



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
FACULTY OF ENGINEERING AND TECHNOLOGY  
UNIVERSITY OF LUCKNOW**

**Course Structure and Syllabus**

**For**

**B.Tech.**

**COMPUTER SCIENCE AND ENGINEERING  
(ARTIFICIAL INTELLIGENCE)**

**3<sup>rd</sup> Year**

**(To be effective from the session 2023-2024)**

**B. Tech. CSE (AI)****YEAR: THIRD, SEMESTER-V****(To be effective from the session 2023-2024)**

| Sl. No.   | Paper Code | Subject                        | Periods |   |    | Evaluation Scheme |    |    |          | Sub Total | Credit |
|-----------|------------|--------------------------------|---------|---|----|-------------------|----|----|----------|-----------|--------|
|           |            |                                |         |   |    | Sessional Exam    |    |    | Exam ESE |           |        |
|           |            |                                |         |   |    | L                 | T  | P  |          |           |        |
| 1.        | AI - 501   | Fundamentals of Data Analytics | 3       | 1 | 0  | 20                | 10 | 30 | 70       | 100       | 4      |
| 2.        | CS - 502   | Database Management Concepts   | 3       | 1 | 0  | 20                | 10 | 30 | 70       | 100       | 4      |
| 3.        | CS - 503   | Software Engineering           | 3       | 0 | 0  | 20                | 10 | 30 | 70       | 100       | 3      |
| 4.        | CS - 504   | Web Technology                 | 3       | 0 | 0  | 20                | 10 | 30 | 70       | 100       | 3      |
| 5.        | CS - 505   | Compiler Design                | 3       | 1 | 0  | 20                | 10 | 30 | 70       | 100       | 4      |
| Practical |            |                                |         |   |    |                   |    |    |          |           |        |
| 6.        | AI - 551   | Data Analytics Lab             | 0       | 0 | 3  | -                 | 40 | 40 | 60       | 100       | 2      |
| 7.        | CS - 552   | Database Management System Lab | 0       | 0 | 3  | -                 | 40 | 40 | 60       | 100       | 2      |
| 8.        | CS - 553   | Software Engineering Lab       | 0       | 0 | 2  | -                 | 20 | 20 | 30       | 50        | 1      |
| 9.        | CS - 554   | Web Technology Lab             | 0       | 0 | 2  | -                 | 20 | 20 | 30       | 50        | 1      |
| 10        | GP - 501   | General Proficiency            |         |   |    |                   |    | 50 |          | 50        |        |
|           |            | Total                          | 15      | 3 | 10 |                   |    |    |          | 800       | 24     |

**Abbreviations:** CT - Class Test

ESE - End Semester Examination

TA – Teacher's Assessment

**B. Tech. CSE (AI)****YEAR: THIRD, SEMESTER-VI****(To be effective from the session 2023-2024)**

| Sl. No.   | Paper Code | Subject                              | Periods |   |    | Evaluation Scheme |    |       |             | Sub<br>Total | Credit |
|-----------|------------|--------------------------------------|---------|---|----|-------------------|----|-------|-------------|--------------|--------|
|           |            |                                      | L       | T | P  | Sessional Exam    |    |       | Exam<br>ESE |              |        |
|           |            |                                      |         |   |    | CT                | TA | Total |             |              |        |
| 1.        | AI - 601   | Essentials of Machine Learning       | 3       | 0 | 0  | 20                | 10 | 30    | 70          | 100          | 3      |
| 2.        | AI - 602   | Operating System                     | 3       | 1 | 0  | 20                | 10 | 30    | 70          | 100          | 4      |
| 3.        | CS - 601   | Design and Analysis of Algorithm     | 3       | 1 | 0  | 20                | 10 | 30    | 70          | 100          | 4      |
| 4.        | CS - 602   | Computer Network                     | 3       | 1 | 0  | 20                | 10 | 30    | 70          | 100          | 4      |
| 5.        | AI - 603X  | Any one from the list (DE-1)         | 3       | 0 | 0  | 20                | 10 | 30    | 70          | 100          | 3      |
| Practical |            |                                      |         |   |    |                   |    |       |             |              |        |
| 6.        | CS - 651   | Design and Analysis of Algorithm Lab | 0       | 0 | 2  | -                 | 20 | 20    | 30          | 50           | 1      |
| 7.        | CS - 652   | Computer Network Lab                 | 0       | 0 | 2  | -                 | 20 | 20    | 30          | 50           | 1      |
| 8.        | CS - 653   | Mini Project                         | 0       | 0 | 3  | -                 | 40 | 40    | 60          | 100          | 2      |
| 9.        | CS - 654   | Seminar                              | 0       | 0 | 3  | -                 | 40 | 40    | 60          | 100          | 2      |
| 10.       | GP - 601   | General Proficiency                  |         |   |    |                   |    | 50    |             | 50           |        |
|           |            | Total                                | 15      | 3 | 10 |                   |    |       |             | 800          | 24     |

**Abbreviations:** CT - Class Test

ESE - End Semester Examination

TA – Teacher's Assessment

DE - Departmental Elective

**Note:** Students have to undergo Industrial Training for a period of **at least six weeks** during summer vacation. The report of Industrial Training will be submitted to the Head of the Department in the beginning of seventh semester.

**Departmental Elective – 1:-**

1. AI-6031                      Soft Computing
2. AI-6032                      Pattern Recognition
3. AI-6033                      Data Mining
4. AI-6034/CS-604              Graph Theory
5. AI-6035/CS-6051              Software Project Management
6. AI-6036/CS-6052              Multimedia System

## FUNDAMENTALS OF DATA ANALYTICS

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>1</b> | <b>0</b> |

## COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Understand Data and its analytics in the real world
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models.
- Handle large scale analytics projects from various domains.
- Develop intelligent decision support systems.

## Unit-I

08

**Introduction to Data Analytics:** Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to data analytics, need of data analytics, types of data analysis, analytic process, tools and techniques, and applications of data analytics.

**Data Analytics Lifecycle:** Need, various phases of data analytics lifecycle-discovery, data preparation, model planning, model building, communicating results and operationalization.

## Unit-II

08

**Data Exploration:** Data profiling, analyzing target data, Statistics and Probability: basic probability, conditional probability, Bayes' theorem, Distribution: continuous vs discrete Distributions, Normal Distribution: sample mean, and population mean, bias and variance and Maximum Likelihood Estimation.

## Unit-III

08

**Data Analysis:** Basic analysis technique: Hypothesis testing, Types of hypothesis: null hypothesis and alternate hypothesis, types of error, P-value and level of significance, types of hypothesis testing: Z-test, t-test, Chi square, ANOVA Test, analysis of variance and regression analysis.

## Unit-IV

08

**Mining data and data cleaning:** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream and filtering streams.

**Data cleaning:** Causes and impact of missing values, types of missing values, imputing missing values, Outliers: deleting and capping, various function of data cleaning and case studies of real-life scenario-based data cleaning on various data set.

## Unit-V

08

**Data Visualization:** Introduction data visualization, benefits of good data visualization, types of data visualization: Box plots, Histograms, Heat maps, Charts and Charts Types, Tree maps and Word Cloud/Network diagram.

**Text Books:**

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley.
2. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier.
3. Learn Data Analysis with Python Lessons In Coding by Henley, Apress.

**Reference Books:**

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
3. John Garrett, Data Analytics for IT Networks: Developing Innovative Use Cases, Pearson Education.
4. Michael Berthold, David J. Hand,” Intelligent Data Analysis”, Springer.

## DATABASE MANAGEMENT CONCEPTS

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>1</b> | <b>0</b> |

**Course Outcomes (COs):**

After the successful completion of the course student will be able to:

- Understand database concepts, structures and query language.
- Understand the E R model and relational model.
- Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
- Understand concept of transaction processing and concurrency control.

**Unit-I****08**

**Introduction:** An overview of database management system, database system vs file system, database system concept and architecture, data model schema and instances, data independence, database language and interfaces, and overall database structure. Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, and relationship of higher degree.

**Unit-II****08**

**Relational data Model and Language:** Relational data model concepts, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, relational algebra, relational calculus, tuple calculus, and domain calculus. Introduction to SQL Statements: Data retrieval, DDL, DML, TCL, DCL, characteristics of SQL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub queries, aggregate functions, joins, unions, intersection, minus, cursors, and triggers.

**Unit-III****08**

**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, lossless join decompositions, and normalization using FD, MVD and JDs.

**Unit-IV****08**

**Transaction Processing Concept:** Transaction system, testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, log based recovery, checkpoints, and deadlock handling.

**Unit-V****08**

**Concurrency Control Techniques:** Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, and validation based protocol.

**Text Book:**

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill.

**Reference Books:**

1. Date C J, "An Introduction to Database Systems", Addison Wesley.
2. Elmasri, Navathe, "Fundamentals of Database Systems", Addison Wesley.

3. O'Neil, Databases, Elsevier Pub.
4. Leon & Leon "Database Management Systems", Vikas Publishing House.
5. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications.
6. Majumdar & Bhattacharya, "Database Management System", TMH.
7. Ramkrishnan, Gehrke, "Database Management System", McGraw Hill.

## SOFTWARE ENGINEERING

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>0</b> | <b>0</b> |

**Course Outcomes (COs):**

After the successful completion of the course student will be able to:

- Understand the basic concepts of software engineering.
- Understand the requirement analysis and importance of SRS documentation.
- Understand the design of software product.
- Understand various testing techniques and maintenance of software product.

**Unit-I****08**

**Introduction:** Software components, software characteristics, software crisis, software engineering processes, similarity and differences from conventional engineering processes, and software quality attributes. SDLC Models: Water fall model, prototype model, spiral model, evolutionary development models, iterative enhancement models, and agile software development model.

**Unit-II****08**

**Software Requirement Specifications:** Requirement engineering process, elicitation, analysis, documentation, review and management of user needs, feasibility study, information modeling, data flow diagrams, entity relationship diagrams, decision tables, SRS document, and IEEE standards for SRS. SQA: Verification and validation, SQA plans, software quality frameworks, ISO 9000 models, and SEI-CMM model

**Unit-III****08**

**Software Design:** Basic concept, architectural design, low level design: modularization, design structure charts, pseudo codes, flow charts, coupling and cohesion measures, design strategies: function oriented design, object oriented design, top-down and bottom-up design. Software Measurement and Metrics: Halstead's software science, function point (FP) based measures, and cyclomatic complexity measures: Control flow graphs.

**Unit-IV****08**

**Software Testing:** Testing objectives, unit testing, integration testing, acceptance and regression test, testing for functionality and performance, Top-down and bottom-up testing strategies: test drivers and test stubs, structural testing (white box testing), functional testing (black box testing), test data suit preparation, alpha and beta testing of products, Static testing strategies: Formal technical reviews, walk through, code inspection, and compliance with design & coding standards.

**Unit-V****08**

**Software Maintenance and Software Project Management:** Software as an evolutionary entity, need for maintenance, categories of maintenance, cost of maintenance, software re-engineering, reverse engineering, software configuration management activities, change control process, software version control, an overview of CASE tools, estimation of various parameters such as cost, efforts, schedule/duration, and constructive cost models (COCOMO).

**Text Book:**

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.



**Reference Books:**

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
3. Pankaj Jalote, Software Engineering, Wiley
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.

## WEB TECHNOLOGY

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>0</b> | <b>0</b> |

**Course Outcomes (COs):**

After the successful completion of the course student will be able to:

- Understand the knowledge of the internet and related internet concepts that are vital in understanding web application development.
- Analyze and apply the role of markup languages like HTML, DHTML, and XML in the workings of the web and web applications.
- Programming web pages with JavaScript.
- Design and implementation of build dynamic web pages using client side programming JavaScript and also develop the web application using servlet and JSP.

**Unit-I****08**

**Introduction:** Introduction to web, protocols governing the web, web development strategies, web applications, web project, and web team.

**Unit-II****08**

**HTML:** List, table, images, frames, forms, and CSS.

**Unit-III****08**

**XML:** TAGS, DTD, XML schemes, presenting and using XML.

**Unit -IV****08**

**Java script:** Introduction, documents, forms, statements, functions, objects, event and event handling, introduction to AJAX, VB Script, and CGI

**Unit-V****08**

**Server Site Programming:** Introduction to active server pages (ASP), ASP.NET, java server pages (JSP), JSP application design, tomcat server, JSP objects, declaring variables and methods, debugging, and sharing data between JSP pages.

**Text Books:**

1. Xavier, C, "Web Technology and Design" , New Age International.
2. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication.

**Reference Books:**

1. Deitel, "Java for programmers", Pearson Education.
2. Ramesh Bangia, "Internet and Web Design", New Age International.
3. Jackson, "Web Technologies" Pearson Education.
4. Patel and Barik,"Introduction to Web Technology & Internet", Acme Learning.

**CS - 505**  
**COMPILER DESIGN**

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>1</b> | <b>0</b> |

**Course Outcomes (COs):**

After the successful completion of the course student will be able to:

- Ability to analyze & design grammars for different formal languages.
- Determine the decidability and intractability of computational problems.
- Identify different formal language and design the recognizer for regular languages to establish their applicability.
- Apply concepts learned in various domains of compiler construction.
- Students will be able to design compiler.

**Unit-I**

**08**

**Introduction:** Introduction to compiler, phases and passes, bootstrapping, finite state machines and regular expressions and their applications to lexical analysis, optimization of DFA-based pattern matchers implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, formal grammars and their application to syntax analysis, ambiguity, and YACC. The syntactic specification of programming languages: Context free grammars, derivation & parse trees, and capabilities of CFG.

**Unit-II**

**08**

**Basic Parsing Techniques:** Parsers, shift reduce parsing, operator precedence parsing, and top down parsing. Predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical collection of LR(0) items, constructing SLR parsing tables, constructing canonical LR parsing tables, constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, and implementation of LR parsing tables.

**Unit-III**

**08**

**Syntax-directed Translation:** Syntax-directed translation schemes, implementation of syntax directed translators, intermediate code, postfix notation, parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, boolean expressions, statements that alter the flow of control, postfix translation, and translation with a top down parser.

**Unit-IV**

**08**

**Symbol Tables:** Data structure for symbols tables, and representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, and storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, and syntactic phase errors semantic errors.

**Unit-V**

**08**

**Code Generation:** Design issues, the target language, addresses in the target code, basic blocks and flow graphs, optimization of basic blocks, and code generator. Code Optimization: Machine-independent optimizations, loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, and global data-flow analysis.

**Text Book:**

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education

**Reference Books:**

1. V Raghvan, "Principles of Compiler Design", TMH

2. Kenneth Loudon," Compiler Construction", Cengage Learning.
3. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

**DATA ANALYTICS LAB**

| <b>L</b> | <b>T</b> | <b>P</b> |
|----------|----------|----------|
| <b>0</b> | <b>0</b> | <b>3</b> |

1. Write a program to create a NumPy array and Access and manipulate elements in the array.
2. Write a Program to create a 5x5 2D array for random numbers between 0 and 1 using NumPy.
3. Write a Program to calculate the mean, median, standard deviation, and variance using NumPy.
4. Write a Program to generate a random array of 50 numbers having mean 110 and standard deviation 15.
5. Write a Program to read the data and perform normalization.
6. Write a Program to create a data frame using Python Pandas.
7. Write a program to sort the data frame based on the first column.
8. Write a program to detect the outliers and remove the rows having outliers.
9. Write a Program to checking for missing values using is null () and not null ().
10. Create a program to identify and count missing values in a data frame.
11. Write a program to remove all duplicates from the first column.
12. Write a Program to Reading a CSV File and reading with Specific Columns and rows.
13. Create a Program we use various functions in NumPy library to carry out the chi-square test.
14. Create a Program we use various functions in NumPy library to carry out the ANOVA test.
15. Write a program to create a data visualization like using matplotlib with taking any datasets: Do the following
  - Create a Box plots,
  - Create a Histograms,
  - Create a Heat maps,
  - Create various Charts

## DATABASE MANAGEMENT SYSTEM LAB

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>0</b> | <b>0</b> | <b>3</b> |

**Course Outcomes (COs):**

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

- Design and implement a data base schema for a given problem domain.
- Create and maintain tables using SQL.
- Populate and query a database using SQL.
- Create and implement cursors, triggers, procedures and functions.

**LIST OF PRACTICALS****Part I:** Getting familiar with SQL (Maximum number of turns allotted: 3)

- 1) Creating tables.
- 2) Insertion, Deletion, Updation and Retrieval of data.
- 3) Arithmetic operations, Logical operations and Pattern matching.
- 4) Concept of Grouping (Group by clause, Having Clause).
- 5) Use Aggregate function in query.
- 6) Write commands for Joins, Union and Intersection.
- 7) Concept of Sub-query.
- 8) Concept of Data constraints (Unique Key, Primary Key, Foreign Key).
- 9) Creating Views and Indexes.
- 10) Creating Trigger.

**Part II:** Relational Database Implementation

Implement the following mini-project's database schemas and give an expression in SQL for each of the queries.

**Project 1. Library Management System:**

Create the following schema. Enter at least 5 records, in accordance with the query asked, in each table and answer the queries given below.

**Library Books** (Accession number, Title, Author, Department, Purchase Date, Price)

**Issued Books** (Accession number, Borrower)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Delete the record of book titled "Database System Concepts".
- c) Change the Department of the book titled "Discrete Mathematics" to "CSE".

- d) List all books that belong to “CSE” department.
- e) List all books that belong to “CSE” department and are written by author “Navathe”.
- f) List all computer (Department=“CSE”) that have been issued.
- g) List all books which have a price less than 500 or purchased between “01/01/2015” and “01/01/2019”.

### **Project 2. Student Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**Student** (College roll number, Name of student, Date of birth, Address, Marks (rounded off to whole number) in percentage at 10 + 2, Phone number)

**Paper Details** (Paper code, Name of the Paper)

**Academic – details** (College roll number, Paper code, Attendance, Marks in home examination)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper 2.
- c) List all students who live in “Lucknow” and have marks greater than 60 in paper 1.
- d) Find the total attendance and total marks obtained by each student.
- e) List the name of student who has got the highest marks in paper 2.

### **Project 3. Customer Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**Customer** (Cust ID, email, Name, Phone, Referrer ID)

**Bicycle** (Bicycle ID, Date Purchased, Color, Cust ID, Model No.)

**Bicycle Model** (Model No., Manufacturer, Style) **Service** (Start Date, Bicycle ID, End Date)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) List all the customers who have the bicycles manufactured by manufacturer “Honda”.
- c) List the bicycles purchased by the customers who have been referred by customer “C1”.
- d) List the manufacturer of red colored bicycles.
- e) List the models of the bicycles given for service.

### **Project 4. Human Resource Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**EMPLOYEE** (Person-Name, Street, City)

**WORKS** (Person-Name, Company-Name, Salary)

**COMPANY** (Company-Name, City) **MANAGES** (Person-Name, Manager-Name)

- a) Identify primary and foreign keys.
- b) Alter table employee, add a column “email” of type varchar (20).
- c) Find the name of all managers who work for both Samba Bank and NCB Bank.
- d) Find the names, street address and cities of residence and salary of all employees who work for “Samba Bank” and earn more than \$10,000.
- e) Find the names of all employees who live in the same city as the company for which they work.
- f) Find the highest salary, lowest salary and average salary paid by each company.
- g) Find the sum of salary and number of employees in each company.
- h) Find the name of the company that pays highest salary.

**Project 5. Supplier Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**Suppliers** (S No, Sname, Status, S City)

**Parts** (P No, Pname, Colour, Weight, City)

**Project** (J No, J name, J city)

**Shipment** (Sno, Pno, Jno, Qunatity)

- a) Identify primary and foreign keys.
- b) Get supplier numbers for suppliers in Paris with status>20.
- c) Get suppliers names for suppliers who do not supply part P2.
- d) For each shipment get full shipment details, including total shipment weights.
- e) Get all the shipments where the quantity is in the range 300 to 750 inclusive.
- f) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.
- g) Get the names of cities that store more than five red parts.
- h) Get full details of parts supplied by a supplier in Delhi.

**Note:** The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.



**Course Outcomes (COs):**

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

- Understand the method of SRS and prepare an SRS document in line with the IEEE recommended standards.
- Prepare the use case diagram and use case study to specify the role of each of the actors. Also understand the precondition, post condition and function of each use case.
- Design the activity diagram. Identify the classes. Classify them as weak and strong classes and draw the class diagram.
- Analyze the sequence diagram, collaboration diagram, state chart diagram, component diagram, and deployment diagram for any two scenarios.

**LIST OF PRACTICALS**

**Note: - At least 6 mini-projects are to be implemented from Part II.**

**Part I** – To Familiarize with CASE tools using ATM system as specification. (Maximum number of turns allotted: 3)

1. Introduction and project definition
2. Software process overview
3. Project planning
4. Software requirements
5. Introduction to UML and use case diagrams
6. System modeling (DFD and ER)
7. Flow of events and activity diagram
8. OO analysis: discovering classes
9. Interaction diagrams: sequence and collaboration diagrams
10. Software Design: software architecture and object-oriented design
11. State Transition Diagram
12. Component and deployment diagrams
13. Software testing
14. Presentations.

**Part II-** Design a mini-project using CASE tools Students are divided into batches of 5 each and each batch has to draw the following diagrams using UML for given different case studies for each batch. UML diagrams to be developed are:

1. Use Case Diagram.
2. Class Diagram.
3. Sequence Diagram.
4. Collaboration Diagram.
5. State Diagram
6. Activity Diagram.
7. Component Diagram
8. Deployment Diagram.

**Projects:**

1. Patient Appointment and Prescription Management System
2. Organized Retail Shopping Management Software
3. Online Hotel Reservation Service System
4. Examination and Result computation system
5. Automatic Internal Assessment System
6. Parking Allocation System
7. Wholesale Management System
8. Criminal Record Management: Implement a criminal record management system for jailers, police officers and CBI officers
9. DTC Route Information: Online information about the bus routes and their frequency and fares
10. Car Pooling: To maintain a web based intranet application that enables the corporate employees within an organization to avail the facility of carpooling effectively.

**Note:** The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

## WEB TECHNOLOGY LAB

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>0</b> | <b>0</b> | <b>2</b> |

**Course Outcomes (COs):**

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

- Create basic level forms using HTML tags to understand a web page.
- Extend the knowledge of HTML by combining CSS tags for updating the existing web page.
- Understand the use of XML for sharing and storing of data using Schema.
- Construct a dynamic web pages using Javascript also utilizing the knowledge of DTD.

**LIST OF PRACTICALS**

1. HTML program to create resume preparation using tables.
2. HTML program for home page creation using frames.
3. HTML program for form creation.
4. Create a web page to embed an image map in a web page using HTML.
5. Create a web page to fix the hot spots and to show all the related information when the hot spots are clicked using HTML.
6. Create a web page to get the coordinates from an image using java script.
7. Create a web page with all types of cascading style sheets.
8. Write HTML/Java scripts to display your CV in navigator, your institute website, Department website and tutorial website for specific subject.
9. Design HTML form for keeping student record and validate it using Java script.
10. Writing program in XML for creation of DTD, which specifies set of rules.
11. Create a style sheet in CSS/ XSL & display the document in internet explorer.

**Note:** The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

## ESSENTIALS OF MACHINE LEARNING

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE OUTCOMES (COs)**

After the completion of this course, students will be able to

- Understand basic concepts of machine learning
- Differentiate artificial intelligence and machine learning
- Understand the concept of bias-variance tradeoff
- Conceptualize supervised and unsupervised machine learning
- Understand the concept of classification and regression

**Unit-I****8**

**Introduction:** Introduction to machine learning, applications, motivation, programming approach vs. machine learning approach in artificial Intelligence, components of a learning problem (such as data, model, and error functions), classification of ML algorithms, general ML architecture and types of machine learning.

**Unit-II****8**

**Forecasting and Learning Theory:** Predicting numerical values: linear and nonlinear regression and regression model using gradient descent, process of learning (training), testing, bias and variance error.

**Unit-III****8**

**Validation:** True and sample error, over-fitting, under-fitting, role of cross validation, regularization, bias-variance analysis. **Performance-Measures:** types-of-errors, accuracy, confusion-matrix and precision-recall.

**Unit-IV****8**

**Dimensionality Reduction:** Feature selection vs. feature extraction, principal component analysis (PCA), singular value decomposition. **Supervised Learning:** support vector machine, decision tree, naïve Bayes classifier and K- nearest neighbor.

**Unit-V****8**

**Unsupervised Learning:** K- means clustering, hierarchical clustering, **Reinforcement Learning:** Q-learning, **Ensemble Learning:** introduction, bagging, boosting, improving classification and Ada-boost algorithm.

**Text Books:**

1. Alpaydin, E. 'Introduction to machine learning', MIT press.
2. Bishop, C. M. 'Pattern recognition and machine learning', Springer-Verlag New York Inc.
3. John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, 'Fundamentals of Machine Learning for Predictive Data Analytics', MIT Press.

**Reference Books:**

1. Mitchell, T.M. 'Machine Learning', McGraw-Hill
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, 'Deep Learning', MIT Press.
3. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani 'An Introduction to Statistical Learning', Springer.

## OPERATING SYSTEM

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|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>1</b> | <b>0</b> |

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Analyze various process scheduling Algorithms and their comparisons.
- Understand deadlock concept and its algorithm.
- Contrast various Memory management schemes and Page replacement policies.
- Demonstration of paging Technique of Memory Management.

**Unit-I****08**

**Introduction:** Operating system and its functions, classification of operating systems- batch, interactive, time sharing, real time system, multiprocessor systems, multiuser systems, multithreaded systems, operating system structure- layered structure, system components, and operating system services.

**Unit-II****06**

**Process and CPU Scheduling:** Process concept, process states, process state transition diagram, scheduling concepts, performance criteria, schedulers, process control block (PCB), threads and their management, scheduling algorithms, and multiprocessor scheduling.

**Unit-III****10**

**Concurrent Processes and Deadlock:** Principle of concurrency, producer / consumer problem, mutual exclusion, critical section problem, semaphores, test and set operation; Classical problem in concurrency- dining philosopher problem, sleeping barber problem; Inter process communication models and schemes, and process generation. Deadlock: System model, deadlock characterization, prevention, avoidance, detection, and recovery from deadlock.

**Unit -IV****08**

**Memory Management:** Basic bare machine, resident monitor, multiprogramming with fixed partitions, multiprogramming with variable partitions, paging, segmentation, paged segmentation, virtual memory concepts, demand paging, performance of demand paging, page replacement algorithms, thrashing, and cache memory organization.

**Unit -V****08**

**I/O Management and Disk Scheduling:** I/O devices, and I/O subsystems, I/O buffering, disk storage and disk scheduling, RAID. File System: File concept, file organization and access mechanism, file directories, file system implementation issues, and file system protection & security.

**Text Book:**

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley

**Reference Books:**

1. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education
2. Harvey M Dietel, "An Introduction to Operating System", Pearson Education
3. D M Dhamdhare, "Operating Systems: A Concept based Approach", 2nd Edition, TMH.
4. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson Education

## DESIGN AND ANALYSIS OF ALGORITHM

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| <b>L</b> | <b>T</b> | <b>P</b> |
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**Course Outcomes (COs):**

After the successful completion of the course student will be able to

- Implementation of various sorting algorithm and their comparisons.
- Analysis of various problem solved using Divide & Conquer and Greedy techniques
- Implementation of Dynamic Programming concept in solving various problems.

**Unit-I****08**

**Introduction:** Algorithms, analyzing algorithms, complexity of algorithms, growth of functions, performance measurements, sorting and order statistics - shell sort, quick sort, merge sort, heap sort, comparison of sorting algorithms, and sorting in linear time.

**Unit -II****08**

**Advanced Data Structures:** Red-Black trees, B – trees, binomial heaps, and fibonacci heaps.

**Unit - III****08**

**Design and Analysis Technique:** Divide and conquer with examples such as sorting, matrix multiplication, convex hull and searching, greedy methods with examples such as optimal reliability allocation, Knapsack, minimum spanning trees – Prim’s and Kruskal’s algorithms, single source shortest paths – Dijkstra’s and Bellman ford algorithms.

**Unit - IV****08**

**Dynamic Programming:** Knapsack, all pair shortest paths – Floyd-Warshall algorithms, backtracking, branch and bound with examples such as travelling salesman problem, graph coloring, n-Queen problem, and Sum of subsets problems.

**Unit -V****08**

**Selected Topics:** String Matching, theory of NP-completeness, approximation algorithms, and randomized algorithms.

**Text Book:**

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India.

**Reference Books:**

1. RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis of Algorithms”, McGraw Hill, 2005.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Berman, Paul,” Algorithms”, Cengage Learning.
4. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008.

## COMPUTER NETWORK

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>1</b> | <b>0</b> |

**Course Outcomes (COs):**

After the successful completion of the course student will be able to:

- Understand basic computer network technology.
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP.
- Understand the concept of IP addressing, subnetting and routing mechanisms.

**Unit –I****08**

**Introduction Concepts:** Goals and applications of networks, network structure and architecture, the OSI reference model, services, Network Topology Design: Delay analysis, back bone design, local access network design, physical layer transmission media, switching methods, ISDN, and terminal handling.

**Unit-II****08**

**Medium Access sub layer:** Medium access sub layer - channel allocations, LAN protocols - ALOHA protocols - overview of IEEE standards - FDDI. Data Link Layer - Elementary data link protocols, sliding window protocols, and error handling.

**Unit - III****08**

**Network Layer:** Point to point networks, routing, and congestion control. Internet Working -TCP / IP, IP packet, IP address, IPv6.

**Unit - IV****08**

**Transport Layer:** Transport layer design issues, connection management, session layer design issues, and remote procedure call. Presentation layer design issues, data compression techniques, cryptography - TCP - window management.

**Unit-V****08**

**Application Layer:** File transfer, access and management, electronic mail, virtual terminals, other application. Example networks - Internet and public networks.

**Text Book:**

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, Computer Networks, Pearson Education

**Reference Books:**

1. W. Stallings, Data and Computer Communication, Macmillan Press
2. Anuranjan Misra, "Computer Networks", Acme Learning
3. G. Shanmugarathinam, "Essential of TCP/ IP", Firewall Media

**LIST OF PRACTICALS****Course Outcomes (COs):**

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

- Understand the given problem and design an algorithm using various design techniques.
- Implement various algorithms such as sorting, searching, shortest path algorithms etc in C language.
- Analyze the performance of various algorithms.
- Compare different algorithms for solving the same problem.
- Demonstrate the concepts of NP Complete theory by implementation of problems such as: Travelling salesman problem etc.

Write a program to implement the following-

1. Program for Recursive Binary & Linear Search.
2. Program for Heap Sort.
3. Program for Merge Sort.
4. Program for Selection Sort.
5. Program for Insertion Sort.
6. Program for Quick Sort.
7. Program for Shell Sort.
8. Program to implement Floyd-Warshall's algorithm.
9. Program for sum of subset algorithm.
10. Knapsack Problem using Greedy Solution
11. Perform Travelling Salesman Problem
12. Find Minimum Spanning Tree using Kruskal's Algorithm
13. Implement N Queen Problem using Backtracking

**Note:** The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.



**COMPUTER NETWORK LAB**

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**Course Outcomes (COs):**

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

- Identify different networking devices such as switches, Hubs, etc and their functions.
- Demonstrate the use of IP addresses and subnet masks in delivery of packets in a networking environment.
- Justify the role of static and dynamic routing in a real scenario using packet tracer.
- Analyze various application layer protocols such as FTP, HTTP and their usage in a client server-based environment.

**LIST OF PRACTICALS**

1. To study different types of network cables and implement cross wired and straight through cables (RJ-45 connector, Crimping Tool, Twisted pair Cable/CAT-6 cable).
2. To study various networking devices in detail such as repeaters, switches, bridges, hubs, routers etc.
3. Connect computers in LAN.
4. Performing an Initial Switch Configuration (Cisco Catalyst 2960 switch).
5. Performing an Initial Router Configuration (Cisco 1841 ISR Router).
6. Study of IP address classification.
7. Study of Subnetting and supernetting.
8. Running and using services/commands like ping, trace route, nslookup, arp, telnet, ftp, etc.
9. Network simulation using Cisco Packet Tracer tool.
10. Socket programming using TCP (e.g., data & time client/server, echo client/server, iterative & concurrent servers).
11. Socket programming using UDP (like simple DNS).
12. Simulation of Sliding Window Protocol.

**Note:** The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**AI-6031**  
**SOFT COMPUTING**

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| <b>L</b> | <b>T</b> | <b>P</b> |
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**Course Outcomes (COs):**

Students will be able to:

- Learn about soft computing techniques and their application.
- Analyze various neural network architecture.
- Students gain knowledge about fuzzy systems.
- Analyze the genetic algorithms and their application.

**Unit-I**

**08**

**Neural Network-I (Introduction & Architecture):** Neuron, nerve structure and synapse, artificial neuron and its model, activation functions, neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; Perception and convergence rule, auto-associative, and hetro-associative memory.

**Unit-II**

**08**

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

**Unit-III**

**08**

**Fuzzy Logic-I (Introduction):** Basic concepts of fuzzy logic, fuzzy sets and crisp sets, fuzzy set theory and operations, properties of fuzzy sets, fuzzy and crisp relations, and fuzzy to crisp conversion.

**Unit-IV**

**08**

**Fuzzy Logic –II (Fuzzy Membership, Rules):** Membership functions, interference in fuzzy logic, fuzzy if-then rules, fuzzy implications and fuzzy algorithms, fuzzification & defuzzification, fuzzy controller, and industrial applications.

**Unit-V**

**08**

**Genetic Algorithm:** Basic concepts, working principle, procedures and flowchart of genetic algorithm, genetic representations, initialization and selection, genetic operators, mutation, generational cycle, and applications.

**Text Books:**

1. Saroj Kaushik, Sunita Tiwari, “Soft Computing”, McGraw Hill.
2. Sivanandam, Deepa, “Principles of Soft Computing”, Wiley.
3. Melanic Mitchell, “An Introduction to Genetic Algorithm”, MIT Press.

**Reference Books:**

1. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley.
2. Simon Haykin, “Neural Networks and Learning Machines”, PHI.
3. Kumar Satish, “Neural Networks”, Tata McGraw Hill.

## PATTERN RECOGNITION

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|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
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**Course Outcomes (COs):**

Students will be able to:

- Explain and define concepts of pattern recognition.
- Explain and distinguish procedures, methods and algorithms related to pattern recognition.
- Apply methods of pattern recognition for new complex applications.
- Analyze and breakdown problem related to the complex pattern recognition system.

**Unit-I****08**

**Introduction:** Basics of pattern recognition, design principles of pattern recognition system, learning and adaptation, pattern recognition approaches, Mathematical foundations – linear algebra, probability theory, expectation, mean and covariance, normal distribution, multivariate normal densities and chi squared test.

**Unit-II****08**

**Statistical Patten recognition:** Bayesian decision theory, classifiers, normal density and discriminant functions.

**Unit-III****08**

**Parameter Estimation Methods:** Maximum-likelihood estimation, Bayesian parameter estimation, dimension reduction methods - Principal Component Analysis (PCA), Fisher linear discriminant analysis, Expectation-Maximization (EM), Hidden Markov Models (HMM) and Gaussian mixture models.

**Unit-IV****08**

**Nonparametric Techniques:** Density estimation, Parzen windows, k-nearest neighbor estimation, nearest neighbor rule and fuzzy classification.

**Unit-V****08**

**Unsupervised Learning & Clustering:** Criterion functions for clustering, clustering techniques: iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, and cluster validation.

**Text Books:**

1. William Gibson, “Pattern Recognition” Oxford University Press.
2. Narasimha Murthy and Susheela Devi, “Pattern Recognition” Universities Press.
3. Christopher M. Bishop, “Pattern Recognition and Machine Learning” Springer.

**Reference Books:**

1. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, 2nd Edition, John Wiley.
2. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer.
3. S. Theodoridis and K. Koutroumbas, “Pattern Recognition”, 4th Edition, Academic Press.

**Course Outcomes (COs):**

Students will be able to:

- Learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications. Gain insight into the challenges and limitations of different data mining technology.
- Provide an overview of the methodologies and approaches to data mining
- Describe the various tasks of mining such as classification, clustering, association rule mining.
- Explore data warehouse and multi-dimensional data models.

**Unit-I****08**

**Introduction:** Overview, motivation (for data mining), data mining-definition & functionalities, data processing, form of data preprocessing, data cleaning: missing values, noisy data,(binning, clustering, regression, computer and human inspection),inconsistent data, data integration and transformation. Data Reduction: Data cube aggregation, dimensionality reduction, data compression, numerosity reduction, and clustering, discretization and concept hierarchy generation.

**Unit-II****08**

**Concept Description:** Definition, data generalization, analytical characterization, analysis of attribute relevance, mining class comparisons, statistical measures in large databases, measuring central tendency, measuring dispersion of data, graph displays of basic statistical class description, mining association rules in large databases, association rule mining, mining single dimensional Boolean association rules from transactional databases– apriori algorithm, mining multilevel association rules from transaction databases, and mining multi-dimensional association rules from relational databases.

**Unit-III****08**

**Classification and Predictions:** Classification & prediction, issues regarding classification and prediction, decision tree, Bayesian classification, classification by back propagation, multilayer feed-forward neural network, back propagation algorithm, classification methods k nearest neighbor classifiers, and genetic algorithm.

**Unit-IV****08**

**Cluster Analysis:** Data types in cluster analysis, categories of clustering methods, partitioning methods. Hierarchical clustering- CURE and Chameleon. Density based methods-DBSCAN, OPTICS. Grid based methods- STING, CLIQUE. Model based method- Statistical approach, neural network approach, and outlier analysis.

**UNIT-V****08**

**Data Warehousing:** Overview, definition, delivery process, difference between database system and data warehouse, multi-dimensional data model, data cubes, stars, snowflakes, fact constellations, concept hierarchy, process architecture, 3 tier architecture, and data marting.

**Text books:**

1. Jiawei Han, MichelineKamber, "Data Mining Concepts and Techniques",Morgan Kaufman Publications.

2. Alex Berson, Stephen Smith, "Data Warehousing, Data Mining& OLAP", McGraw Hill.
3. Charu C. Aggarwal, "Data Mining -The Textbook", Springer.

**Reference Books:**

1. Margaret H Dunhan,"Data Mining Introductory and Advanced Topics", Pearson Education.
2. Ian H. Witten Eibe Frank, "Data Mining", Morgan Kaufman Publications.
3. Pang-Ning Tan Michael Steinbach, Vipin Kumar, Data Mining, Pearson Education.

## GRAPH THEORY

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|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>0</b> | <b>0</b> |

**Course Outcomes (COs):**

Students will be able to:

- Solve problems using graph theory and apply some basic algorithms for graphs.
- Determine whether a graph is a Hamiltonian and/or an Euler graph.
- Demonstrate different traversal methods for trees and graphs.
- Solve problems involving vertex and edge connectivity, planarity and crossing numbers.
- Represent graphs in Vector space and using Matrix.
- Model real world problems using graph theory like four color problem.

**Unit-I****08**

**Introduction:** Graphs, sub graphs, some basic properties, various example of graphs & their sub graphs, walks, path & circuits, connected graphs, disconnected graphs and component, Euler graphs, various operation on graphs, Hamiltonian paths and circuits, and the traveling sales man problem.

**Unit- II****08**

**Trees and Fundamental Circuits:** Distance diameters, radius and pendent vertices, rooted and binary trees, spanning trees, fundamental circuits, finding all spanning trees of a graph and a weighted graph, Prim's and Kruskal's algorithm.

**Unit -III****08**

**Cut Set and Planarity:** Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets, connectivity and separability, network flows planer graphs, Combinatorial and Geometric dual: Kuratowski's graphs, detection of planarity, geometric dual, discussion on criterion of planarity, thickness and crossings.

**Unit -IV****08**

**Vector Space and Matrix Representation:** Vector space of a graph and vectors, basis vector, cut set vector, circuit vector, circuit and cut set subspaces, matrix representation of graph – basic concepts; incidence matrix, circuit matrix, path matrix, cut-set matrix, and adjacency matrix.

**Unit -V****08**

**Graph Coloring:** Coloring, covering and partitioning of a graph, chromatic number, chromatic partitioning, chromatic polynomials, matching, covering, and four color problem.

**Text Book:**

1. Deo, N, Graph theory with applications to Engineering and Computer Science, PHI.

**Reference Books:**

1. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, TMH.
2. Robin J. Wilson, Introduction to Graph Theory, Pearson Education.
3. Harary, F, Graph Theory, Narosa.

## SOFTWARE PROJECT MANAGEMENT

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|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>0</b> | <b>0</b> |

**Course Outcomes (COs):**

Students will be able to:

- Successful development of the project's procedures of initiation, planning, execution, regulation and closure.
- Guidance of the project team's operations towards achieving all the agreed upon goals within the set scope, time, quality and budget standards.
- Project plans that address real-world management challenges.
- Develop the skills for tracking and controlling software deliverables.

**Unit-I****08**

**Introduction and Software Project Planning:** Fundamentals of software project management (SPM), need identification, vision and scope document, project management cycle, SPM objectives, management spectrum, SPM framework, software project planning, planning objectives, project plan, types of project plan, structure of a software project management plan, software project estimation, estimation methods, estimation models, and decision process.

**Unit-II****08**

**Project Organization and Scheduling:** Project elements, work breakdown structure (WBS), Types of WBS, functions, activities and tasks, project life cycle and product life cycle, ways to organize personnel, project schedule, scheduling objectives, building the project schedule, scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar charts, Milestone charts, and Gantt charts.

**Unit-III****08**

**Project Monitoring and Control:** Dimensions of project monitoring & control, earned value analysis, earned value indicators: budgeted cost for work scheduled (BCWS), cost variance (CV), schedule variance (SV), cost performance index (CPI), schedule performance index (SPI), interpretation of earned value indicators, error tracking, software reviews, types of review: inspections, desk checks, walkthroughs, code reviews, and pair programming.

**Unit-IV****08**

**Software Quality Assurance and Testing:** Testing objectives, testing principles, test plans, test cases, types of testing, levels of testing, test strategies, program correctness, program verification & validation, testing automation & testing tools, concept of software quality, software quality attributes, software quality metrics and indicators, the SEI capability maturity model (CMM), SQA activities, formal SQA approaches: proof of correctness, statistical quality assurance, and clean room process.

**Unit-V****08**

**Project Management and Project Management Tools:** Software configuration management: software configuration items and tasks, baselines, plan for change, change control, change requests management, version control, risk management: risks and risk types, risk breakdown structure (RBS), risk management process: risk identification, risk analysis, risk planning, risk monitoring, cost benefit analysis, software project management tools: CASE tools, planning and scheduling tools, and MS-project.

**Text Books:**

1. M. Cotterell, Software Project Management, Tata McGraw Hill Publication.
2. S. A. Kelkar, Software Project Management, PHI Publication.

**Reference Books:**

1. Royce, Software Project Management, Pearson Education
2. Kieron Conway, Software Project Management, Dreamtech Press



## MULTIMEDIA SYSTEM

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|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>3</b> | <b>0</b> | <b>0</b> |

**Course Outcomes (COs):**

Students will be able to:

- Describe the types of media and define multimedia system.
- Describe the process of digitizing (quantization) of different analog signals (text, graphics, sound and video).
- Use and apply tools for image processing, video, sound and animation.
- Apply methodology to develop a multimedia system.
- Apply acquired knowledge in the field of multimedia in practice and independently continue to expand knowledge in this field.

**Unit-I****09**

**Introduction:** Multimedia, multimedia information, multimedia objects, multimedia in business and work, convergence of computer, communication and entertainment products, stages of multimedia projects, multimedia hardware, memory & storage devices, communication devices, multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

**Unit-II****06**

**Multimedia Building Blocks:** Text, sound MIDI, digital audio, audio file formats, MIDI under windows environment, audio & video capture.

**Unit-III****09**

**Data Compression:** Huffman coding, Shannon Fano algorithm, Huffman algorithms, adaptive coding, arithmetic coding, higher order modelling, finite context modelling, dictionary based compression, sliding window compression, LZ77, LZW compression, compression ratio, lossless & lossy compression.

**Unit-IV****06**

**Speech Compression & Synthesis:** Digital audio concepts, sampling variables, lossless compression of sound, lossy compression & silence compression.

**Unit-V****10**

**Images:** Multiple monitors, bitmaps, vector drawing, lossy graphic compression, image file format animations, images standards, JPEG compression, Zig-Zag coding, multimedia database, content based retrieval for text and images. Video: Video representation, colors, video compression, MPEG standards, MHEG standard video streaming on net, video conferencing, multimedia broadcast services, indexing and retrieval of video database, and recent development in multimedia.

**Text Books:**

1. Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill.
2. Buford "Multimedia Systems" Addison Wesley.
3. Agrawal & Tiwari "Multimedia Systems" Excel.

**Reference Books:**

1. Mark Nelson "Data Compression Book" BPB.
2. David Hillman "Multimedia technology and Applications" Galgotia Publications.
3. Rosch "Multimedia Bible" Sams Publishing.
4. Sleinreitz "Multimedia System" Addison Wesley.