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization referencemodel, 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, datastructures 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

**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI5E1X | COMPILER DESIGN | 3 | 0 | 0 | 3 |

**Course Objectives:**

- Use the knowledge of Finite Automata and able to represent the language in form ofRegular Expressions, Grammar and convert NFA to DFA and vice versa.
- Understand different phases of the compiler, Lexical analyser and Top down parsing.
- Demonstrate Bottom up parsing technique.
- Illustrate memory management techniques during different phases.
- Identify the effectiveness of optimization and differences between machine dependentand independent translation.

**Course Outcomes:**

At the end of the course, student will be able to

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 Jeffery D. Ullman,2nd edition,pearson,2007
2. Compiler Design K.Muneeswaran, OXFORD
3. 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.

**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20GE5C03** | **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 beings with proper personality.
- Professional Ethics installs the student to maintain ethical conduct and dischargetheir professional duties.

**Course Outcome:**

1. It gives a comprehensive understanding of a variety issues that areencountered by every professional in discharging professional duties.
2. It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively**.**

**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. 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, Pritchard and 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. Natarajan and V. S.SenthilKumar- PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values, A. Alavudeen, R.Kalil Rahman and M.Jayakumaran – University Science Press.
8. Professional Ethics and Human Values, D. R. Kiran-Tata McGraw-Hill - 2013
9. Human Values And Professional Ethics, Jayshree Suresh and B. S. Raghavan,S.Chand Publications

III Year I Semester

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI5L02 | Machine Learning Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives**:

- Learn usage of Libraries for Machine Learning in Python
- Demonstrate Dimensionality reduction methods
- Describe appropriate supervised learning algorithms for a given problem.
- Explore back propagation algorithm and ensemble methods
- Discuss different unsupervised learning algorithms

**Course Outcomes:**

At the end of the course, student 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

**Experiment:**

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.

III Year I Semester

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20IT5L02 | Operating Systems 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.

**Course Outcomes:**

At the end of the course, student will be able to

1. To use of an operating system to develop software
2. To implement the compilation phases
3. To implement the memory management techniques
4. To implement the CPU scheduling algorithms
5. To implement the CPU scheduling algorithms
6. File allocation strategies

1. Simulate the following CPU scheduling algorithms
   a) Round Robin b) SJF c) FCFS d) Priority
2. Multiprogramming-Memory management- Implementation of fork (), wait (), exec() and exit (), System calls
3. Simulate the following
   a) Multiprogramming with a fixed number of tasks (MFT)
   b) Multiprogramming with a variable number of tasks (MVT)
4. Simulate Bankers Algorithm for Dead Lock Avoidance
5. Simulate Bankers Algorithm for Dead Lock Prevention.
6. Simulate the following page replacement algorithms.
   a) FIFO b) LRU c) LFU
7. Simulate the following File allocation strategies
   a) Sequenced b) Indexed c) Linked
8. Write a Program to Scan and Count the number of characters, words, and lines in a file.
9. Write a Program to implement NFAs that recognize identifiers, constants, and operators of
   the mini language.
11. Write a Program to implement DFAs that recognize identifiers, constants, and operators of
    the mini language.

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| Minor | Machine Learning | 3 | 0 | 0 | 4 |

**COURSE OBJECTIVES:**

- Acquire theoretical Knowledge on setting hypothesis for pattern recognition.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms and to provide solution for various real world applications.

**COURSE OUTCOMES:**

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**.**

**UNIT II**

**Supervised and Unsupervised Learning**

Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support Vector Machines: Linear and Non-Linear, K Nearest Neighbours. Introduction to 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.

**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,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.

**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. Charu C.Aggarwal,“Data Classification Algorithms and Applications”,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

And Techniques”,3rd edition, Morgan Kaufman Publications, 2012.


**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CD6T01** | **Computer Networks** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Learn various Network topologies and Network models and transmission media..
- Describe error detection, Flow control mechanisms and Multiple access protocols.
- Understand different Routing technologies involved to route packets
- Distinguish the standard Internet Protocol (IP), Transport Control Protocol (TCP) and User Datagram Protocol for Internet.
- Analyze and understand application layer protocols.

**Course Outcomes:**

At the end of the course, student will be able to

1. Define basic terminologies of Computer Networks and to apply various networkingconfigurations and transmission media to build a network for an organization.
2. Summarize error correction and detection techniques and MAC Protocols for specificnetworks.
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 ServiceApplication 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

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6T01 | Deep Learning | 3 | 0 | 0 | 3 |

**Course Objectives:**

- Comprehend the math required for building deep learning networks.
- Understand the basic building blocks of artificial neural networks (ANNs).
- Acquire knowledge of supervised/unsupervised learning in neural networks.
- Explore the methods to develop optimized deep learning networks considering hyperparameters of convolution networks, recurrent neural networks.
- Model solutions for real life problems using optimized deep learning networks.

**Course Outcomes:**

At the end of the course, student will be able to

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 consideredfor a deep learning network.
5. Design optimized deep learning applications for small problems using algorithms learntin 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 Propand 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, Aaron Courville — MIT Press book- ISBN-13: 978-0262035613,
2. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.


**References**


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 - InformationScience and Statistics. ISBN-13:978-1493938438.

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6T02 | **Expert Systems** (Professional Elective -2**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- In this course the student will learn the methodology used to transfer the knowledge of a human expert into an intelligent program that can be used to solve problems.

**Course Outcomes:**

At the end of the course, student will be able to

1. Apply the methodology to transfer human knowledge into an expert system
2. Apply knowledge representation
3. Design a knowledge base and Implement a rule-based expert system
4. Evaluate Expert System tools
5. Apply CLIPS for the implementation of an expert system

**UNIT-I**

Introduction what is AI? The Foundations of AI, What is an AI Technique?-Tic-TacToe. Problems, Problem Spaces and Search Defining the problem as a state space search, Production systems, Problem characteristics, production system characteristics, Issues in the design of search programs.

**UNIT-II**

Heuristic Search Techniques Generate-and-test, Hill climbing, Simulated Annealing, Best-First search, A* algorithm, AO* algorithm, Constraint satisfaction, Means-Ends Analysis.

**UNIT-III**

First-Order Logic Syntax and Semantics, Extensions and Notational Variations, Using First-Order Logic, Representing Change in the world, deducing hidden properties of the world. Interface in First-Order Logic Inference rules involving Quantifiers, An Example proof, Generalized Modus Ponens, Forward and Backward Chaining, Completeness, Resolution, Completeness of Resolution.

**UNIT-IV**

Slot-and-Filler Structures Semantic Nets, Frames, And Conceptual Dependency. Game Playing Overview, The Mini-max Search Procedure, Adding Alpha-Beta Cutoffs, Additional Refinements, Iterative Deepening.

**UNIT-V**

Natural Language Processing Introduction, Syntactic processing, Semantic analysis. Expert Systems Representing and Using Domain Knowledge, Expert System Shells,Explanation, Knowledge Acquisition.

**Text Books :**

1. Rich, Elaine and Knight, Kevin, Artificial Intelligence, Tata McGraw-Hill publications, 2nd Edition, 2006

2. Russell, Stuart and Norvig, Peter, Artificial Intelligence A Modern Approach, Pearson Education

**Reference Books:**

1. Eugene Charniak and Drew McDermott, Introduction to Artificial Intelligence, Addison Wesley, Pearson Education, 2005

2.George F Luger, Artificial Intelligence Structures and Strategies for Complex Problem Solving, earson Education Ltd., 2nd Edition, 2002.

3. Dan W Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice-Hall of ndia, 2001.

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6E2X | **Software Project Management** (Professional Elective -2**)** | **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, student will be able to

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, 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, Pankaj Jalote, Pearson Education, 2005.

3) Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6E2X | **Distributed Systems** (Professional Elective -2**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- 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.
- Expose students to current technology used to build architectures to enhance distributed Computing infrastructures with various computing principles

**Course Outcomes:**

At the end of the course, student will be able to

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

**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.

**UNIT-VI:**

**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.

**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

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6E2X | **Internet of Things**<br>(Professional Elective -2**)** | **3** | **0** | **0** | **3** |

**Course objectives**

- Understand the basic characteristics of IoT system
- Realize the different IoT Protocols and architectures
- Analyze the cloud interface and security concerns of IoT devices
- Introduce programming in various real-time hardware platforms
- Design a complete IoT ecosystem for various smart applications

**Course outcomes:**

At the end of the course, student will be able to

1. Ability to learn characteristics, applications, components and challenges of Internetof 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 serviceproviders 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 developvarious application areas - smart homes, smart grids, smart health care, smart citiesand 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, Edgecomputing

**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, PearsonEducation 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

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6E2X | **Data Warehousing and Data Mining** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Understand the basic principles, concepts and applications of data warehousing and data mining.
- Obtain an idea of designing a data warehouse or data mart to present information needed by end user
- Acquire knowledge on various data mining functionalities and pre-processing techniques.
- Implement various data mining algorithms
- Identify appropriate data mining algorithm for solving practical problems.

**Course Outcomes:**

At the end of the course, student will be able to

1. Learn the concepts of database technology evolutionary path which has led to the needfor data mining and its applications.
2. Design a data mart or data warehouse for any organization
3. Apply pre-processing statistical methods for any given raw data.
4. Extract knowledge and implementation of data mining techniques
5. Explore recent trends in data mining such as web mining, spatial-temporal mining.

**UNIT I**

**Introduction:** Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System witha Database or a Data Warehouse System, Major issues in Data Mining, CRISP model.
**Data Preprocessing:** Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

**UNIT II**

**Data Warehouse and OLAP Technology for Data Mining:** Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Marts, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing toData Mining, Data Cube Computation and Data Generalization, Attribute-Oriented Induction.

**UNIT III**

**Mining Frequent Patterns, Associations and Correlations:** Basic Concepts, Market Basket Analysis, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of

Association Rules, From Association Mining to Correlation Analysis, Constraint- Based Association Mining.

**UNIT IV**

**Classification and Prediction:** Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Prediction, Regression techniques, Accuracyand Error measures, Evaluating the accuracy of a Classifier or a Predictor.

**Cluster Analysis Introduction :**Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Outlier Analysis - Distance-Based Outlier Detection, Density-Based Local Outlier Detection.

**UNIT V**

**Mining Streams, Time Series and Sequence Data:** Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases.

**Mining Object, Spatial, Multimedia, Text and Web Data:** Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining,Text Mining, Mining the World Wide Web.

**Text Books:**

1. Data Mining– Concepts and Techniques - Jiawei Han & Micheline Kamber,Morgan Kaufmann Publishers, Elsevier, Second Edition,2006.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Pearson education.

**References:**

1. Data Mining Techniques – Arun K. Pujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory and Dennis Murray, Pearson Edn Asia.

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20GE6M03 | **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 Outcome:**

1. IPR Laws and patents pave the way for innovative ideas which are instrumental for Inventions to seek Patents.
2. Student gets an insight on Copyrights, Patents and trademarks, trade secrets which are Instrumental for further advancements and also a brief knowledge on cyber crimes and its correcting measurements.

**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.

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6L01 | **Deep Learning Lab** | **0** | **0** | **3** | **1.5** |

**Course Objectives:**

- Understand the working principle of perceptron model.
- Learn different activation functions and optimization techniques used in neural networks.
- Know the applications of deep learning models for binary and multiclass classification.
- Understand the architectures of CNN, RNN, LSTM and GRU.
- Explore various types of Categorical Data Encoding Schemes.

**Course Outcomes:**

At the end of the course, student will be able to

1. Illustrate Perceptron training algorithm and apply various activation functions.
2. Design multi-layer neural network with Back propagation algorithm and evaluate theperformance of various optimization techniques.
3. Build Deep Learning models for binary and multiclass classification problems.
4. Compare the application of Deep learning models CNN, RNN, LSTM and GRU
5. Use data encoding schemes and develop Deep learning models for real world applications.

**TASK 1**

Implement Perceptron training algorithm to classify flowers in IRIS dataset.

**TASK 2**

Implement Activation Functions in Neural Networks and analyse their usage.

**TASK 3**

Build a three-layer Artificial Neural Network by implementing the Back propagation algorithm.

**TASK 4**

Design a GRU-based deep learning model for IMDB dataset. Compare the performance of GRU based model with LSTM based model

**TASK 5**

Build a Deep Neural Network for multi class text classification using Reuters dataset

**TASK 6**

Design a model for MNIST hand written digit classification using Deep Convolution Neural networks.

**TASK 7**

Train a simple Recurrent Neural Network using an Embedding layer and a Simple RNN layerfor movie review classification problem.

**TASK 8**

Build a Deep learning model using LSTM layer in Keras for IMDB dataset.

**TASK 9**

Design a Neural network with various optimization algorithms and analyse their performanceusing Keras.

**TASK 10**

Design a Deep Learning Model to classify the movie reviews as Positive or Negative based on the text content of reviews using IMDB dataset.

**TASK 11**

Apply One Hot Encoding for categorical sequence data.

**TASK 12**

Design a Deep Learning framework for Object Detection.

**Text Books**

1. Deep Learning with Python, Francois Chollet, Manning Publications Co.

2. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms with contributions by Nikhil Buduma , O'Reilly publications

**References:**

1. Deep Learning, Ian Good fellow,Yoshua Bengio and Aaron Courville, MIT Press, London, England

Deep Learning: A Practitioner's Approach by Josh Patterson, Adam Gibs, O'Reillypublications

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| 20CI6L02 | **Data Warehousing And Data Mining Lab** | **0** | **0** | **3** | **1.5** |

**Course Objectives:**

- Understand the basic concepts of creating tables in attribute relation file format
- Identify the use of attribute relation file format table for data analysis.
- Acquire knowledge on various pre-processing techniques.
- Obtain the skill in implementing various data mining functionalities.
- Implement appropriate mining algorithm using Weka tool to solve real time problems.

**Course Outcomes:**

At the end of the course, student will be able to

1. Learn the concept of creating database tables in attribute relation file format(.arff).
2. Design a database tables in .arff format and insert, modify the data.
3. Apply pre-processing statistical methods for any given raw data.
4. Extract knowledge and implementation of various data mining techniques.
5. Implement data mining algorithms in real time problem solving using weka tool.

**Implement the following Tasks using Weka Tool:**

(Solve the tasks 1 to 6 by taking given German credit data as case study)

**The German Credit Data:**

Actual historical credit data is not always easy to come by because of confidentiality rules. Here is one such dataset, consisting of 1000 actual cases collected in Germany. Credit dataset(original) Excel Spreadsheet version of the German credit data. (Download from web). In spiteof the fact that the data is German, you should probably make use of it for this assignment. (Unless you really can consult a real loan officer).A few notes on the German dataset:

- DM stands for Deutsche Mark, the UNIT of currency, worth about 90 centsCanadian (but looks and acts like aquarter).
- Own_telephone: German phone rates are much higher than in Canada, so fewerpeople own telephones.
- Foreign_worker: There are millions of these in Germany (many from Turkey). It isvery hard to get German citizenship if you were not born of German parents.
- There are 20 attributes in judging a loan applicant. The goal is to

classify theapplicant into two categories: good orbad.

**TASK 1**

List all the categorical (or nominal) attributes and the real-valued attributes separately. What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes. One type of model that you can create is a Decision Tree - train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.

**TASK 2**

Suppose you use your above model (task1) trained on the complete dataset, and classify creditgood/bad for each of the examples in the dataset. What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100
% training accuracy? Why or Why not? Check to see if the data shows a bias against "foreign workers" (attribute 20),or "personal-status" (attribute 9). Did removing these attributes have any significant effect? Discuss.

**TASK 3**

Describe what cross-validation is briefly. Train a Decision Tree again using cross-validation and report your results. Does your accuracy increase/decrease? Why?

**TASK 4**

Another question might be, do you really need to input so many attributes to get good results? Maybe only a few would do. For example, you could try just having attributes 2, 3, 5, 7, 10, 17 (and 21, the class attribute (naturally)). Try out some combinations. Train your Decision Tree again and report the Decision Tree and cross-validation results.

**TASK 5**

Do you think it is a good idea to prefer simple decision trees instead of having long complex decision trees? How does the complexity of a Decision Tree relate to the bias of the model? You can make your Decision Trees simpler by pruning the nodes. One approach is to use Reduced Error Pruning - Explain this idea briefly. Try reduced error pruning for training your Decision Trees using cross- validation (you can do this in Weka) and report the Decision Tree you obtain? Also, report your accuracy using the pruned model. Does your accuracy increase?

**TASK 6**

How can you convert a Decision Trees into "if-then-else rules". Make up your own small Decision Tree consisting of 2-3 levels and convert it into a set of rules. There also exist differentclassifiers that output the model in the form of rules - one such classifier in Weka is rules. PART, train this model and report the set of rules obtained. Sometimes just one attribute can be good enough in making the decision, yes, just one! Can you predict what attribute that mightbe in this dataset? Report the rule obtained by training a one R classifier. Rank the performanceof j48, PART and one R.

**TASK 7**

(a) Create a data set Student.arff with required data.

(b) Demonstrate preprocessing techniques on dataset Student.arff

**TASK 8**

(a) Create a data set Employee.arff by adding required data fields.

(b) Apply Association rule mining on dataset Employee.arff (Use Apriori Algorithm)

**TASK 9**

(a) Create a data set Weather.arff with required fields.

(b) Apply preprocessing techniques on dataset Weather.arff and normalize Weather Tabledata using Knowledge Flow.

**TASK 10**

(a) Demonstrate classification algorithm on dataset student.arff using j48algorithm

(b) Demonstration of classification rule process on dataset employee.arff using naïve bayesalgorithm

**TASK 11**

(a) Create a data set customer.arff with required fields.

(b) Write a procedure for Clustering Customer data using Simple K-Means Algorithm.

**TASK 12**

Demonstration of clustering rule process on dataset student.arff using simple k-means

**Text Books:**


1. Data Mining– Concepts and Techniques - Jiawei Han &Micheline Kamber,Morgan Kaufmann Publishers, Elsevier, Second Edition,2006.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Pearson education.

**References:**


1. Data Mining Techniques – Arun K. Pujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory and Dennis Murray, PearsonEdnAsia.
3. www.data.gov.in repository

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| Minor | Deep Learning | 3 | 0 | 0 | 3 |

**Course Objectives:**

- Comprehend the math required for building deep learning networks.
- Understand the basic building blocks of artificial neural networks (ANNs).
- Acquire knowledge of supervised/unsupervised learning in neural networks.
- Explore the methods to develop optimized deep learning networks considering hyperparameters of convolution networks, recurrent neural networks.
- Model solutions for real life problems using optimized deep learning networks.

**Course Outcomes:**

At the end of the course, student will be able to

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 consideredfor a deep learning network.
5. Design optimized deep learning applications for small problems using algorithms learntin 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.

**UNIT II**

**Unsupervised Learning Network-** Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization.

**UNIT III**

**Introduction to Deep Learning:** Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Back- Propagation 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.

**UNIT V**

**Optimization for Train Deep Models:** Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive LearningRates, Approximate Second-Order Methods.

**Applications:** Large-Scale Deep Learning, Image classification, Natural Language Processing

**Text Books**

1. Deep Learning –Ian Good fellow, Yoshua Bengio, Aaron Courville — MIT Press book- ISBN-13: 978-0262035613,
2. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

**References**

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 - InformationScience and Statistics. ISBN-13:978-1493938438.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E3X** | **Reinforcement Learning** (Professional Elective -3**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

• Learn how to define RL tasks and the core principals behind the RL, including policies, value functions, deriving Bellman equations
• Implement in code common algorithms following code standards and libraries used in RL
• Understand and work with tabular methods to solve classical control problems
• Understand and work with approximate solutions
• Learn the policy gradient methods from vanilla to more complex cases
• Explore imitation learning tasks and solutions
• Recognize current advanced techniques and applications in RL

**Course Outcomes:**

At the end of the course, student will be able to

1. Formulate the given domain as an MDP and suggest/justify appropriate RL techniques.
2. Characterize different classes of RL algorithms according to their advantages and drawbacks with respect to various domain characteristics.
3. Efficiently implement common RL and deep RL algorithms.
4. Describe common evaluation matrices for RL algorithms.

**Unit-1: Introduction** – Reinforcement Learning –examples –elements of reinforcement learning-limitation and scope.

**Multi armed bandits**- A k -armed Bandit Problem- Action-value Methods- The 10-armed Test beds- Tracking a Non stationary Problem- Optimistic Initial Values- Upper-Confidence-Bound Action Selection- Gradient Bandit Algorithm- Associative Search (Contextual Bandits).

**Unit-2: Finite Markov Decision Processes**- The Agent–Environment Interface- Goals and Rewards- Returns and Episodes- Unified Notation for Episodic and Continuing Tasks- Policies and Value Function- Optimal Policies and Optimal Value Functions- Optimality and Approximation.

**Dynamic Programming:** Policy Evaluation (Prediction)- Policy Improvement- Policy Iterations- Value Iteration- Asynchronous Dynamic Programming- Generalized Policy Iterations- Efficiency of Dynamic programming.

**Unit-3: Temporal-Deference Learning**- TD Prediction- Advantages of TD Prediction Method- Optimality of TD(0)- Sarsa: On-policy TD Control- Q-learning: O↲-policy TD Control- Expected Sarsa- Maximization Bias and Double Lear- Games, After states, and Other Special Cases.
n-step Bootstrapping- n-step TD Prediction- n-step Sarsa- n-step O↲-policy Learning- *Per-decision Methods with Control Variates- O↲-policy Learning Without Importance Sampling: The n-step Tree Backup Algorithm- *A Unifying Algorithm: n-step Q (σ).

**Unit-4: Planning and Learning with Tabular Methods**- Models and Planing- Dyna: Integrated Planning, Acting, and Lear- When the Model Is Wrong- Prioritized Sweeping- Expected vs. Sample Updates- Trajectory Sampling- Real-time Dynamic Programming - Planning at Decision Time- Heuristic Search- Rollout Algorithm- Monte Carlo Tree Search.

**Unit-5: Applications and Case Studies**- TD-Gammon- Samuel's Checkers Player- atson's Daily-Double Wagering.

Text Book:

1. *"Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, 2nd Edition Link*
2. *"Machine Learning: A Probabilistic Perspective", Kevin P. Murphy Link*

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E3X** | **Soft Computing** (Professional Elective -3**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Understand soft computing techniques and apply these techniques to solve real-world problems.
- Understand the complete structure of Neurons and its applicability in differentdomains.
- To know the fundamental things about fuzzy systems, fuzzy logic and its applications.
- To analyze the Fuzzy Inference technique with different variables.
- Differentiate between the Neural Networks and Genetic Algorithms.

**Course Outcomes:**

At the end of the course, student will be able to

1. Apply all the Soft Computing Techniques to solve real world problems.
2. Identify the problems, where Supervised and (Neural Networks) Unsupervised Learning Techniques can be applied.
3. Apply Genetic Algorithm to design New Algorithms/Protocols in any domain.
4. Differentiate between Fuzzy Model with respect to Probabilistic Model andapply Fuzzy Inference Techniques to solve problems in different domain.
5. To know how to evaluate the Fitness function in Genetic Algorithm.

**UNIT I**

**Introduction to Soft Computing and Neural Networks:** Neural Networks: I (Introduction and Architecture) Neuron, Nerve Structure and synapse, Artificial Neuron and It's Model, Activations functions.

**Neural Network Architectures:** Single Layer and Multi-Layer feed forward Networks, Recurrent Networks, Various learning techniques; Perception and Convergence Rules, Auto Associative and hetero Associative Memory.

**UNIT II**

**Neural Networks-II (Back Propagation Networks) Architecture**: perception model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient; back propagation algorithm, factors affecting back propagation training and Applications.

**UNIT III**

**Fuzzy Logic: I(Introduction):** Fuzzy Logic Basic concepts, Fuzzy Sets and CrispSets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to

Crisp Conversation.

**UNIT IV**

**Fuzzy Logic: II (Fuzzy Membership, Rules):** Membership Functions, Interference in Fuzzy Logic, Fuzzy if then else Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications and Defuzzifications, Fuzzy Controller, Industrial Applications.

**UNIT V**

**Genetic Algorithms:**

Basic operators and terminology, Traditional Algorithm vs Genetic Algorithm, Simple GA, General GA, Classification of GA, Genetic Programming, Applications of GA, Ant Colony Optimisation(ACO),Particle Swam Optimisation(PSO)

**Applications of Soft Computing:** Internet Search Technique, Hybrid Fuzzy Controllers.

**Text Book:**


1. S.Rajsekaran and G.A. VijaylakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.
2. Introduction to Artificial Neural Systems- Jacek M. Zuarda, Jaico Publishing House, 1997
3. N. P. Padhy, "Artificial Intelligence and Intelligent Systems" Oxford UniversityPress


**REFERNCES:**


1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall,1998.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley,1997.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India
4. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer,2007

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E3X** | **Cryptography and Network Security** (Professional Elective -3**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Importance and applications of confidentiality, integrity, authentication, availability.
- Develop various cryptographic algorithms, related to conventional and asymmetricencryption.
- Familiarize how to generate and distribute PGP key pair and use the PGP package to sendand encrypted E-mail message.
- Understand the public-key cryptosystem and enhancements made to IPV4 by IPSec.
- Understand with intrusion and intrusion detection / web security and Firewalls.

**Course Outcomes:**

At the end of the course, student will be able to

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 keymanagement.

**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 PearsonEducation.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W.Manzuik and RyanPermeh, wiley Dreamtech


**References**


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.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E3X** | **NOSQL Databases**<br>(Professional Elective -3**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

After successfully completing this course, students will be able to:

- Distinguish the different types of NoSQL databases
- Understand the impact of the cluster on database design
- Work with the Hadoop Distributed File System (HDFS) as a foundation for NoSQL technologies
- Warehouse HDFS data using Apache Hive
- Use the data control, definition, and manipulation languages of the NoSQL databases covered in the course

**Course Outcomes:**

At the end of the course, student will be able to

1. Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.
4. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Key-Value Pair NoSQL databases.
5. Explain the detailed architecture, define objects, load data, query data and performance tune Graph NoSQL databases.

**Unit 1: Why NoSQL?** The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access.

**Unit-2: Distribution Models;** Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

**Unit-3: Introduction to Map-Reduce**, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two-Stage Map-Reduce Example, Incremental Map-Reduce.

**NOSQL in CLOUD**, Parallel Processing with Map Reduce, BigData with Hive

**Unit-4: Document Databases**, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, ECommerce Applications, When Not to Use, Complex Transactions Spanning Dif erent Operations, Queries against Varying Aggregate Structure

**Unit-5: Graph Databases**, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.

**Text Books:**


1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012
2. Redmond, E. & Wilson, J. (2012). Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.). Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978-1934356920 ISBN-10: 1934356921

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E3X** | **NATURAL LANGUAGE PROCESSING** (Professional Elective -3**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Role of natural language processing and language modeling.
- The analysis of text at word level, syntactic level and semantic level.
- Discourse processing of the text.
- Knowledge in automated natural language generation and machine translation.
- Explanation of information retrieval systems and usage of Lexical resources.

**Course Outcomes:**

At the end of the course, student will be able to

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 Modelling**: 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, AI Innovations and catboats.

**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.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E4X** | **Block Chain Technologies** (Professional Elective -4**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
- To securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their own projects.
- Explaining design principles of Bitcoin and Ethereum and Nakamoto consensus.

**Course Outcomes:**

At the end of the course, student will be able to

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 1**

**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 HardAlgorithm, 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


**References**


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 smartcontracts.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E4X** | **Robotic Process Automation** (Professional Elective -4**)** | **3** | **0** | **0** | **3** |

Course Objectives:

- Understand the emergence of Robotic Process Automation (RPA) and its future scope
- Learn the concepts of RPA and distinguish it from Automation
- Understand the types of Bots
- Discuss how RPA works
- Gain insights into the RPA development methodology and identify its application areas
- Get an overview of the relevant RPA tools and their selection criteria

**Course Outcome:**

At the end of the course, student will be able to

1. Understand the basics of Robotic Process Automation
2. Identify processes which can be automated
3. Setup the environment
4. Develop and deploy basic robots independently using RPA Platform
5. Explore the Advanced Automation concepts and techniques.

**Unit 1: Programming Basics & Recap:** Programming Concepts Basics – Understanding the application, Basic Web Concepts, Protocols, Email Clients, Data Structures, Data Tables, Algorithms, Software.

**RPA Basics :**History of Automation, What is RPA,RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated. Planning and AI Constraints: Planning techniques can be integrated with general constraint solving frameworks, like SAT, IP and CP.

**Unit 2: RPA Advanced Concepts:** Standardization of processes, RPA Developemt methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks& Challenges with RPA,RPA and emerging ecosystem.

**Variables:** Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces.

**Unit 3: Control Flow :**Control Flow Introduction, If Else Statements, Loops, Advanced Control

Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity

**Data Manipulation :**Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data. Recording and Advanced UI Interaction : Recording Introduction, Basic and Desktop Recording, Web Recording, Input/Output Methods, Screen Scraping, Data Scraping, Scraping Advanced techniques.

**Selectors :** Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge.

**Unit-4: Advanced Automation concepts and techniques:** Image, Text & Advanced Citrix Automation :Introduction to Image & Text ,Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps.

**Excel Data Tables & PDF :**Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF

Email Automation :Email Automation, Incoming Email automation, Sending Email automation

**Exceptional Handling & Best Practice:** Debugging and Exception Handling ,Debugging Tools, Strategies for solving issues, Catching errors

**Project Organization:** What is project organization ,Best practices ,Avoiding pit falls, Invoke Activity.

**Unit-5: Introduction to Orchestrator:** Tenants, Authentication, Users, Roles, Robots, Environments, Queues &Transactions, Schedules.

**Emerging and Future Trends in IT:** Emerging and Future Trends in IT: Artificial Intelligence, Machine Learning, Agent awareness, Natural Language Processing, Computer Vision.**Capstone Project:** Real life case studies which can be used to apply the concepts learnt during the course. The projects shall test student's skills right from process transformation and documentation to the design and development of the actual robot.

**TEXT BOOKS:**

1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.

**REFERENCES:**

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.

2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E4X** | **Cloud Computing**<br>(Professional Elective -4**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Understand the current trend and basics of cloud computing.
- Learn cloud services from different providers.
- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization
- Learn basic concepts of MapReduce programming models for big data analysis oncloud.

**Course Outcomes:**

At the end of the course, student will be able to

1. Understand the features, advantages and challenges of cloud computing, comparetheir operation ,implementation and performance
2. Understand, Analyze and compare different types of clouds and cloud services.
3. Understanding and validating the financial and technological implications in selectingcloud computing paradigm for an organization.
4. Understand and Analyze the security challenges and risks involved in the cloud.
5. 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**


1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud"O'Reilly.
2. Kumar Saurabh, " Cloud Computing , insights into New-Era Infrastructure", WileyIndia,2011
3. RajkumarBuyya, Christian Vecchiola, S.TamaraiSelvi, 'Mastering CloudComputing", TMGH,2013.


**References**


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

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E4X** | **Big Data Analytics**<br>(Professional Elective -4**)** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Describe Big Data and its use cases from selected business domains.
- Provide an overview of HDFS Architecture and its daemon services.
- Perform Map Reduce analytics with YARN using Hadoop.
- Understand the working of data ingestion tools and PIG Latin.
- Use Hadoop related tools such as Hive and HBase for big data analytics.

**Course Outcomes:**

At the end of the course, 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, Limitations of 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, PIGExecution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data ProcessingOperators.

**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, HBase Vs RDBMS, HBASE Shell Commands.

**Text Books:**


1. Tom White “Hadoop: The Definitive Guide” 4thedition, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley2015.


**References:**


1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer,2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press(2013)
3. Anand Rajaraman and Jefrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons,2012.
5. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons,2007
6. Pete Warden, “Big Data Glossary”, O’Reily,2011.
7. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
8. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, MC Press,2012
9. 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.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E4X** | **Image and Video Analytics**<br>(Professional Elective -4) | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Describe and explain basic principles of digital image processing.
- Cover the basic analytical methods such as image enhancement, restoration, segmentation
- Learn Image compression techniques
- Learn and explain basic principles of digital image and video processing.
- Cover the basic motion estimations used in video processing.

**Course Outcomes:**

At the end of the course, student will be able to

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, Thresholding,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, JPEGStandards.

**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**

**Motion Estimation:** Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, 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, JoemOysterman and Ya–quinZhang. 1st Ed., PHInt.


**References**


1. Digital Image Processing and Analysis-Human and Computer Vision Applicationwith CVIP Tools – ScotteUmbaugh, 2nd Ed, CRCPress,2011.
2. Digital Video Processing – M. Tekalp, Prentice HallInternational
3. Digital Image Processing with MATLAB and Lab view – VipulaSingh, Elsevier

Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed.,Elsevier

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E5X** | **Social Network Analysis**<br>(Professional Elective -5) | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Formalize different types of entities and relationships as nodes and edges and represent this information as relational data
- Plan and execute network analytical computations
- Use advanced network analysis software to generate visualizations and perform empirical investigations of network data
- Interpret and synthesize the meaning of the results with respect to a question, goal, or task
- Collect network data in different ways and from different sources while adhering to legal standards and ethics standards

**Course Outcomes:**

At the end of the course, student will be able to

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) 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

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E5X** | **Recommender Systems** (Professional Elective -5) | **3** | **0** | **0** | **3** |

**Course Objective:**

- To develop state-of-the-art recommender systems that automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations

**Course Outcomes:**

1.Describe basic concepts behind recommender systems
2 Explain a variety of approaches for building recommender systems
3 Describe system evaluation methods from both algorithmic and users' perspectives
4 Describe applications of recommender systems in various domains
5 Reproduce recommender algorithms using an open source toolkit
6 Conduct experimental evaluations on implemented algorithms

**Unit-1: Introduction:** Recommender system functions, Linear Algebra notation: Matrix addition,
Multiplication, transposition, and inverses; covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

**Unit-2: Collaborative Filtering:** User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

**Unit-3: Content-based recommendation:** High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles,
Similarity based retrieval, Classification algorithms.

**Knowledge based recommendation:** Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

**Unit-4: 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-5: Evaluating Recommender System:** Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics,User-Centred metrics.

**Recommender Systems and communities:** Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and recommendations, Group recommender systems.

**Text Books:**

1.Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.

2.Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.

3.Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E5X** | **Computer vision** (Professional Elective-5) | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Understanding basic concepts of image processing and their development.
- Knowledge of various configuration of image processing techniques used in industry, role in industry
- To Know the application areas

**Course Outcomes:**

At the end of the course, student will be able to

1.To implement fundamental image processing techniques required for computer vision

2. Understand Image formation process

3. To perform shape analysis

4. Extract features form Images and do analysis of Images

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.

**References:**

**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.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E5X** | **Mining Massive Datasets** **(**Professional Elective -5) | **3** | **0** | **0** | **3** |

**Course Objective:**

• To understand modern distributed file systems and MapReduce and related algorithms

• To know about locality-sensitive hashing, a bit of magic that allows you to find similar items in a set of items so large.

• Study algorithms for extracting models and information from large datasets.

**Course Outcome:**

At the end of the course, student will be able to

1.Differenceate the Distributed file systems and map-reduce as a tool for creating parallel algorithms that succeed on very large amounts of data.

2. Work with search engines, including Google's PageRank, link-spam detection, and the hubs-and-authorities approach.

3. Analyze Frequent-itemset mining, including , market-baskets, the A-Priori Algorithm and its improvements.

4. Apply the dimensionality reduction techniques to very large, high-dimensional datasets.

5. Compare different MapReduce algorithms.

**UNIT-I:**

**MapReduce**: Distributed File Systems, Physical Organization of Compute Nodes, Large-Scale File-System Organization. MapReduce : The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures.

**UNIT-II:**

**Link Analysis**: PageRank: Early Search Engines and Term Spam, Definition of PageRank, Structure of the Web, Avoiding Dead, Spider Traps and Taxation, Using PageRank in a Search Engine. Efficient Computation of PageRank, Topic-Sensitive PageRank, Link Spam, Hubs and Authorities.

**UNIT-III:**

**Locality-Sensitive Hashing**: Basics and applications. Distance Measures, Learning from Nearest Neighbors. Frequent Itemsets: The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.

**UNIT-IV:**

**Dimensionality Reduction:** UV-Decomposition, Root-Mean-Square Error, Incremental Computation of a UV-Decomposition, Optimizing an Arbitrary Element, Building a Complete UV-Decomposition Algorithm.

**UNIT-V:**

**Algorithms:** Support-Vector Machines**,** Algorithms Using MapReduce, Extensions to MapReduce: Workflow ystems, Recursive Extensions to MapReduce , Pregel .

**TEXT BOOKS:**

1. Mining of Massive Datasets, by Leskovec, Rajaraman, and Ullman

**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
1. “The Unified modeling language Reference manual”, James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **20CI7E5X** | **Semantic Web** **(**Professional Elective -5) | **3** | **0** | **0** | **3** |

**Course Objectives:**

- To Introduce Semantic Web Vision
- Understanding about XML,RDF,RDFS,OWL
- Querying Ontology
- Ontology Reasoning
- Migration from Document to Data Web
- LOD Cloud

**Course Outcome:**

At the end of the course, student will be able to

1. Understand the semantic web Vision and technologies
2. Understand about ontology
3. Understanding about Data Web(Linked open data Cloud)
4. Use the RDF framework and associated technologies such as RDFa;
5. Understand the relationship between Semantic Web and Web 2.0.

Unit-1: Foundation of Semantic Web Technologies- Introduction- Current web vs Semantic Web - Semantic Web Technologies- A layered approach
Descriptive Logic- Introduction- Definition of the basic formalism- Reasoning algorithms- Language extensions.

Unit-2 Structured Web Documents in XML – Introduction- XML- Structuring-Namespaces- Addressing and querying XML document- Processing
**Describing Web Resources:** RDF Introduction- RDF: Basic Ideas RDF: XML-Based Syntax- RDF serialization- RDF Schema: Basic Ideas- RDF Schema: The Language- RDF and RDF Schema in RDF Schema

**Unit-3 Web Ontology Language:** OWL – Introduction- OWL and RDF/RDFS- Three Sublanguages of OWL - Description of the OWL Language- Layering of OWL- Examples- OWL in OWL

**Unit-4: SPARQL**- SPARQL simple Graph Patterns, Complex Graph Patterns,-Group Patterns, Queries with Data Values, Filters- OWL Formal Semantics.

**Unit-5: Linked Open data** – Introduction- Principles of Linked Data- Web of Data- LOD Cloud- Linked Data Source : Dbpedia, Freebase

**Text Book:**

1. A Semantic Web Primer by Grigoris Antoniou Frank van Harmelen, The MIT Press Cambridge
2. Foundation of Semantic Web Technologies, Pascal Hitzler, Markus and Sebastian
3. Linked Data : Evolving the Web into a Global Data space by Tom Heath, Christian Bizer , Morgan & Claypool publication
4. Basic Description Logic by Franz Baader, Warner Nutt

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **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:**

1. After completion of the Course the student will acquire the knowledge on management functions, global leadership and organizational behavior.
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:

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, 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.

**III Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **PYTHON PROGRAMMING**<br>**Open Elective-1** | **3** | **0** | **0** | **3** |

**Course objectives:**

- Acquire problem solving skills
- Develop flow charts
- Learn programming and solve problems using Python language

**Course outcomes:**

At the end of the course, student will be able to

1. Design python programs using arithmetic expressions and decision making
2. Design modular python programs using functions
3. Design programs using strings and list
4. Develop programs using tuples and dictionaries

**UNIT-I**

Introduction to Python – variables, expressions and statements, order of operations Conditionals-Modulus operators, Boolean expressions, logical operators.

**UNIT-II**

Conditional execution, alternative executions, chained conditional, nested conditional Iteration - while statement

**UNIT-III**

Functions- function calls, type conversion and coercion, mathematical functions, User-defined functions, parameters and arguments. Recursion

**UNIT-IV**

Strings – string length, string traversal, string slices and string comparison with examples, strings are immutable, find function, string module List –list values, accessing elements, list traversal, list length, list membership, list and for loop, list operations with examples

**UNIT-V**

Tuples-Mutability, tuple assignment, tuple as return values Dictionaries- dictionary operations, dictionary methods, aliasing and copying, counting letters using dictionaries

**Text Books:**

1. Downey A, How to think like a Computer Scientist :Learning with Python, 1st Edition(2015), John Wiley

2. Lambert K.A, Fundamentals of Python –First Programs, 1st Edition( 2015), Cengage Learning India 3. Perkovic L, Introduction to Computing using Python,2/e, (2015), John Wiley

**Reference Books:** 1. Stewart Venit and Elizabeth Drake, Prelude to Programming: Concepts and Design, 6th Edition( 2015), Pearson India

**III Year II Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**<br>**Open Elective-2** | **3** | **0** | **0** | **3** |

**Course objectives:**

- To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- To provide a basic exposition to the goals and methods of Artificial Intelligence.
- To apply the techniques in applications which involve perception, reasoning and learning?

**Course outcomes:**

At the end of the course, student will be able to

1. Summarize the fundamental concepts of Artificial Intelligence.
2. Illustrate the Concepts of Heuristic Search Techniques.
3. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
4. Make use of concept of Game Playing Algorithms.
5. Outline the concept of Planning System

**Unit I**

Introduction Definition, AI problems, AI techniques, Defining problem as a state space search, Production SystemsControl Strategies, Problem characteristics, Production system characteristics.

**Unit II**

Heuristic Search Techniques Generate-and-test, Hill climbing, Best-first-search – OR Graphs – A* Algorithm, Problem reduction – ANDOR Graphs – AO* Algorithm.

**Unit III**

Knowledge representation Knowledge Representation Issues, Representation and mapping, Approaches to Knowledge Representation, Frame Problem, Propositional logic, Predicate logic.

**Unit IV**

Game Playing and Planning Mini-max search, Alpha-beta cutoffs, planning system, Block world problem, goal stack planning, and hierarchical planning.

**Unit V**

Natural language processing, syntactic processing, Decision trees, Perception, Vision, Speech recognition.

**Text book:**

1. E. Rich K .Knight, and B. Nair, Artificial Intelligence, 3rdEdition, TMH, 1 July 2017

2. Russel Norvig, Artificial Intelligence A modern Approach, 3rd Edition, Pearson Education, 2010

**Reference Book:**

1. Patrick henry Winston, Artificial Intelligence, third edition, Pearson Education Asia, 2005
2. Dan W. Patterson, Introduction to Artificial intelligence and Expert Systems, 2nd Edition, PHI, 2009

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **HUMAN COMPUTER INTERACTION**<br>**Open Elective-3** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- The course introduces students to analysis, design, and evaluation of the interaction between people and information and communication technologies.
- The aim is to give students an adequate understanding of the concepts of usability, user experience, and user-centered designees:

**Course Outcomes:**

At the end of the course students will be able to

1. Demonstrate the capabilities of both humans and computers from the viewpoint of human information processing.
2. Understand typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Understand interactive design process and universal design principles to designing HCI systems
4. Apply HCI design principles, standards and guidelines.
5. Understand user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems

**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 data and content-screen navigation and flow Visually pleasing composition- amount of information-focus and emphasis-presentation information simply and meaningfully-information retrieval on web-statistical graphics-Technological consideration in interface design

**Unit IV** Windows New and Navigation schemes selection of window, selection of devices based and screen based controls, Components-text and messages, Icons and increases-Multimedia, uses problems, choosing colors

**Unit V** Software Tools and Interaction Devices Specification methods, interface-Building Tools, Keyboard and function keys, pointing devices-speech recognition digitization and generation-image and video displays-drivers.

**Textbook Books**:

1. Wilbert O Galitz, Wiley Dream Tech, The essential guide to user interface design, 3rdEdition, Wiley Computer Publishing, 2007.
2. Ben Shneidermann, Designing the user interface, 3rdEdition, Pearson Education Asia, 2008.

**Reference Books**:

1. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Human Computer Interaction., 3rd EditionPearson Education, 2004.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| | **APPLICATIONS OF ARTIFICIAL INTELLIGENCE**<br>**Open Elective-4** | **3** | **0** | **0** | **3** |

**Course Objectives:**

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks.
- Experience AI development tools such as an 'AI language', expert system shell.

**Course Outcomes:**

1. Illustrate the scope of Artificial Intelligence (AI) in gaming and expert systems.
2. Demonstrate various applications of AI related to perception and biometrics.
3. Summarize and learn different case studies in classification and recognition systems.
4. Describe and apply natural language processing techniques for designing AI Bots,
5. Illustrate the role of AI in robotics

**Unit -I:** AI for Everyone, Gaming and Expert Systems AI for Everyone- What is AI? AI Explosion, AI at work, AI at Society, Applications of AI. Gaming – Games as search problems- Mini Max Search, Alpha Beta Cutt-Offs, State of the Art Games- Chess & Checkers Problem. Expert Systems- Representing and using domain knowledge, Expert System Shells, Explanation and Knowledge Acquisition.

**Unit -II:** Perceptions and Biometrics Perceptions-Image formation, Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D world, Object recognition from structural information. Using Vision for manipulation and navigation. Biometrics- Understanding the Biometric fingerprints, facials, voice, iris, palm, and finger vein patterns Identifies Challenges in Biometric Systems.

**Unit -III:** Natural Language Processing and Natural Language Communication Natural

Language Processing- Language Models, Text Classification, Information Retrieval and Information Extraction. Natural Language Communication- Phrase Structure Grammars, Syntactic Analysis, Augmented Grammars and Semantic Analysis, Machine Translation and Speech Recognition.

**Unit -IV:** Robotics and Impact of AI on Human Labor and Social Equity Robotics- Robot Hardware- Robot Perception- Planning to Move- Planning Uncertain Movements- Planning Moves- Robotic Software Architectures and Domains.

**Unit V** Impact of AI on Human Labor and Social Equity - Benefits on this Technological Revolution- Need and Necessity of Labor based Economy and Society Distribute future assets more equitably-Support for Unemployed.

**Text Book:**

1. Russel and Norvig, Artificial Intelligence A Modern Approach, 4th Edition, Pearson Education 2021.

2. Stevan Finaly, Artificial Intelligence for Everyone, Relativistic Publications, Great Britan,2020.

3. E. Rich K. Knight and B.Nair – Artificial Intelligence– Third Edition – Tata McGraw Hill, 2017.

4. Jerry Kaplan, Artificial Intelligence- What everyone needs to know, Oxford University Press,2016.

**Reference Books:**

1. Artificial intelligence: a very short introduction; Margaret A. Boden; Oxford University Press; 2018.

2. Artificial Intelligence and Social Work; Milind Tambe, Eric Rice; Cambridge University Press; 2018.

3. Artificial Unintelligence; Meredith Broussard; The MIT Press; 2018. 4. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

**IV Year I Semester**

| Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|
| **Minor** | **Reinforcement Learning**<br>(Professional Elective -3) | **3** | **0** | **0** | **3** |

**Course Objectives:**

• Learn how to define RL tasks and the core principals behind the RL, including policies, value functions, deriving Bellman equations

• Implement in code common algorithms following code standards and libraries used in RL

• Understand and work with tabular methods to solve classical control problems

• Understand and work with approximate solutions

• Learn the policy gradient methods from vanilla to more complex cases

• Explore imitation learning tasks and solutions
• Recognize current advanced techniques and applications in RL

**Course Outcomes:**

At the end of the course, student will be able to

1. Formulate the given domain as an MDP and suggest/justify appropriate RL techniques.
2. Characterize different classes of RL algorithms according to their advantages and drawbacks with respect to various domain characteristics.
3. Efficiently implement common RL and deep RL algorithms.
4. Describe common evaluation matrices for RL algorithms.

**Unit-1: Introduction** – Reinforcement Learning –examples –elements of reinforcement learning-limitation and scope.

**Multi armed bandits**- A k -armed Bandit Problem-Gradient Bandit Algorithm- Associative Search (Contextual Bandits).

**Unit-2: Finite Markov Decision Processes**- The Agent–Environment Interface- Goals and Rewards- Returns and Episodes- Optimal Policies and Optimal Value Functions- Optimality and Approximation.

**Dynamic Programming:** Policy Evaluation (Prediction)- Policy Improvement- Policy Iterations- Value Iteration.

**Unit-3: Temporal-Deference Learning**- TD Prediction- Advantages of TD Prediction Method- Optimality of TD(0)- Sarsa: On-policy TD Control-Q-learning: O↵-policy TD Control- Expected Sarsa- Maximization Bias and Double Lear- Games, After states, and Other Special Cases.

**Unit-4: Planning and Learning with Tabular Methods**- Models and Planing- Dyna: Integrated Planning, Acting, and Lear- When the Model Is Wrong- Prioritized Sweeping- Expected vs. Sample Updates- Trajectory Sampling.

**Unit-5: Applications and Case Studies**- TD-Gammon- Samuel's Checkers Player- atson's Daily-Double Wagering.

**Text Book:**

1. *"Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, 2nd Edition Link*

*2. "Machine Learning: A Probabilistic Perspective", Kevin P. Murphy Link*

## HONOR DEGREE IN COMPUTER SCIENCE AND ENGINEERING

| | | | | Credits |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| **Computer Networks** | | | | |
| **Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)**<br>**1. Data Communication**<br>**2. Internetworking TCP/IP**<br>**3. Network Programming**<br>**4. Wireless Network Technologies**<br>**5.02 MOOCS courses @ 2credits each**<br>**(Any CSE/IT related Program Core subject from NPTEL/ SWAYAM course of 8 weeks (2 credits) other than the courses listed above needs to be taken)** | 3 | 1 | 0 | 4 |

| | | | | Credits |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| **Data Science** | | | | |
| **Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)**<br>**1. Mathematical Essential for Data Science**<br>**2. Introduction to Data Science**<br>**3. Data Analytics and Visualization**<br>**4. Python for Data Science (2+4)**<br>**5. 02 MOOCS courses @ 2credits each**<br>**(Any CSE/IT related Program Core subject from NPTEL/ SWAYAM course of 8 weeks (2 credits) other than the courses listed above needs to be taken)** | 3 | 1 | 0 | 4 |

| | **Honors/Minor courses** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **1** | **0** | **4** |
| **DATA COMMUNICATION** | | | | | |

**Course Objectives:**

i. To have a detailed study of various analog and digital modulation and demodulation techniques
ii. To have a thorough knowledge of various multiplexing schemes and Data communication protocols
iii. To know about the standards and mechanisms of television systems.

**UNIT- I**

INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING:Standards Organizations for Data Communications, Layered Network Architecture, Open Systems Interconnection, Data Communications Circuits, Serial and

parallel Data Transmission, Data communications Networks, Alternate Protocol Suites.

SIGNALS, NOISE, MODULATION, AND DEMODULATION: Signal Analysis, Electrical Noise and Signal-to- Noise Ratio, Analog Modulation Systems, Information Capacity, Bits, Bit Rate, Baud, and M-ary Encoding, Digital Modulation.

**UNIT-II**

METALLIC CABLE TRANSMISSION MEDIA: Metallic Transmission Lines, Transverse Electromagnetic Waves, Characteristics of Electromagnetic Waves

OPTICAL FIBER TRANSMISSION MEDIA: Advantages of Optical Fiber cables, Disadvantages of Optical Fiber Cables, Electromagnetic spectrum, Optical Fiber Communications System Block Diagram, Optical Fiber construction, Propagation of Light Through an Optical fiber Cable, Optical Fiber Modes and Classifications, Optical Fiber Comparison, Losses in Optical Fiber Cables, Light sources, Light Detectors, Lasers.

**UNIT-III**

DIGITAL TRANSMISSION: Pulse Modulation, Pulse code Modulation, Dynamic Range, Signal Voltage to- Quantization Noise Voltage Ratio, Linear Versus Nonlinear PCM Codes, Companding, PCM Line Speed, Delta Modulation PCM and Differential PCM.

MULTIPLEXING AND T CARRIERS : Time- Division Multiplexing, T1 Digital Carrier System, Digital Line Encoding, T Carrier systems, Frequency-Division Multiplexing, Wavelength- Division Multiplexing, Synchronous Optical Network.

**UNIT- IV**

WIRELESS COMMUNICATIONS SYSTEMS: Electromagnetic Polarization, Electromagnetic Radiation, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, Free-Space Path Loss, Microwave Communications Systems, Satellite Communications Systems.

**UNIT-V**

TELEPHONE INSTRUMENTS AND SIGNALS: The Subscriber Loop, Standard Telephone Set, Basic Telephone Call Procedures, Call Progress Tones and Signals, Cordless Telephones, Caller ID, Electronic Telephones, Paging systems.

CELLULAR TELEPHONE SYSTEMS: First- Generation Analog Cellular Telephone, Personal Communications system, Second-Generation Cellular Telephone Systems, N-AMPS, Digital Cellular Telephone, Interim Standard, Global system for Mobile Communications.

**Course Outcomes:**

By the end of this course, the student will be able to

i. Have the knowledge of working of basic communication systems
ii. Explore about the Transmission media
iii. Know about Digital Transmission and Mutiplexing
iv. Know about Wireless Communication systems
v. Have indepth knowlwdge about Telephone Instruments and Cellular Systems

**Text Books**

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education.

**Reference Books**

1. Data Communications and Networking, Behrouz A Forouzan, Fourth Edition.TMH.
2. Data and Computer communications, 8/e, William Stallings, PHI.
3. Computer Communications and Networking Technologies, Gallow, Second Edition Thomson
4. Computer Networking and Internet, Fred Halsll, Lingana Gouda Kulkarni, Fifth Edition, Pearson Education.

| | Honors/Minor courses | L | T | P | C |
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| **INTERNETWORKING WITH TCP/IP** | | | | | |

**Course Objectives:**

i. To understand the fundamental concepts in Internetworking, Internet Addressing, IP, UDP, and TCP Protocols, Routing Architecture, Network Virtualization and Software Defined Networking

**UNIT – I:**

Introduction and Overview, Overview of Underlying Network Technologies, Internetworking Concept and Architectural Model, Protocol Layering Internet Addressing, Mapping Internet Addresses To Physical Addresses (ARP), Internet Protocol: Connectionless Datagram Delivery (IPv4, Ipv6) CIDR Sub netting.

**UNIT – II:**

Internet Protocol: Forwarding IP Datagrams, Internet Protocol: Error And Control Messages (ICMP), User Datagram Protocol (UDP)

**UNIT – III:**

Reliable Stream Transport Service (TCP) Routing Architecture: Cores, Peers, And Algorithms, Routing Among Autonomous Systems (BGP), Routing Within An Autonomous System (RIP, RIPng, OSPF, IS-IS).

**UNIT – IV:**

Internet Multicasting , Label Switching, Flows, And MPLS, Packet Classification, Mobility And Mobile IP, Network Virtualization: VPNs, NATs, And Overlays Bootstrap And Auto configuration (DHCP, NDP, Ipv6-ND), Voice And Video Over IP (RTP, RSVP, QoS)

**UNIT – V:**

Software Defined Networking (SDN, OpenFlow)

**Course outcomes**:

By the end of this course, the student will be able to Understand

i. The working of Internetworking, Internet Addressing,
ii. IP, UDP, and TCP Protocols,
iii. Routing Architecture, Network Virtualization
iv. Internet Multicasting
v. Software Defined Networking

**Text Books:**


1. Behrouz A Forouzan, "TCP/IP Protocol Suite", TMH, 3rd Edition
2. B.A. Forouzan, "Data communication & Networking", TMH, 4th Edition.


**References:**


1. Mahbub Hasan & Raj Jain, " High performance TCP/IP Networking", PHI - 2005
2. Douglas. E.Comer, "Internetworking with TCP/IP ", Volume I PHI
3. Larry L. Perterson and Bruce S. Davie , "Computer Networks- A Systems Approach", 2011, Morgan Kaufmann
4. Jochen Schiiler, "Mobile Communications", Pearson, 2nd Edition.
5. Douglas E Comer, "Internetworking with TCP/IP Principles, Protocol, and Architecture" , Volume I, 6th Edition, Pearson Education, 2013
6. William Stallings, "Data and Computer Communications", 9th Edition, Pearson Education, 2011.

| | Honors/Minor courses | L | T | P | C |
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| **NETWORK PROGRAMMING** | | | | | |

**Course Objectives:**

i. To understand to Linux utilities
ii. To understand file handling, signals
iii. To understand IPC, network programming in Java
iv. To learn the basics of socket programming using TCP and UDP Sockets.
v. To understand simple network management protocols & practical issues.

**UNIT – I**

**Introduction to Network Programming:** OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

**Sockets :** Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function.

**UNIT – II**

**TCP client server :** Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.

**Elementary UDP sockets:** Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP.

**I/O Multiplexing:** I/O Models, select function, Batch input, shutdown function, poll function, TCP Echo server,

**UNIT – III**

**Socket options:** getsockopt and setsockopt functions. Socket states, Generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options.

**Advanced I/O Functions-**Introduction, Socket Timeouts, recv and send Functions, readv and writev Functions, recvmsg and sendmsg Functions, Ancillary Data, How Much Data Is Queued, Sockets and Standard I/O, T/TCP: TCP for Transactions.

**UNIT – IV**

**Elementary name and Address conversions:** DNS, gethost by Name function, Resolver option, Function and IPV6 support, uname function, other networking information.

**Daemon Processes and inetd Superserver** –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd Function

**Broadcasting-**Introduction, Broadcast Addresses, Unicast versus Broadcast, dg_cli Function Using Broadcasting, Race Conditions

**Multicasting-**Introduction, Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, mcast_join and Related Functions, dg_cli Function Using Multicasting, Receiving MBone Session Announcements, Sending and Receiving, SNTP: Simple Network Time Protocol, SNTP (Continued)

**UNIT-V:**

**Raw Sockets-**Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program, An ICMP Message Daemon, Datalink Access- Introduction, BPF: BSD Packet Filter, DLPI: Data Link Provider Interface, Linux: **SOCK_PACKET, libpcap:** Packet Capture Library, Examining the UDP Checksum Field. Remote Login: Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.

**Course Outcomes:**

By the end of this course, the student will be able to

i. Write socket API based programs
ii. Design and implement client-server applications using TCP and UDP sockets
iii. Analyze network programs
iv. Design and implement client/server programs using a variety of protocols and platforms.
v. Implement specific network programming constructs on Unix platforms to create robust real- world sockets-based applications.

**Text Books:**

1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
2. UNIX Network Programming, 1st Edition, - W. Richard Stevens. PHI.

**References:**


1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

| | Honors/Minor courses | L | T | P | C |
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| **WIRELESS NETWORK TECHNOLOGIES** | | | | | |

**Course Objectives:**

i. This course examines common and different aspects of wired and wireless networks. The topics covered are: antenna basics, radio propagation, coding and error control, MAC protocols, network layer protocols to address mobility, TCP and wireless, wireless LANs and ad-hoc networks, cellular communication concepts, wireless mesh networks, long-distance and last-hop wireless technologies, and security in wireless systems.

**UNIT – I:**

**Wireless Network Architecture:**

The OSI Network Model, Network Layer Technologies, Data Link Layer Technologies, Physical Layer Technologies, Operating System Considerations

Wired Network Topologies – A Refresher, Wireless Network Topologies, Wireless LAN Devices, Wireless PAN Devices, Wireless MAN Devices.

**UNIT – II:**

**Wireless Communication:**

**Radio Communication Basics**: The RF Spectrum, Spread Spectrum Transmission, Wireless Multiplexing and Multiple Access Techniques, Digital Modulation Technique, RF Signal Propagation and Reception, Ultra Wideband Radio, MIMO Radio ,Near Field Communications **Infrared Communication Basics**: The Ir Spectrum, Infrared Propagation and Reception

**UNIT – III:**

**Wireless LAN Standards:**

The 802.11 WLAN Standards, The 802.11 MAC Layer, 802.11 PHY Layer, 802.11 Enhancements, Other WLAN Standards.

Implementing Wireless LANs: Evaluating Wireless LAN Requirements ,Planning and Designing the Wireless LAN,Pilot Testing ,Installation and Configuration, Operation and Support

**UNIT – IV:**

**Wireless PAN Implementation:**

Introduction, Bluetooth (IEEE 802.15.1), Wireless USB ,Contents vii ZigBee (IEEE 802.15.4) ,IRDA,Near Field Communications

**Implementing Wireless PANs:**

Wireless PAN Technology Choices,Pilot Testing ,Wireless PAN Security

**UNIT – V:**

**Wireless MANs (WiMaX):**

802.16 standards, Voice and QoS support

**Trends:** Overlay networks

**The Future of Wireless Networking Technology:**

Wireless Mesh Network Routing, Network Independent Roaming, Gigabit Wireless LANs, Cognitive Radio

**Course Outcomes:**

At the end of this course, students will be able to

i. Understand Cellular communication concepts
ii. Study the mobile radio propagation
iii. Study the wireless network different type of MAC protocols
iv. Demonstrate wireless Local and Wide area networks and their specifications.
v. Analyze and Familiar with some of the existing and emerging wireless standards.

**Text Books:**


1. Wireless Networking Technology: From Principles to Successful Implementation -Steve Rackley
2. Principles of Wireless Networks, K. Pahlavan and P. Krishnamurthy, Pearson Education, 2002.
3. Wireless Communication and Networks, W. Stallings, Pearson Education, 2002.
4. Mobile Communications, Jochen Schiller, Addison Wesley, 2003.


**References:**


1. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.
2. Wireless Communications-Andrea Goldsmith, Cambridge University Press, 2005.
3. Ad Hoc Wireless Networks: Architectures and Protocols-C. Siva ram Murthy and B.S. Manoj, 2004, PHI.
4. Wireless Communications-Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.


| | **Honors/Minor courses** | **L** | **T** | **P** | **C** |
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| **MATHEMATICAL ESSENTIAL FOR DATA SCIENCE** | | | | | |

**Course Objectives:**

i. Recall the basics of sets, natural numbers, integers, rational numbers, and real

numbers.

ii. Learn to use the coordinate system, and plot straight lines.
iii. Identify the properties and differences between linear, quadratic, polynomial, exponential, and logarithmic functions.
iv. Find roots, maxima and minima of polynomials using algorithmic methods.
v. Learn to represent sets and relations between set elements as discrete graphs using nodes and edges.
vi. Formulate some common real-life problems on graphs and solve them

**UNIT – 1:**

Set Theory - Number system, Sets and their operations

Relations and functions - Relations and their types, Functions and their types, Rectangular coordinate system

**UNIT – 2:**

Straight Lines- Slope of a line, Parallel and perpendicular lines, Representations of a Line, General equations of a line, Straight-line fit

Quadratic Functions - Quadratic functions, Minima, maxima, vertex, and slope, Quadratic Equations

**UNIT – 3:**

Algebra of Polynomials - Addition, subtraction, multiplication, and division, Algorithms

**UNIT – 4:**

Graphs of Polynomials - X-intercepts, multiplicities, end behavior, and turning points, Graphing & polynomial creation

Functions - Horizontal and vertical line tests, Exponential functions, Composite functions, Inverse functions

Logarithmic Functions - Properties, Graphs, Exponential equations, Logarithmic equations

**UNIT – 5:**

Graph Theory - Representation of graphs, Breadth-first search, Depth-first search, Applications of BFS and DFS

Directed Acyclic Graphs - Complexity of BFS and DFS, Topological sorting and longest path, Transitive closure, Matrix multiplication

Graph theory Algorithms - Single source shortest paths, Dijkstra's algorithm, Bellman-Ford algorithm, All-pairs shortest paths, Floyd–Warshall algorithm, Minimum cost spanning trees, Prim's algorithm, Kruskal's algorithm

**Course Outcomes:**

At the end of the course, the students will be able to:

i. Demonstrate understanding of basic mathematical concepts in data science, relating to linear algebra, probability, and calculus.
ii. Employ methods related to these concepts in a variety of data science

applications.

iii. Apply logical thinking to problem-solving in context.
iv. Use appropriate technology to aid problem-solving and data analysis.
v. Demonstrate skills in writing mathematics.

**Text Book:**

1. Introductory Algebra: a real-world approach (4th Edition) - by Ignacio Bello

**References:**

1. Mathematical Foundations OfData Science Using Rby Emmert-Streib Frank.

| | Honors/Minor courses | L | T | P | C |
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| INTRODUCTION TO DATA SCIENCE | | | | | |

**Course Objectives:**

i. The course teaches critical concepts and skills in computer programming and statistical inference, in conjunction with hands-on analysis of real-world datasets, including economic data, document collections, geographical data, and social networks.

ii. It delves into social issues surrounding data analysis such as privacy and design.

**UNIT – I: INTRODUCTION**

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

**UNIT – II: DATA COLLECTION AND DATA PRE-PROCESSING**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

**UNIT – III: EXPLORATORY DATA ANALYTICS**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

**UNIT – IV: MODEL DEVELOPMENT**

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

**UNIT – V: MODEL EVALUATION**

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

**Course Outcomes:**

At the end of the course, the students will be able to:

i. Apply dimensionality reduction tools such as principle component analysis
ii. Evaluate outcomes and make decisions based on data
iii. Understand how to Use exploratory tools such as clustering and visualization tools to analyze data.
iv. Apply dimensionality reduction tools such as principle component analysis
v. Able to know how to Perform basic analysis of network data.

**Text Books:**

1. Data Science for Beginners, by Andrew Park
2. The Art of Data Science — A Guide for Anyone Who Works With Data, by Roger D. Peng and Elizabeth Matsui.

**References:**


1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”,PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”,EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big DataAnalytics”, IGI Global.

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| **DATA ANALYTICS AND VISUALIZATION** | | | | | |

**Course Objectives:**

i. To demonstrate expert knowledge of data analysis, statistics, tools, techniques and technologies of data analytics and Visualization.
ii. To enable learners to develop knowledge and skills in current and emerging areas of data analytics and Visualization.
iii. To formulate and implement a novel research idea and conduct research in the field of data analytics and Visualization.
iv. To critically assess and evaluate business and technical strategies for data analytics.
v. Todevelop project-management, critical-thinking, problem-solving and decisionmaking skills.

**UNIT -1: INTRODUCTION AND TABLEAU PRIMER:**

Introduction to data visualization Data for data graphics Tableau introduction

**UNIT-2:DESIGN PRINCIPLES**

Design principles Categorical, time series, and statistical data graphics

**UNIT-3: Display types,Geospatial displays, Interactivity**

Storytelling Multivariate displays, Geospatial displays, Dashboards, interactive and animated displays

**UNIT-4: Data Definitions and Analysis Techniques:**

Elements, Variables, and Data categorization,Levels of Measurement, Data management and indexing,Introduction to statistical learning.

**Descriptive Statistics:**

Measures of central tendency, Measures of location of dispersions

**UNIT-5: Basic analysis techniques**

Statistical hypothesis generation and testing,Chi-Square test,t-Test,Analysis of variance,Correlation analysis,Maximum likelihood test.

After completing the course, student will be able to:

i. Present data with visual representations for your target audience, task, and data;
ii. Identify appropriate data visualization techniques given particularrequirements imposed by the data;
iii. Display types, Geospatial displays, Interactivity
iv. Data Definitions and Analysis Techniques
v. Implement the analytic algorithms and Basic analysis techniques

**Text Books:**

1. Sosulski, K. (2018). Data Visualization Made Simple: Insights into BecomingVisual. New York: Routledge.
2. Probability & Statistics for Engineers & Scientists (9th Edn.), Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Prentice Hall Inc.
3. The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Trevor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014

**References:**

1. An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013
2. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer
3. Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012
4. Advances in Complex Data Modeling and Computational Methods in Statistics, Anna Maria Paganoni and Piercesare Secchi, Springer, 2013

**Optional readings:**

1. Few, S. (2012). Show me the numbers: Designing tables and graphs toenlighten. Burlingame, CA: Analytics Press.
2. Few, S. (2006). Information dashboard design: The effective visualcommunication of data. Sebastopol: O'Reilly.
3. Ware, C & Kaufman, M. (2008). Visual thinking for design. Burlington: MorganKaufmann Publishers.
4. Wong, D. (2011). The Wall Street Journal guide to information graphics: The dosand don'ts of presenting data, facts and figures. New York: W.W. Norton& Company.
5. Yau, N. (2011). Visualize This: The FlowingData Guide to Design, Visualization,and Statistics. Indianapolis: O'Reilly.
6. Yau, N. (2013). Data Points: Visualization that means something. Indianapolis: O'Reilly.

| | Honors/Minor courses | L | T | P | C |
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| **PYTHON FOR DATA SCIENCE** | | | | | |

**Course Objectives:**

i. The course aims at equipping participants to be able to use python programming for solving data science problems

**UNIT-I**

Introduction to Python for Data Science, Introduction to Python, Introduction to Spyder - Part 1, Introduction to Spyder - Part 2, Variables and Datatypes, Operators,

**UNIT-II**

Jupyter setup, Sequence_data_part_1, Sequence_data_part_2, Sequence_data_part_3, Numpy

**UNIT-III**

Reading Data, Pandas Dataframes I, Pandas Dataframes II, Pandas Dataframes III,Control Srtuctures and Functions, Explonatory Data Analysis, Data visualization Part-I,Data visualization Part- II,Dealing with Missing Data

**UNIT-IV**

Introduction to Classification.Case Study on Classification Part I, Case Study on Classification Part II

**UNIT-V**

Introduction to Regression.Case Study on Regression Part I, Case Study on Regression Part II

**Course Outcomes:**

At the end of the course, the students will be able to:

i. Understand how to work in Jupyter Notebook.
ii. Know how to import data in Python.
iii. Ability to learnpandas library, the main methods for Data Frames.
iv. Able to applythe Basic Data types, Operators, how to clean and merge datasets.
v. Apply Classification and Regression case studies in real time environment.

**Text Books:**

1. Python Data Science Handbook: Essential Tools for Working with Data- Oreilly Publication- author by Jake VanderPlus.
2. Python for Data Science For Dummies authors by Luca Massaron John Paul Mueller.

**References:**

1. https://nptel.ac.in/courses/106/106/106106212/