**MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI**

UG COURSES – AFFILIATED COLLEGES

**B.Sc Software Engineering**

(Choice Based Credit System)

(With effect from the academic year 2020-2021 onwards)

| Sem | Part I/ II/ III/ IV/V | Subject No | Subject Status | Subject Title | Contact Hrs / week | L Hrs/ week | T Hrs/ week | P Hrs/ week | C Credits |
|---|---|---|---|---|---|---|---|---|---|
| III | **III** | **15** | **Core** | **Java Programming** | **5** | **4** | **1** | **0** | **4** |
| | III | 16 | Core | Software Engineering | 5 | 5 | 0 | 0 | 4 |
| | III | 17 | Major Practical - III | Java Programming | 6 | 0 | 0 | 6 | 3 |
| | III | 18 | Allied -III | Scripting Languages | 4 | 4 | 0 | 0 | 3 |
| | III | 19 | Allied Practical - III | Scripting Languages | 4 | 0 | 0 | 4 | 2 |
| | III | 20 | Skill Based I Core | Computer Architecture | 4 | 4 | 0 | 0 | 4 |
| | IV | 21 | Non-Major Elective | 1. Fundamentals of Internet and Emerging Technologies<br>2. Basic Programming Design | 2 | 2 | 0 | 0 | 2 |
| | **Subtotal** | | | | **30** | **19** | **1** | **10** | **22** |
| IV | III | 22 | Core | Data Structures | 5 | 4 | 1 | 0 | 4 |
| | III | 23 | Major Practical - IV | Data Structures | 6 | 0 | 0 | 6 | 3 |
| | III | 24 | Major Elective - I | 1. Mobile Computing<br>2. Embedded System<br>3. Open Source | 5 | 5 | 0 | 0 | 4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Technologies | | | | | |
| | III | 25 | Allied -IV | Software Quality & Testing methods | 4 | 4 | 0 | 0 | 3 |
| | III | 26 | Allied Practical - IV | PYTHON | 4 | 0 | 0 | 4 | 2 |
| | III | 27 | Skill Based II Common | Personality Development & Yoga | 4 | 4 | 0 | 0 | 4 |
| | IV | 28 | Non-Major Elective | 1. HTML<br>2. Programming in C | 2 | 2 | 0 | 0 | 2 |
| | V | | Extension Activity | NCC, NSS, YRC, YWF | | | | | 1 |
| | **Subtotal** | | | | **30** | **19** | **1** | **10** | **23** |
| **V** | III | 29 | Core | Dot NET Technologies | 5 | 4 | 1 | | 4 |
| | III | 30 | Core | Database Management System | 5 | 5 | 0 | 0 | 4 |
| | III | 31 | Core | Software Project Management | 5 | 5 | 0 | 0 | 4 |
| | III | 32 | Major Practical - V | Dot NET | 4 | 0 | 4 | 4 | 2 |
| | III | 33 | Mini Project | | 4 | 0 | 4 | 4 | 4 |
| | III | 40 | Major Elective - II | 1. Data Mining<br>2. Cryptography<br>3. Cloud Computing | 5 | 5 | 0 | 0 | 4 |
| | III | 41 | Skill Based III Common | Computers for Digital Era | 2 | 2 | 0 | * | 2 |
| | **Subtotal** | | | | **30** | **21** | **1** | **8** | **24** |
| **VI** | III | 42 | Core | Object Oriented Software Engineering | 4 | 4 | 0 | 0 | 4 |
| | III | 43 | Core | Oracle | 4 | 3 | 1 | 0 | 4 |
| | III | 44 | Core | Operating Systems | 4 | 4 | 0 | 0 | 4 |
| | III | 45 | Core | Computer Networks and Communication | 4 | 4 | 0 | 0 | 4 |
| | III | 46 | Major Practical - VII | Oracle | 4 | 0 | 0 | 4 | 2 |

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|---|---|---|---|---|---|---|---|---|---|
| | III | 47 | Major Project | | 6 | 0 | 0 | 6 | 7 |
| | III | 48 | Major Elective - III | 1. Network Security<br>2. Software Agents<br>3. Multimedia Technologies | 4 | 4 | 0 | 0 | 4 |
| | **Subtotal** | | | | **30** | **19** | **1** | **10** | **29** |
| | **Total** | | | | | | | | **143** |

- * 10 hours of practical
- **L**-Lecture **T**-Tutorial **P**-Practical

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – III / Core-3**

# JAVA PROGRAMMING

**L T P C**

**4 1 0 4**

**Objectives:**

- To understand the basic concepts & tools of Object – Oriented Paradigm in programming
- To understand the fundamentals of applet, event – driven programming
- To build ability to develop Applet programs with tools of Java
- To mould the skills to develop software

**UNIT I Class, Objects, Inheritances, Arrays, Strings**:

Classes, Objects and methods: Defining A Class – Fields Declaration – Methods Declaration – Creating Objects – Accessing Class Members – Constructors – Methods Overloading – Static Members – Nesting Of Methods. Extending a Class – Overriding Methods – Final – Variables, Methods And Classes – Finalizer Methods. (15L)

**UNIT II Arrays, Strings, Interfaces and Packages**:

One-Dimensional Arrays – Creating An Array – Two-Dimensional Arrays – Strings.

Interfaces: Defining Interfaces – Extending Interfaces – Implementing Interfaces – Accessing Interface Variables.Java API Packages – Using System Packages – Naming Conventions – Creating Packages - Accessing A Package – Using A Package – Adding Classes To A Package – Hiding Classes – Static Import. (15L)

**UNIT IIIMultithreading and Exceptions**:

Creating Threads – Extending Thread Class – Stopping And Blocking A Thread – Life Cycle Of A Thread – Using Thread Methods – Thread Exceptions – Thread Priority – Synchronization – Implementing Runnable Interface. Managing Errors and Exceptions: Types Of Errors – Exceptions – Syntax Of Exception Handling Code – Multiple Catch Statements – Finally Statement – Throwing Our Own Exceptions – Using Exceptions For Debugging.(15L)

**UNIT IVApplet Programming**

Applet Programming: How Applets Differ From Applications? – Preparing Applets – Building Applet Code – Applet Life Cycle – Creating An Executable Applet – Designing A Web Page – Applet Tag – Adding Applet To HTML File – Running Applet - More About Applet Tag - Passing Parameters To Applets – Aligning The Display – Displaying Numerical Values .(15L)

**UNIT V Event Handling and Graphics Programming**

Getting Input from User – Event Handling**.** The Graphics Class – Drawing Lines, Rectangles, Circles, Ellipses, Arcs, Polygons – Line Graphs – Using Control Loops in Applets – Drawing Bar Charts – Introducing to AWT Package. (15L)

**TEXT BOOK:**

Programming with Java A Primer – E.Balagurusamy, McGraw Hill- Fourth Edition

**REFERENCE BOOKS:**

Java2 – Complete Reference – Herbert Schildt, McGraw Hill Publications

**L T P C**

**5 0 0 4**

# SOFTWARE ENGINEERING

## Objectives

- To understand the software engineering concepts.
- Understand the coding, testing and user interface design
- Design, develop the software projects and software reliability and quality management

### UNIT - I

Introduction - Software Engineering Discipline - Evolution and Impact - Programs Vs Software Products. Software Life Cycle Models: Use of a Life Cycle Models - Classical Waterfall Model -Iterative Waterfall Model - PrototypingModel - Evolutionary Model - Spiral Model. Software Project Management: Responsibilities of a Software Project Manager - Project Planning - Metrics for Project Size Estimation - Project Estimation Techniques -Risk Management.(15L)

### UNIT - II

Requirements Analysis and Specification: Requirements Gathering and Analysis – Software Requirements Specification (SRS) - Formal System Development Techniques. Software Design: Characteristics of a Good Software Design - Cohesion and Coupling -Neat Arrangement - Software Design Approaches.(15L)

### UNIT - III

Function-Oriented Software Design: Overview of SA/SD Methodology - Structured Analysis - Data Flow Diagrams (DFDs).Object Modeling Using UML: Overview of Object-Oriented Concepts - UML Diagrams - Use Case Model -Class Diagrams – Interaction Diagrams - Activity Diagrams - State Chart Diagram.(15L)

**UNIT - IV**

User Interface Design: Characteristics of a Good User Interface - Basic Concepts - Types of User Interfaces - Component-Based GUI Development; Coding and Testing: Coding - Testing - UNIT Testing - Black-Box Testing - White-Box Testing - Debugging -Integration Testing - System Testing.(15L)

**UNIT - V**

Software Reliability and Quality Management: Software Reliability - Statistical Testing -Software Quality - Software Quality Management System - ISO 9000.Computer Aided Software Engineering: CASE Environment - CASE support in Software Life Cycle - Characteristics of CASE Tools - Architecture of a CASE Environment. Software Maintenance: Characteristics of Software Maintenance - Software Reverse Engineering - Software Maintenance Process Models - Estimation of Maintenance Cost. Software Reuse: Issues in any Reuse Program - Reuse Approach.(15L)

**TEXT BOOK**

1. Rajib Mall, "Fundamentals of Software Engineering",3rd Edition, Prentice Hall of India Private Limited, 2008.

**REFERENCE BOOKS**

1. Rajib Mall, "Fundamentals of Software Engineering", 4thEdition, Prentice Hall of India Private Limited, 2014.
2. Richard Fairley, "Software Engineering Concepts", TMGH Publications, 2004.

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**L T P C**

**0 0 6 3**

## JAVA PROGRAMMING Lab

**Objective:**

To understand and make effective use of Java Programming to develop softwares.

1. Write a JAVA program using Multiple Constructors
2. Write a JAVA program using different types of inheritance
3. Write a JAVA program using Overriding Methods.
4. Write a JAVA program using one-dimensional arrays
5. Write a JAVA program using Two-dimensional arrays
6. Write a JAVA program implementing interface(s)
7. Write a JAVA program to create and import package
8. Write a JAVA program to create and deal multiple threads
9. Write a JAVA program with throwing your own exception
10. Write a JAVA program using Applet to Designa Web Page.
11. Write a JAVA program using Applet to Display
12. Write a JAVA program for handling mouse events

13.Write a JAVA program for handling keyboard events.

**MSU/ 2020-21/ UG-Colleges /Part - III (B.Sc. Software Engineering) / Semester – III / Allied-III**

# SCRIPTING LANGUAGES

**L T P C**

**4 0 0 3**

**Objectives:**

- To Understand the concepts of scripting languages for developing web-based projects
- Ability to understand the differences between Scripting languages and programming languages

**Unit I: Introduction to Web programming and HTML**

**Examining the Pieces of Web Programming:** Creating a Simple Web Page - Creating a Dynamic Web Page - Storing Content

**The Basics of HTML5:** Diving into Document Structure - Looking at the Basic HTML5 Elements - Marking Your Text - Working with Characters - Making a List - Building Tables

**Unit II: CSS and HTML Forms**

**The Basics of CSS3:** Understanding Styles - Styling Text - Working with the Box Model - Styling Tables - Positioning Elements

**HTML5 Forms:** Understanding HTML5 Forms - Using Input Fields - Adding a Text Area - Using Drop-Down Lists - Enhancing HTML5 Forms - Using HTML5 Data Validation

**Unit III: Advanced CSS and HTML Multimedia**

**Advanced CSS3:** Rounding Your Corners - Using Border Images - Looking at the CSS3 Colors - Adding Shadows. **HTML5 and Multimedia:** Working with Images - Playing Audio - Watching Videos

**Unit IV: JavaScript**

**JAVASCRIPT:** Knowing Why You Should Use JavaScript - Seeing Where to Put Your JavaScript Code - The Basics of JavaScript - Controlling Program Flow - Working with Functions. **Advanced JavaScript Coding:** Understanding the Document Object Model - Finding Your Elements

**Unit V: Introduction to jQuery**

**Using jQuery:** Using jQuery Functions - Finding Elements - Replacing Data - Changing Styles

**Reacting to Events with JavaScript and jQuery**: Understanding Events - Focusing on JavaScript and Events - Looking at jQuery and Events

**Text Book:**

1. PHP, MySQL & Javascript for dummies - Richard Blum, Wiley Publishing – 2018 (Book:Chapter - 1:1, 2:1, 2:2, 2:3, 2:4, 2:5, 3:1, 3:2, 3:3, 3:4)

**Reference Books:**

1. MASTERING HTML, CSS & JavaScript Web Publishing – Laura Lemay, Rafe Coburn and Jennifer Kyrnin – BPB publishing – 2016

2. Beginning HTML, XTML, CSS and Java script - Jon Duckett - Wiley Publishing

3. Web Technologics for Beginners - Ashwin Mehta - Shroff Publishers & Distributors Pvt. Ltd.

**MSU/ 2020-21/ UG-Colleges /Part - III (B.Sc. Software Engineering/ Semester – III / Allied Practical-III**

## SCRIPTING LANGUAGES LAB

**L T P C**

**4 0 0 2**

**Objectives:**

- To develop knowledge in web-based projects

1. Create a web page with HTML5 media elements.
2. Use CSS script to display different background-colour for different tags including header, footer, nav etc. in a form. Use HTML5 data validation.
3. Develop a HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluates the expression and Displays the result.
4. Write a JavaScript code to find the sum of N natural Numbers. (Use user-defined function)
5. Create a web page using two image files, which switch between one another as the mouse pointer moves over the image. Use the on Mouse Over and on Mouse Out event handlers.
6. Create a form having number of elements (Textboxes, Radio buttons, Checkboxes, and so on). Write JavaScript code to count the number of elements in a form.
7. Create a HTML form that has number of Textboxes. When the form runs in the Browser fill the textboxes with data. Write JavaScript code that verifies that all textboxes has been filled. If a textboxes has been left empty, popup an alert indicating which textbox has been left empty.
8. Create a form for Student information. Write JavaScript code to find Total, Average, Result and Grade.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – III / Skill Based I Core**

**L T P C**

**4 0 0 4**

## COMPUTER ARCHITECTURE

**Objectives**

- To understand the concept of computer architecture
- To understand the working of a central processing unit & architecture of a computer.

**UNIT I**

Basic of Computer, Von Neumann Architecture, Generation of Computer, Classification of Computers, Instruction Execution. Register Transfer and Micro operations: Register Transfer, Bus and Memory Transfers, Three-State Bus Buffers, Memory Transfer, Micro-Operations, Register Transfer Micro- Operations, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro- Operations.(12L)

**UNIT II**

Stack Organization, Register Stack, Memory Stack, Reverse Polish Notation. Instruction Formats, Three- Address Instructions, Two – Address Instructions, One - Address Instructions, Zero - Address Instructions, RISC Instructions, Addressing Modes. RISC & CISC and their characteristics.(12L)

**UNIT III**

Addition And Subtraction With Signed-Magnitude, Multiplication Algorithm, Booth Multiplication Algorithm, Array Multiplier, Division Algorithm, Hardware Algorithm,Divide Overflow, Floating-Point Arithmetic Operations, Decimal Arithmetic Operations, BCD Adder, BCD Subtraction.(12L)

**UNIT IV**

Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPU-IOP Communication. Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory, Virtual Memory, Associative Memory.(12L)

**UNIT V**

Control memory – Address sequencing – Design of Control unit. Pipelining: Parallel Processing, Pipelining - Arithmetic Pipeline, Instruction Pipeline. Multiprocessors: Characteristics of Multiprocessors, Interconnection Structure: Time-Shared Common Bus, Multi-Port Memory, Crossbar Switch, Multistage Switching Network, Hypercube Interconnection.(12L)

**Text Books:**


1. "Computer System Architecture", M.Morris Mano.
2. "Computer System Architecture", John. P. Hayes.
3. "Computer Organization, C. Hamacher, Z. Vranesic, S.Zaky.
4. "Computer Architecture and parallel Processing ", Hwang K. Briggs.


**Reference Books**


1.William Stallings, "Computer Organization and Architecture – Designing for Performance",William Stallings, Sixth Edition, Pearson Education, 2003.

2.John P. Hayes, "Computer Architecture and Organization", Third Edition, McGraw Hill, 1998.

3. "Computer Architecture – A Quantitative Approach", John L. Hennessey and David A. Patterson,Morgan Kaufmann / Elsevier Publishers, Fourth Edition, 2007.

4. "Computer Systems Design and Architecture", V.P. Heuring, H.F. Jordan, Second Edition, Pearson Education, 2004.6.Behrooz Parhami, "Computer Architecture", Oxford University Press, 2007.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – III / Non-Major Elective**

## 1. Fundamentals of Internet and Emerging Technologies

**L T P C**

**2 0 0 2**

**Course Objective:**

1. To introduce the background, drivers and history in the invention of computers so that the student gains a big picture of the subject.
2. To provide a high level understanding various branches of Computer Science so that students can detect their interest and specialization
3. To introduce the computational models such as cloud computing and make students choose one for their use
4. Understand the Artificial Intelligence technologies, Networks and Cybersecurity and its impact on human life in future
5. Introduce Computer Ethics and help the society retain human values while technology is developing.

**Unit I**

Man and Machines - Human Capability of five senses to see, hear, smell, speak and act - Basic Structure of a Computer - Data - Characteristics of a Computer-History of Computers - - Classification of Computers (6L)

**Unit II**

Application Software and Programming Languages - Application Software - Packaged Software Products (Off-the-Shelf Products) - Office Automation - Core Banking System - Enterprise Software Products – SAP - Sales Force – Oracle - CRM and ERP - Early High Level Programming Languages - Translators (Compilers and Interpreters) – FORTRAN – BASIC – COBOL – PASCAL - C Language - Web Programming Languages – HTML - Java Script - Objected Oriented Programming with C++ - C++ Language - C# Language - Java Programming - Modern Programming Language – Python - GO Language - Swift Language - Kotlin Language - R Language - Artificial Intelligence Languages - Database Management Software (6L)

**Unit III**

Digital Transformation - Data (High Value Commodity) - Digital Transformation in Business - Features of Digital Transformation - Banking and Financial Services Industry (BFSI) - Human Resource Management – Healthcare - Big Data Analytics in Healthcare - Virtual Reality Wearable medical devices - Retail Industry and CPG -Computer Networks - Basic Networking Terminologies - Node / Host - Client / Server - MAC Address - IP Address - Unicast, Multicast and Broadcast - Half Duplex and Full Duplex – Encapsulation - Network Protocols - Open System Interconnection (OSI) Model - TCP/IP Protocol Suite - Transfer Control Protocol (TCP) - User Datagram Protocol (UDP) – Ethernet - Hardware Used for Networking - Hubs and Switches – Routers - Networking Cables - Coaxial Cable - Twisted Pair Cable - Fiber Optics Cable - Network Topology - Ring Topology - Star Topology (Hub and Spoke Topology) - Bus Topology - More Topologies - Wireless Networks - Radio Waves - Micro Waves – Bluetooth – WiFi - Types of Networks - Personal Area Network (PAN) - Local Area Network (LAN) - MAN and WAN (6L)

**Unit IV**

Cyber Security - IT Assets - Risk and Vulnerabilities - Computer Security Types - Fundamental Principles of Security - Physical Safety and Security - Access Control - Biometric Access Control - Network Security - AAA Server -– Firewall – Malware – Spyware – Adware – Spamware – Virus – Ransomware – Worms - Trojan Horse - Computer Virus - Types of Computer Viruses - Antivirus Protection - Digital Signature - Cyber Crime – Hacking – Phishing - Spam e-mails - Attack using Malware - ATM Skimming – Ransomware - Fake News - Deep fake – Cyberbullying - Cyber Law (IT Law) -

Cloud Computing and Virtualization - Own Versus Hire - Benefits and Challenges of Cloud Computing – Virtualization –Hypervisor - Data Center - Hardware Platform Infrastructure - Infrastructure as a Service (IaaS) - Software as a Service (SaaS) - Platform as a Service (PaaS) - Application as a Service (AaaS) - Functions as a Service (FaaS) - Cloud Deployment Models - Private Cloud - Community Cloud - Public Cloud - Hybrid Cloud (6L)

**Unit V**

Artificial Intelligence - Machine Learning - Training Data - Machine Learning Models - Deep Learning and Neural Networks - Robotics Process Automation (RPA) - Speech Recognition -

Natural Language Processing – Bots - Natural Language Generation - Computer Vision – Biometrics - Sentiment Analysis - Artificial Intelligence Applications - Banking and Financial Fraud Detection - Medical Diagnostics - Retail Business - Autonomous Car / Driverless Car Professional Ethics in Computer - Ethics and Law - Ethical Behaviors - Professional Ethics Frameworks - Utilitarian Ethics - Deontological Ethics - Virtue Ethics, Communitarian Ethics - Ethical Issue in Computer Science - Intellectual Property Rights (IPR) - Data Protection Law - Information Security and Privacy - Software License - Open-Source Software - Freeware - Unethical Content Filtering - Technology Impact on Society (6L)

**Textbook**

Fundamentals of Internet and Emerging Technologies (2021) , C. Xavier, *New Age International Publishers Ltd.*, New Delhi., Chapters 1, 2, 3 and 9 to 16 only.

**Reference Book**


1. Introduction to Computer Science, Second Edition, ITL Education Solutions Ltd, Pearson Education
2. Introduction to Computers, Peter Norton, 7th Edition, McGraw Hill Education
3. Fundamentals of Computers, V.Rajaram, 5th Edition, PHI

## 2.BASIC PROGRAMMING DESIGN

**L T P C**

**2 0 0 2**

**Objective:**

To study the basic concepts of Programming and understand the structures of programming constructs.

**Unit I**

Computer Program: Introduction – Developing a program – Algorithm – Flowchart – Decision Tables.(6L)

**Unit II**

Program Testing and Debugging – Program Documentation – Program Paradigms: Unstructured programming, Structured programming and Object Oriented Programming – Characteristics of a Good Programming. (6L)

**Unit III**

Computer Languages: Evolution Programming Languages – Classification of Programming Languages – Generation of Programming Languages – Features of Good Programming language.(6L)

**Unit IV**

Computer Software: Software Definition – Relationship between Software and Hardware - Software Categories : System Software and Application Software – Terminology Software Firmware, Liveware, Freeware, Public Domain Software,Shareware, Commercial Software and Proprietary Software. (6L)

**Unit V**

Evolution of Internet - Internet Basics: Basic Internet Terms – Getting connected to Internet - Internet Applications – E-mail – Searching the Web – Internet and Viruses. (6L)

**Text Book:**

Introduction to Computer Science, ITL Education Solutions Limited, 2/e, Pearson

**Reference Books**:

1. Fundamentals of Computers, V.Rajaram, 5th Edition, PHI
2. IntroductiontoComputers,PeterNorton,7/e,TMH.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Core-5**

## DATA STRUCTURES

L T P C
4 1 0 4

**Objectives**

- To understand the concepts of basic data structures such as stack, Queues and Linked list.
- To have general understanding of the network structures through trees and graph.
- To make the students to understand the basic algorithms for sorting.

**Unit I**

**Basic Concepts**:- Algorithm specification – Data Abstraction – Performance Analysis.
**Arrays and Structures:-** Arrays: Abstract data type – Polynomials – Sparse Matrices – Representation of Multidimensional Arrays.
(15L)

**Unit-II**

**Stacks and Queues**:- Stacks – Queues – Evaluation of Expressions. **Linked Lists**:-
Singly Linked Lists and Chains – Linked Stacks and Queues – Polynomials: Polynomial Representation – Adding Polynomials. Sparse Matrices: Sparse Matrix Representation. – Doubly

Linked Lists.(15L)

**Unit III**

**Trees**:- Introduction – Binary Trees – Binary Tree Traversals: Inorder Traversal – Preorder Traversal – Postorder Traversal. Heaps – Binary Search Trees Forests: Transforming a Forest into a Binary Tree.(15L)

**Unit IV**

**Graphs**: - The Graph Abstract Data Type-Elementary Graph Operations – Minimum Cost Spanning Trees: Kruskal's Algorithm – Prim's Algorithm. – Shortest Paths and Transitive Closure: Single Source/ All Destination: Nonnegative Edge Costs - All Pairs Shortest Paths.(15L)

**Sor**
**Unit V**

**Sorting**:- Motivation – Insertion Sort – Quick Sort – Merge Sort: Recursive Merge Sort. – Heap Sort – External Sorting: Introduction – k-way Merging..**Hashing**:- Static Hashing: HashTables.

**Text Book**:

Fundamentals of Data Structures in C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed – Second Edition – Universities Press (India) Private Limited.

**Reference Books**:

1. Data Structures Using C, Second Edition by Reema Thareja – Oxford University Press
2. Data Structures by Dr N Jeya Prakash – Anuradha Publications

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Major Practical-IV**

## DATA STRUCTURES PRACTICAL LIST

**L T P C**

**0 0 6 3**

**Objective:** To develop skills in implementing data structure algorithms

**Each exercise should be completed within two hours.**

**It is compulsory to complete all the exercises given in the list in the stipulated time.**

1. Search an element in a list using Binary Search.
2. Implementation of Stack- Push and Pop.
3. Implementation of Queue – Enqueue and Dequeue
4. Implementation of Binary Tree Traversals using recursion.

a) Pre-order b) In-order c) Post-Order

5. Implementation of Breadth First Search algorithm.
6. Implementation of Depth First Search algorithm.
7. Implementation of Merge Sort
8. Implementation of Quick Sort

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Major Elective-I**

## 1.MOBILE COMPUTING

**L T P C**

**5 0 0 4**

**Objective:** To understand the concepts of mobile computing.

### Unit I

**Basics of Communication Technologies:** Components of a Wireless Communication System – Architecture of a Mobile Telecommunication System – Wireless Local Area Networks – Bluetooth Technology. **Introduction to Mobile Computing and Wireless Networking:** What is Mobile Computing ? Mobile Computing vs. Wireless Networking – Characteristics of Mobile Computing – Structure of Mobile Computing Application-Cellular Mobile Communication –Global System for Mobile Communications (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunications System (UMTS).(15L)

### Unit II

**MAC Protocols:** Properties required of MAC Protocols – Wireless MAC Protocols : Some Issues- A taxonomy of MAC Protocols –Fixed Assignment schemes – Random Assignment Schemes – Reservation based Schemes. **Mobile Internet Protocol:** Mobile IP – Packet Delivery – Overview of Mobile IP – Desirable features of Mobile IP- Key mechanism used in Mobile IP – Route Optimization – Dynamic Host Configuration Protocol.(15L)

### Unit III

**Mobile Transport Layer:** Overview of TCP/IP – Terminologies of TCP/IP – Architecture of TCP/IP – An overview of the operation of TCP – Application Layer Protocols of TCP – TCP in Mobile Networks. **Mobile Databases** : Issues in Transaction Processing – Transaction Processing Environment –Data dissemination – Transaction Processing in Mobile Environment – Data

Replication – Mobile Transaction Models – Rollback Process – Two-Phase Commit Protocol – Query Processing – Recovery.(15L)

**Unit IV**

**Wireless Sensor Networks:** WSN vs. MANET – Applications – Architecture of the Sensor Node – Challenges in the design of an effective WSN – Characteristics of Sensor Networks –WSN Routing Protocols –Target Coverage –Clustered Wireless Sensor Networks. **Operating Systems for Mobile Computing:** Special Constraints and requirements of Mobile O/S- A survey of Commercial Mobile Operating Systems – A Comparative study of Mobile OSs.(15L)

**Unit V**

**Mobile Application Development and Protocols:** Mobile Devices as Web Clients – WAP – J2ME– Android Application Development. **Mobile Commerce:** Applications of M-Commerce – Business-to-Business(B2B) Applications –Structure of Mobile Commerce –Pros and Cons of **M-Commerce** – Mobile Payment Systems. (15L)

**Text Book :**

Fundamentals of Mobile Computing –by Prasant Kumar Pattnaik, Rajib Mall,, PHI.

**Reference Books :**


1. Wireless and Mobile Communication, T.G. Palanivelu & R. Nakkeeran,PHI Learning Private Limited,2009
2. Wireless and Cellular Telecommunications, Third Edition William C.Y. Lee, McGraw Hill
3. Mobile Computing Technology, Applications and Service Creation, Asoke K. Talukder & Roopa R. Yavagal,TMH Publication
4. Wireless Communications and Networking made simple, Prof. Satish Jain, Vineeta Pillai, BPB Publications

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Major Elective-I**

## 2.EMBEDDED SYSTEM DESIGN

**L T P C**

**5 0 0 4**

**Objective:** To understand the concepts of Embedded Systems.

**UNIT 1**

Introduction To Embedded Systems: Introducing embedded systems - Philosophy - Embedded systems - embedded design and development process. The Hardware Side: An introduction - the core level - Representing information - Understanding numbers addresses instruction register - Register view of a microprocessor - Storage elements and Finite state Machines - concept of state and time - The state diagram - Finite state machines - A theoretical model(15L)

**UNIT 2**

**Memories and Memory Subsystem:** Classifying memory - A general Memory interface - ROM Overview - Static RAM Overview - Dynamic RAM Overview - Chip organization - Terminology - Memory interface in detail - SRAM and DRAM design - DRAM Memory interface - Memory subsystem Architecture - Dynamic memory Allocation(15L)

**UNIT 3**

**Embedded Systems Design And Devlopment**: Systems design and development - Life cycle Models - The design process - Formulating the requirements specification - System specification v/s system requirements - Partitioning and decomposing a system - Functional design - Architectural design - function model v/s architectural model - Prototyping - Archiving the project.(15L)

**UNIT 4**

**Real Time Kernels and Operating Systems**

Introduction to real time Kernels - Tasks and things - Programs and processes - The CPU is a resource

- Threads-Lightweight and heavyweight - Sharing resource - Foreground/Background systems - The operating system - The real time operating system - OS Architecture - Task and Task control blocks - Memory management(15L)

**UNIT 5**

**Perofrmance Analysis and Optimization**

Performance or Efficiency measures - Complexity Analysis - The Methodology - Analyzing code - Instruction in detail - Time - etc - - A more detailed look - Response time - Time loading - Memory loading - Evaluating performance - Thoughts on performance optimization - Performance Optimization - Tricks of the trade - Hardware Accelerators - caches and performance(15L)

**Text Book:**


1. Embedded Systems-A contemporary Design tool - James K Peckol - John Weily India Pvt Ltd - 2019


**Reference Books:**


1. Embedded Systems:Architecture and programming - Raj Kamal - TMH.
2. Embedded Systems Architecture-A comprehensive guide for Engineers and programmers - Tammy Noergaard - Elsevier Publication.
3. Programming for Embedded Systems - Dreamtech Software Team - John Wiely India pvt.Lt

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Major Elective-I**

## 3.OPEN SOURCE TECHNOLOGY

**L T P C**

**5 0 0 4**

**Objective:**

- To make the students to gain experience using open source tools, languages and frame works to prepare for careers in software development.

**UNITI**

Introduction :OpenSource,FreeSoftware,FreeSoftwarevs.OpenSourcesoftware, Public Domain Software, FOSS does not mean no cost. History : BSD,The Free Software Foundation and the GNU Project.(15L)

**UNITII**

Open Source History, Initiatives, Principle and methodologies. Philosophy:SoftwareFreedom,OpenSourceDevelopmentModelLicencesandPatents:WhatIsALicense,ImportantFOSSLicenses(Apache,BSD,GPL,LGPL),copyrightsandcopylefts,PatentsEconomics of FOSS :ZeroMarginalCost,Income-generationopportunities,Problemswithtraditionalcommercialsoftware,Internationalization (15L)

**UNITIII**

Community Building: Importance of Communities in Open Source Movement-JBoss Community- Starting and Maintaining an Open Source Project-OpenSourceHardware(15L)

**UNITIV**

Apache HTTP Server and its flavors- WAMP server (Windows, Apache, MySQL,PHP)-Apache,MySQL,PHP,JAVAasdevelopmentplatform.(15L)

**UNITV**

Open source vs. closed source Open source government, Open source ethics.SocialandFinancialimpactsofopensourcetechnology,Sharedsoftware,Sharedsource. (15L)

**TEXTBOOK(S):**


1. SumitabhaDas "Unix Concepts and Applications, McGrawHillEducation.
2. TheOfficialUbuntuBook,8thEdition.
3. KailashVadera,BhavyeshGandhi,"OpenSourceTechnology",UniversitySciencepress, 2013.


**REFERENCEBOOKS**


1. PaulKavanagh,"OpenSourceSoftware:ImplementationandManagement",ElsevierDigitalPress
2. TheLinuxDocumentationProject:http://www.tldp.orgDockerProjectHome:http://www.docker.com

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Allied-IV**

## SOFTWARE QUALITY AND TESTING METHODS

**L T P C**

**4 0 0 3**

**Objectives:**

- To understand software testing and quality assurance as a fundamental component of software life cycle
- To define the scope of SW T & QA projects
- To efficiently perform T & QA activities using modern software tools
- To estimate cost of a T & QA project and manage budgets
- To prepare test plans and schedules for a T&QA project

**UNIT I**

**Software Quality Assurance and Standards:**The Software Quality challenge, What is Software Quality, Software Quality factors, The components of Software Quality Assurance system, Software Quality Metrics, Costs of Software Quality, Quality Management Standards, Management and its role in Software Quality Assurance, SQA unit and other actors in SQA system. (12L)

**UNIT II**

**Software Testing Strategy and Environment:**Minimizing Risks, Writing a Policy for Software Testing, Economics of Testing, Testing-an organizational issue, Management Support for Software Testing, Building a Structured Approach to Software Testing, Developing a Test Strategy Building Software Testing Process: Software Testing Guidelines, workbench concept, Customizing the Software Testing Process, Process Preparation checklist.(12L)

**UNIT III**

Software Testing Techniques: Dynamic Testing – Black Box testing techniques, White Box testing techniques, Static testing, Validation Activities, Regression testing**. Software Testing Tools:**Selecting and Installing Software Testing tools – Automation and Testing Tools.(12L)

**UNIT IV**

**Testing Process :** Seven Step Testing Process – I: Overview of the Software Testing Process, Organizing of Testing, Developing the Test Plan, Verification Testing, Validation Testing. (12L)

**UNIT V**

**Seven Step Testing Process – II:**Analyzing and Reporting Test results, Acceptance and Operational Testing, Post-Implementation Analysis Specialized Testing Responsibilities: Software Development Methodologies, Testing Client/Server Systems.(12L)

**TEXT BOOK(S):**

1. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India, 2006. (Unit II, IV, V)
2. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press, 2010. (Unit III)
3. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education, 2009. (Unit I)**REFERENCE BOOK(S):**

1. Testing Computer Software, CemKaner, Jack Falk, Hung Quoc Nguyen, Wiley India, rp2012.
2. Software Testing – Principles, Techniques and Tools, M.G.Limaye, McGraw-Hill, 2009.
3. Software Testing – A Craftsman's approach, Paul C. Jorgensen, Third edition, Auerbach Publications, 2010.
4. Foundations of Software Testing, Aditya P. Mathur, Pearson Education, 2008.

**MSU/ 2020-21/ UG-Colleges /Part - III (B.Sc. Software Engineering) / Semester – IV / Allied**

**Practical-IV**

# PYTHON LAB

**L T P C**

**4 0 0 3**

**Objective:**

- To understand python programming and develop basic programs in Python

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user‟s choice.
2. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
3. Write a program (WAP) to display the first n terms of Fibonacci series.
4. WAP to find factorial of the given number.
5. WAP to find sum of the following series for n terms: 1 – 2/2! + 3/3! - - - - - n/n!
6. WAP to calculate the sum and product of two compatible matrices.
7. WAP to explore String functions.
8. WAP to create and read a CSV file and display the file contents.
9. WAP to write the text “hello python” in an existing file.
10. WAP to set background colour and draw a circle using turtle module

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Non Major Elective**

# HTML

**L T P C**

**2 0 0 2**

**Objectives:**

- To study the basic concepts of Web design using HTML.
- To learn the various tags used in HTML
- To make use of Dynamic HTML

**Unit I:**

Introduction to HTML: Designing a Home page – History of HTML – HTML generations- HTML Documents-Anchor tag –Hyper links –Sample HTML documents.(6L)

**Unit II :**

Head and Body section: Header Section –Title-Prologue-Links-Colorful web page – Comments lines Designing the body: Heading printing –Aligning the headings-Horizontal rule- paragraph-Tab settings-Image and pictures-Embedding PNG format Images(6L)

**Unit III:**

Ordered and unordered lists: List-Unordered lists- headings in a list – ordered lists- Nested lists. Table handling: Tables- table creation in HTML- Width of the Tables and cells-Cells spanning multiple rows/Columns- Coloring cells – Column specification(6L)

**Unit IV:**

Frames: Frame set - Definition – Frame definition –Nested Frames Web Page Design Project : Frameset Definition – Animals – Birds – Fish Forms: Action attributes –Method attributes – Enctype attribute – Drop down list- sample forms(6L)

**Unit V**:

DHTML and Style sheets: Defining styles –Elements of styles- Linking a style sheet to an HTML document –Inline styles –Internal & External style sheets –Multiple styles(6L)

**Text Book:**

World Wide Web Design with HTML, C. Xavier, TMH, 2001

**Reference Book:**

1. Internet & World Wide Web, H.M.Deital, P.J.Deital & A.B.Goldberg, Pearson Education
2. Fundamentals of information technology, Mathew's lenon and Alxis leon, Vijay Nicole privatelimited, Chennai.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – IV / Non Major Elective**

## PROGRAMMING IN C

L T P C

2 0 0 2

**Objectives:**

To obtain knowledge about the structure of the programming language C and to develop the program writing and logical thinking skill.

**UNIT I**

C Declarations –Introduction-Character Set-C tokens-Keywords and Identifiers- Constants-Variables-Data types- Declaration of Variables- Initializing Variables- Dynamic Initialization-Type Modifiers- Type Conversion- Constant And Volatile Variables

**Operators and Expressions:-** Introduction – Arithmetic Operators – Relational Operators – Logical Operators – Assignment Operators – Increment and Decrement Operators – Conditional Operator – Bitwise Operators – Special Operators – Arithmetic Expressions – Evaluation of Expressions – Operator Precedence.(6L)

**Unit II**

**Input and Output in C:** Introduction – Formatted Functions – Flags, widths and Precision with Format String – Unformatted Functions – Commonly used Library functions. **Decision Statements :** Introduction – Simple IF statement – The IF…Else Statement — Nesting of IF…Else Statements — The ELSE IF ladder — The Break Statement – The Continue Statement – The Goto Statement – The Switch Statement.(6L)

**Unit III**

**Loop Control:-** Introduction –The WHILE Statement – The DO Statement – The FOR statement – Nested FOR Loops. **Arrays :-** Introduction – One-dimensional arraysDeclaration of One-dimensional arrays – Initialization of One-dimensional arrays –Array terminology - Two-dimensional arrays – Initialization of Two-dimensional arrays.(6L)

**Unit IV**

**Strings and Standard functions:-** Introduction – Declaring and Initializing String Variables – Display of strings in different formats – String Standard functions – String Conversion Functions.(6L)

**Unit V**

**Functions:-** Introduction – Basics of a function - Function definition – The Return statement Types of functions – Call by Value and Reference – Function as an argument – Function with operators – function and decision statements – function and loop statements – functions with arrays.(6L)

**Text Book:**

Programming in C – 3th Edition by Ashok Kamthane – Pearson Education

**Reference Book:**

1. Computer Basics and C Programming by V. Rajaraman – PHI Learning Private Limited
2. Programming with C, Third Edition, Byron S Gottfried, McGraw Hill Education Private Limited.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – V / Core-7**

# DOT NET TECHNOLOGIES

**L T P C**

**4 1 0 4**

**OBJECTIVES:**

- To highlight the features of ASP.NET and apply it to develop various applications.
- To understand the concepts of .Net framework as a whole and the technologies that
  - constitutes the frame work.
- To make the students to get experience and be ready for the large scale projects in IT
  - industry.

**Unit I**

The .NET Platform and the Web: The Web Client/Server Model – Components of ASP.NET and the .NET Framework – Overview of Internet Information Server – Overview of ASP.NET – The .NETCommon Language Runtime and Class Library – Managed Components in .NET – Web Services – Language Independence in the .NET Framework – COM+ Component Services and .NET – Direction andplans for .NET. The VB.NET: What is VB.NET? – First VB application – Variables, Constants and Operators– Modularizing Code – Functions and Subroutines – Controlling Program Flow – Handling Errors and Exceptions – Object Oriented Programming – Multithread Programming**.** (15L)

**Unit II**

Working with ASP.NET: The features of ASP.NET – The Anatomy of ASP.NET Pages –Introducing Web Forms – VS.NET Web Applications and other IDE Basics – Separating Content and Code – the Code-Behind Feature – Application Configuration – Using HTML Forms – Using Web Controls – Web Controls for displaying and formatting data –Web Controls for creating buttons – Web control for

inputting text –Web controls for selecting choices – Web controls for creating lists – Miscellaneous Basic Controls –Creating a simple ASP.NET Application – ASP.NET Page Directives – ASP.NET Rich Controls – Validation Controls – Data List Controls – User Controls - Saving state with the StateBag Object – ASP.NET IntrinsicObjects. (15L)

**Unit III**

Using the .NET Framework Class Library: Common Features of the .NET Framework Class

Library – Using Data Collections – Handling File Input/output and Directories – Watching the File System for Changes – Using the Windows Event Log – Working with Active Directory Services – Using Message Queues – Communicating with Servers on the Internet – Manipulating XML Data – Sending Internet E-mail. (15L)

**Unit IV**

Building .NET Managed Components for COM+: The concept of Managed Code Execution – The

Common Language Runtime – COM+ Component Services – Using VB.NET to develop Managed

Components – Serviced Components – Building VB.NET Serviced Components. Building Web Services:The need for Web Services – Overview of Web Services – Web Service Description Language – Web Service Wire Formats – Web Services Discovery – Creating a simple Web Service – Calling Web Services with Proxy Classes – Creating a Client for a Web Service – Managing State in Web Services – Using Transactions in Web Services. (12L)

**Unit V**

Accessing Data with ADO.NET: Overview of Data Access on the Web – ADO.NET: The next

generation of Data-Access Technology – ADO.NET Programming Objects and Architecture – Displaying Database Data – Programming with the DataList and DataGrid Controls – Working with the DataSet and DataTable Objects – Maintaining Data Integrity with the DataRelation Class – Using Manual Database Transactions – Working with Typed DataSet Objects. Securing .NET Applications: Windows Security – IIS Authentication and Authorization Security – A crash course in Cryptography – Implementing Data Encryption – ASD.NET Authentication Security. (12L)

**Text Book**

ASP.NET and VB.NET Web Programming –by Matt J. Crouch, Pearson.

**Reference Books**

1. Upgrading Microsoft Visual Basic 6.0 to .NET - by d Robinson, Michael Bond, Robert Ian Oliver, WP

Publishers.

3. Visual Basic.NET - by Shirish Chavan, Pearson

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – V / Core-7**

## DATABASE MANAGEMENT SYSTEM

L T P C
5 0 0 4

**Objectives:**

To learn the fundamental data models and conceptualize and depict a database system using ER diagram

To make a study of SQL and relational database design using Oracle

**UNIT I**

**Introduction**: Database - system applications-Purpose of Database Systems - View of Data- Database languages -Relational Databases - Database Design - Data Storage and Querying - Transaction Management - Database Architecture - Data Mining and Information Retrieval-Specialty Databases - Database Users and Administrators. (15L)

**UNIT II**

**Introduction to the Relational Model and Introduction to SQL: Structure** of Relational Databases - Database Schema-Keys-Schema Diagrams- Relational Query Languages-Relational Operations-Overview of the SQL Query Language -SQL Data Definition-Basic Structure of SQL Queries (15L)

**UNIT III**

**SQL operations and Intermediate SQL :** Additional Basic Operations-Set Operations-Null values-Aggregate functions- Nested Sub queries- Views - Integrity Constraints - SQL Data Types and Schemas .(15L)

**UNIT IV**

**Database Design using E-R Model & Relational Database Design**: Overview – E-R Moel – Complex attributes – Mapping Cardinalities – Primary key – Removing redundant attributes – Reducing E-R diagrams to schema –Extended E-R features –Features of goo Relational design – Decomposition – Normal forms – Functional Dependency – Decomposition Functional & Multi value Dependencies – More Normal Forms**.** (15L)

**UNIT V**

**Implementation using Oracle:** Creating Table-Modifying Table-Creating SEQUENCE- Creating a Views - PL/SQL- Stored procedures and Functions.(15L)

**Text Book:**


1. Database System Concepts – Abraham Silberschatz, Henry F.Horth and S.Sudarashan, McGraw-Hill International Seventh Edition.
2. Oracle8i Jose A.Ramalho BPB Publications

   **Reference Books**:1. Database Management Systems, R.Panneerselvam, PHI Learning Private Limited

   2. Database Management Systems, Ramakrishnan and Gehrke, Mc Graw Hill Publications

   3. Relational Database Management Systems,P. Simon Navis, Ave Maria Publications

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – V / Core-7**

# SOFTWARE PROJECT MANAGEMENT

L T P C

5 0 0 4

**Objectives:**

- To outline the need for Software Project Management
- To highlight different techniques for software cost estimation and activity planning.

## Unit I -PROJECT EVALUATION AND PROJECT PLANNING

Importance of Software Project Management –Activities Methodologies –Categorization of Software Projects –Setting objectives –Management Principles –Management Control –Project portfolio Management –Cost-benefit evaluation technology –Risk evaluation –Strategic program Management – Stepwise Project Planning.(12L)

## Unit II -PROJECT LIFE CYCLE AND EFFORT ESTIMATION

Software process and Process Models –Choice of Process models –mental delivery –Rapid Application development –Agile methods –Extreme Programming –SCRUM –Managing interactive processes –Basics of Software estimation –Effort and Cost estimation techniques –COSMIC Full function points – COCOMO II A Parametric ProductivityModel –Staffing Pattern.(12L)

## Unit III –ACTIVITY PLANNING AND RISK MANAGEMENT

Objectives of Activity planning –Project schedules –Activities –Sequencing and scheduling –Network Planning models –Forward Pass & Backward Pass techniques –Criticalpath (CRM) method –Risk identification –Assessment –Monitoring –PERT technique –Monte Carlo simulation –Resource Allocation –Creation of critical patterns –Cost schedules. (12L)

**Unit IV –PROJECT MANAGEMENT AND CONTROL**

Framework for Management and control –Collection of data Project termination –Visualizing progress – Cost monitoring –Earned Value Analysis-Project tracking –Change control-Software Configuration Management –Managing contracts –Contract Management..(12L)

**Unit V -STAFFING IN SOFTWARE PROJECTS**

Managing people –Organizational behavior –Best methods of staff selection –Motivation –The Oldham-Hackman job characteristic model –Ethical and Programmed concerns –Working in teams –Decision making –Team structures –Virtual teams –Communications genres –Communication plans.(12L)

**Text Book:**

Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management –Fifth Edition, McGraw Hill, New Delhi, 2012

**Reference Books:**


1. Robert K. Wysocki "Effective Software Project Management" –Wiley Publication,2011.
2. Walker Royce: "Software Project Management"-Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" –McGraw Hill Education (India), Fourteenth Reprint 2013.


**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – V / Major Practical-V**

**DOT NET PRACTICAL**

L T P C

0 0 4 2

**Objective:** Learn to program in Dot Net and to develop web pages using ASP.NET

Each exercise should be completed within two hours.

It is compulsory to complete all the exercises given in the list in the stipulated time.

1. Build a homepage for XYZ Corporation using Web Controls.
2. Create a login page using user control in a web form.
3. Create a simple multiple choice questionnaire. Submit the answers and display the score.
4. Develop a project to input data through a web form to a database and retrieve the data. Use the calendar control to input date.
5. Develop a project to input data through a web form to a database and validate the data. Use the Required Field Validator and RangeValidator Controls.
6. Check whether a given word or phrase is a palindrome using Web Service.
7. Create an online photo gallery using DataList and DataGrid Controls.
8. Develop code to send email from ASP.NET

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – V / Major Elective -II**

## 1.DATA MINING

L T P C
5 0 0 4

**Objectives:**

- To understand and implement classical models and algorithms in data warehousing and data mining.
- To analyze the data, identify the problems and choose the relevant models and algorithms to apply.
- To assess the strength and weaknesses of various methods and algorithms and analyze the

behaviour.

**UNIT I**

**DATA WAREHOUSING – Data warehousing Components:** Overall Architecture - Datawarehouse Database- Sourcing, Acquisition, Cleanup, and Transformation tools – Metadata - Access Tools - Data Marts - DataWarehouse Administration and Management - Information Delivery System – **Building a Data warehouse:** Business Considerations : Return on Investment - Design Considerations - Benefits of Data Warehousing.(15L)

**UNIT II**

**BUSINESS ANALYSIS -T**ools categories -The Need for Applications - Need of OLAP - Multidimensional Data Model - OLAP Guidelines - Multidimensional versus Multirelational OLAP - Categorization of OLAP Tools - OLAP Tools and the Internet.(15L)

**UNIT III**

**DATA MINING -** Introduction – What is Data Mining? – Kinds of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives –Integration of a Data Mining System with a Data Warehouse – Issues – Data **Preprocessing:** Why Preprocess the Data?- Data Cleaning-Data Integration and Transformation.(15L)

**UNIT IV**

**ASSOCIATION RULE MINING AND CLASSIFICATION** - Mining Frequent Patterns, Associations and Correlations — Basic Concepts-: **Frequent Itemset Mining Methods** — The Apriori Algorithm — Mining VariousKinds of Association Rules **— Classification and Prediction** - What Is Classification? What Is Prediction? - Classification by Decision Tree Induction : Decision Tree Induction - Bayesian Classification : Bayes' Theorem - Naïve Bayesian Classification – Rule Based Classification : Using IF-THEN Rules for Classification - Rule Extraction from a Decision Tree –Classification by Backpropagation : A Multilayer Feed-Forward Neural Network - Defining a Network Topology – Backpropagation – Prediction : Linear Regression - Nonlinear Regression.(15L)

**UNIT V**

**CLUSTER ANALYSIS:** What Is Cluster Analysis? - Categorization of Major clustering Methods – Partitioning Methods : K means –Hierarchical Methods : Agglomerative and Divisive Hierarchical Clustering-– Density-Based Methods-DBSCAN- Data Mining Applications.(15L)

**Text Books**

1. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", McGraw ― HillEdition, Tenth Reprint 2007.

2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier,2007.

**Reference Books**

1. Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education2007.

2. Insight into Data Mining Theory and Practice ― K.P.Soman, Shyam Diwakar, V.Ajay, Prentice Hall ofIndia, 2008.

3. Introduction to Data Mining with Case Studies by G.K.Gupta, PHI 3rd Edition, 2015.

## 2.**CRYPTOGRAPHY**

**L T P C**

**5 0 0 4**

**Unit-I**

Services,machanisms and attack –The OSI security architecture-A model for network Security – Symmetric Cipher model – Substitution techniques – Transposition techniques – Simplified DES – Block Cipher principles – the strength of DES – Block Cipher design principles and modes of operation.(15L)

**UNIT II**

Triple DES – Blow fish – RC5 – Advanced Symmetric Block Ciphers – RC4 Stream Cipher Confidentiality using Symmetric encryption – Introduction to Number theory – Public _ Key cryptography and RSA.(15L)

**UNIT III**

Key Management – Diffie Hellman Key exchange – Message authentication and hash function – Hash algorithms – Digital Signatures and authentication protocols – Digital signature standard.(15L)

**UNIT IV**

**Authentication applications – Pretty good privacy – S\MIME – IP security – Web** security considerations – Secure sockets Layer -Transport layer security – Secure Electronic transaction.(15L)

**UNIT V**

Intruders – intrusion detection – Password management – Viruses and Related threats – Virus countermeasures – Firewall design principles - Trusted Systems.(15L)

**Textbook :**

William Stallings, “Cryptography and Network security Principles and Practice”, Fourth edition, Pearson Education Asia.

**References:**


1. Roberta Bragg, Mark Rhodes – Qusely, Keith Strassberg, "Network Security", McGraw-Hill, 2004.
2. Greg Holden, "Guide to Network Defense and counter measures", Thomson Course Technology, 2003.


## 3.CLOUD COMPUTING

**L T P C**

**5 0 0 4**

**UNIT I:**

Introduction to cloud computing- History of cloud computing. Fundamentals of the cloud computing ecosystem. Cloud computing characteristics. Technical characteristics of cloud computing Basic characteristics of cloud computing- Advantages and disadvantages of cloud computing. Comparison of traditional and cloud computing paradigms. Cluster computing- Grid computing.. Cloud computing- Evaluating the cloud's business impact and economics Business drivers of cloud computing adoption. Future of the cloud (FoC).

Cloud Services and Deployment Models. Objectives. Cloud deployment models. Public (external) cloud. Private/Internal/Corporate cloud. Hybrid cloud. Cloud Service Models- Infrastructure-as-a-Service (laas) Platform-as-a-Service (Paas). Software as a-Service (Saas) Cloud infrastructure mechanisms Logical network perimeter (LNP) Virtual server. Cloud storage devices (CSD) Cloud usage monitor -Resource replication. Ready-made environment. Cloud service management.(15L)

**UNIT II:**

Cloud Computing Architecture.. Objectives. Cloud computing architecture design principles.. Cloud computing life cycle (CCLC). Phase 1- Architect. Phase 2- Engage Phase 3- Operate.. Phase 4- Refresh .Cloud computing reference architecture Load balancing approach Mobile cloud computing (MCC). Mobile computing features.. Challenges.. Mobile cloud computing architecture.

Virtualization Technology. Objectives. Understanding virtualization Adopting virtualization. Techniques of virtualization. How virtualization works? XEN- Kernel-based virtual machine (KVM). VMware. Virtual Box – Citrix.Types of Virtualization Data virtualization-Desktop virtualization -CPU virtualization Network virtualization. Storage virtualization -Server virtualization. Virtualization in Cloud (15L)

**UNIT III:**

Service oriented Architecture Objectives SOA foundation.. Web Services and SOA .SOA communication. SOA components. SOA Infrastructure. Need of SOA. Business Process Management (BPM).Business Process Management Platform as a Service - BPM PaaS Business Process as a Service-BPaaS.

Cloud Security and Privacy... Objectives. Cloud security - Cloud CIA security model.. Data confidentiality Data integrity.. Data availability., Cloud computing security architecture Service provider security issues. Security issues in virtualization. Cloud legal issues . Performance monitoring and management of cloud services Legal issues in cloud computing Data security in cloud .The cloud risk management framework. Risk management process for cloud consumers- Requirement for risk management in ISO/IEC 27001- Data privacy risks in the cloud. Availability risks. Service provisioning risks . (15L)

**UNIT IV:**

Business continuity and disaster recovery Disaster recovery requirements... Mechanisms for cloud disaster recovery. Disaster recovery as a service. The cloud disaster recovery architecture. Challenges of the cloud disaster recovery. Threats in cloud. Security techniques for threats protection. Cloud service level agreements (SLA) practices Components of a cloud SLA. Types of SLAS. Cloud vendors. Issues of Quality of Cloud Services. Techniques for providing QoS to the cloud applications. Migration of a local server into cloud.. Preliminary checklist/planning for migration. Migration steps. Types of migration for cloud-enabled applications.. Trust management. Trust management evaluation attributes. Cloud trust management techniques

Cloud Computing Applications.. Objectives. Introducing cloud computing applications Google App Engine. Google Apps. Gmail. Google Docs.. Google Calendar Google Drive. Google Cloud Data store. Drop box Cloud. Apple iCloud Microsoft Windows Azure Cloud. Amazon Web Services (AWS) Amazon Elastic Compute Cloud (Amazon EC2) Amazon Simple Storage Service (S3). (15L)

**UNIT V:**

Cloud Computing Technologies, Platforms and Services. Objectives. High-performance computing with cloud technologies. Message Passing Interface (MPI).. Map Reduce programming model. Dryad and DryadLINQ.. Eucalyptus cloud platform. Components of Eucalyptus OpenNebula cloud platform. Layers of OpenNebula Features of OpenNebula. OpenStack cloud platform.. OpenStack components Benefits of Open Stack.. Nimbus

Cloud Computing Platform Features of Nimbus. The Apache Hadoop ecosystem

Architecture of IHladoop Major components of Hadoop. Hadoop and cloud..

Adoption of Cloud Computing. Objectives. Adoption of cloud computing in the current era Factors affecting cloud computing adoption. Technological factors. Organizational factors Environmental factors.. Cloud computing existing areas of application.. Cloud computing in education. Cloud computing in healthcare. Cloud computing in politics. Cloud computing in business. Cloud computing in agriculture. Case studies Cloud computing adoption in Sub-Saharan Africa. Cloud computing adoption in India. Cloud computing certifications Google Cloud Certifications.. IBM Cloud Certifications.. Amazon Web Services (AWS) Cloud Certifications.(15L)

**TEXT BOOK:**

Cloud Computing, Kamal Kant Hiran,Ruchi Dosai, Temitayo Fagbola,Mehul Mahrishi, BPB publication, First edition 2019.

**REFERENCE BOOK:**


1. Cloud Computing, V. K. Pachghare, PHI Learning Pvt Ltd, 2016
2. 2 Cloud Computing, Anthony T.Velte, Toby J.Velte, Pobert Elsenpeter, TMH, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley Publishing, Inc.


3 1

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – VI / Core-9**

**OBJECT ORIENTED SOFTWARE ENGINEERING**

**L T P C**

**4 0 0 4**

**Objective**

To provide an in-depth knowledge of the Software Life cycle with Object Oriented approach.

**Unit-I**

Introduction to Software Engineering: Software Engineering Development, Software Engineering Development, Software Life Cycle Models, Standards for developing life cycle models.

**Unit-II**

Object Methodology & Requirement Elicitation: Introduction to Object Oriented Methodology, Overview of Requirements Elicitation, Requirements Model-Action & Use cases, Requirements Elicitation Activities, Managing Requirements Elicitation

**Unit-III**

Architecture: Model Architecture, Requirements Model, Analysis Model, Design Model, Implementation Model, Test Model

Modeling with UML: Basic Building Blocks of UML, A Conceptual Model of UML, Basic Structural Modeling, UML Diagrams

**Unit-IV**

System Analysis: Analysis Model, Dynamic Modelling & Testing

System Design: Design concepts & activities, Design models, Block design, Testing

**Unit-V**

Testing Object Oriented Systems: Introduction, Testing Activities & Techniques, The Testing Process, Managing Testing -Case Studies

**Text Books:**

1. Stephen R. Scach, “Classical & Object Oriented Software Engineering with UML and Java”, McGraw Hill, 1999.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Software Engineering) / Semester – VI / Core-10**

## 1.INTERNET OF THINGS

**L T P C**

**4 0 0 4**

**Objective:**

- To give a brief idea about IOT working
- To make the students understand the Architecture of IOT

**UNIT I**:

Fundamentals of Internet of Things: Introduction – Characteristics of IoT – The Physical Design of IoT – Iot Architecture an Components – Logical design of IoT – Communication Models – IoT Communication API – IoT Architecture and Protocols – Introduction –Fog based Architecture of IoT – Near Field Communication – Wireless Sensor Networks – IoT Network protocol stack – IoT technology stack – Blue tooth – Zig Bee – and 6LowPAN.(12L)

**UNITII:**

Programming Framework for IoT: Interoperability – Programming Paradigm – Assembly – Introduction to Arduino Programming – Introduction to Python Programming – Introduction to Raspberry Pi . Virtualization: Introduction – Types – Virtualization and IoT – Embedded Virtualization.(12L)

**UNIT III**:

IoT Application Area: Introduction – Homes – Health care – Agriculture – Military applications – Politics – Constructions – Other application areas . Cloud an IoT : Introduction – Cloud – IoT – Difference between cloud and IoT – Cloud IoT architecture –challenges.(12L)

**UNIT IV**:

Smart City using IoT: Introduction – Concept – The emergence – Dimensions and Components – Design strategies – Factors affecting automation – IoT applications in smart cities – Education – E-governance – Industry . IoT Use Cases: Industrial IoT Use Case – IoT and smart energy – Smart transportation – Smart health – Smart home – Smart Education system – Governance use case – Smart cities.(12L)

**UNIT V**:

Network Security for IoT and M2M communications: Introduction – Network Technologies for IoT and M2M – Security for IoT and M2M Technologies – Securities in IETF M2M network Technologies – Security in ETSI M2M Network Technologies – Other M2M standard Efforts.(12L)

**Text Books**:

1. Internet of Things – Principles, Paradigms and Applications of IoT by Dr.Kamlesh Lakhwani, Dr.Hemant Kumar Gianey, Joseph Kofi Wireko, Kamal Kant Hiran (BPB publication First Edition 2020)
2. Internet of Things(IoT) Systems and Applications By Jamil Y . Khan & Mehmet R.Yuce Jenny Stanford Publishing.

**Reference Book**

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

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## OPERATING SYSTEMS

**L T P C**

**4 0 0 4**

**Objectives:**

- To acquire the fundamental knowledge of the operating system architecture and components and to know the various operations performed by the operating system.
- Understand the basic working process of an operating system.
- Understand the importance of process and scheduling.
- Understand the issues in synchronization and memory management.

**Unit I**

**Introduction:** What Operating system do – Computer System Organization – Computer System Architecture – Operating System Structures- Operating System Operation. **System Structures:** Operating System Services – System Calls – System Programs – Operating System Design and Implementation- Operation System Generation- System Boot. (12L)

**Unit II**

**Process Concept:** Process Concept- Process Scheduling –Operation on Processes- Inter Process Communication- Example of IPC System – Communication in Client – Server system. **Process Scheduling :** Basic concept-Scheduling criteria- Scheduling algorithm-Thread scheduling-Multiple Processor Scheduling-Real Time CPU Scheduling-Operating system example- Algorithm evaluation. (12L)

**Unit III Synchronization:** Background - The Critical section problem-Peterson's solution - Semaphores – Classic problems of Synchronization. **DeadLocks:** System model-Deadlock Characterization-Methods for handling deadlocks- Deadlock Prevention-Deadlock Avoidance-Deadlock detection - Recovery from deadlock. (12L)

**Unit IV Memory Management:** Background – Swapping - Contiguous Memory allocation – Segmentation – paging. **Virtual Memory Management :** Background - Demand paging - Copy and Write-page replacement- Allocation of Frames - Thrashing. (12L)

**Unit V File System :** File Concept-Access Method-Directory and Disk Structure--File Sharing-Protection**. Implementing File System:** File System Structure - File System implementation-Directory implementation- Allocation Methods - Free Space Management**. Mass Storage Structure:** Overview of Mass Storage Structure- Disk Structure - Disk Scheduling - Disk Management. (12L)

**Text Book:**

Operating System Concepts – Abraham Silberscartz, Peter Baer Galvin, and Greg Gange. Addision Wesley Publishing Company – Ninth Edition.

**Reference Books:**

1. Operating System: Internal and Design Principles – Fifth Edition, William Stalling ,PHI Learning Private Limited.

2. Understanding Operating Systes: Ida M.Flynn ,Ann MclverMcHoes.

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## COMPUTER NETWORKS AND COMMUNICATION

**L T P C**
**4 0 0 4**

**Unit I**

**Introduction -** Data communication – Networks-the Internet –Protocols and Standards.

**Network Models** –Layered tasks –OSI model- layers in OSI model-TCP/IP protocol Suit-Addressing. (12L )

**Unit II**

Physical layer – Analog and digital – Transmission Impairment –Data rate limits- Performance-Transmission mode -Bandwidth Utilization- Multiplexing. Transmission media – Guided and Unguided media.(12L)

**Unit III**

Switching – Circuit Switched Network-Datagram Network – Virtual Circuit Network. Using telephone and cable networks – Telephone Network- Dial-Up Modem–Digital Subscriber line – Cable TV Network - Cable TV for Data transfer. (12L)

**Unit IV**

Data Link Layer :Error Detection and Correction- Introduction- Checksum. Data link control-Framing-Flow and Error Control-Protocols-Noiseless Channels-Noisy Channels. Wired LANs-IEEE standards-Standard Ethernet- Changes in the Standard – Fast Ethernet-Gigabit Ethernet.(12L)

**Unit V**

Wireless LANs: IEEE 802.11-Blue tooth. Connecting LANs - Connecting devices. Wireless WANs: Cellular Telephony, Satellite Networks. Network Layer- IPv4 Address-IPv6 Address-Internetworking. Transport Layer- Process to Process delivery –UDP-TCP. Application Layer-Name space-DNS. (12L)

**Text Book**

Data Communication and Networking –"BEHROUZ A FOROUZAN ",The McGraw- Hill- 4th edition.

**References**

1. Data Communication and Computer Networks – " PrakashC.Gupta

2. Computer Networks Protocols,Standards and Interfaces- " Uyless Black

3. Data Communications and Computer Networks – Brijendra Singh

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## ORACLE LAB

**L T P C**

**0 0 4 2**

**Objective:**

1. To acquire skills in SQL statements with various constructs
2. To acquire skills in PL/SQL Programming

**Each exercise should be completed within two hours.**

**It is compulsory to complete all the exercises given in the list in the stipulated time.**

1. Create an employee database with tables department, employee details, address, pay details andproject details. Alter the tables and add constraints relevant to the fields in the tables. Insert records into all the tables.
2. Create queries to retrieve relevant information from a table.
3. Create a table from the existing tables.
4. Develop queries to retrieve information from more than one table.
5. Develop summary queries to retrieve relevant information from the tables.
6. Write a PL/SQL program to print multiplication table
7. Write a PL/SQL program to check whether given string is palindrome or not
8. Write a PL/SQL program to find factorial of numbers using function and procedure.

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## 1.NETWORK SECURITY

**L T P C**

**4 0 0 4**

### Unit-I

Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher PrinciplesDES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality.(12L)

### Unit-II

Number Theory – Prime number – Modular arithmetic – Euclid's algorithm - Fermet's andEuler's theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography.(12L)

### Unit-III

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.(12L)

### Unit-IV

Authentication applications – Kerberos – X.509 Authentication services - E- mail security – IP security - Web security(12L)

### Unit-V

Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical

implementation of cryptography and security(12L)

**Text Book:**

1. William Stallings, "Cryptography & Network Security", Pearson Education, Fourth Edition 2010.

**Reference Books:**

1. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security, Private communication in public world", PHI Second Edition, 2002.
2. Bruce Schneier, Neils Ferguson, "Practical Cryptography", Wiley Dreamtech India Pvt Ltd, First Edition, 2003.
3. Douglas R Simson "Cryptography – Theory and practice", CRC Press, First Edition, 1995.

## 2.SOFTWARE AGENTS

**L T P C**

**4 0 0 4**

**Objective :**

- To gather knowledge about the basic concepts of intelligent agents, Mobile agents, agent security and simple construction tools.

**Unit I**

AGENTS - OVERVIEWAgent Definition - Agent Programming Paradigms - Agent Vs Object - Abstract and concrete Architecturesfor Intelligent Agents - Mobile Agents.(12L)

**Unit II**

MULTIAGENT SYSTEMS AND SOCIETIES OF AGENTSIntroduction - Agent Communications - Agent Interaction Protocols - Societies of Agents - Learning:Introduction - Learning and Activity Coordination - Learning about and from other Agents - Learning andCommunication.(12L)

**Unit III**

AGENT COMMUNICATION LANGUAGESAgent Knowledge representation - KQML - KIF - Agent adaptability - Belief Desire Intention -BDIArchitecture. (12L)

**Unit IV**

AGENTS AND SECURITYAgent Security Issues - Mobile Agents Security - Protecting Agents against malicious hosts - UntrustedAgent - Black Box Security - Authentication for agents - Security issues.(12L)

**Unit V**

AGENT CONSTRUCTIONMobile agent with java: Agent characteristics of java - Aglet model - Aglet package - Anatomy of an Agent- Agent Design Pattern: classification - Master Slave Pattern - Itinerary pattern.(12L)

**Text Books**

1.Gerhard Weiss, "Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence", MITPress, USA, 2012.

2.Bradshaw, "Software Agents", MIT Press, USA, 2010.

## 3.MULTIMEDIA TECHNOLOGIES

**L T P C**

**4 0 0 4**

**UNIT I**

What is Multimedia : Definition – Where to use Multimedia - Delivering Multimedia . Text: About Fonts and Faces - Using Text in Multimedia - Computers and Text - Font Editing and Design Tools - Hypermedia and Hypertext. (12L)

**UNIT II**

Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images - Color - Image File Format Sound: The Power of Sound - Digital Audio - Midi Audio - Midi vs. Digital Audio - Multimedia System Sounds - Audio File Formats -Vaughan's Law of Multimedia

Minimums - Adding Sound to Multimedia Project. (12L)

**UNIT III**

Animation: The Power of Motion - Principles of Animation - Animation by Computer - Making Animations that Work. Video: Using Video – How Video Works and is Displayed - Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video. (12L)

**UNIT IV**

Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs - The Software Needs - Authoring Systems Needs. Multimedia Skills: The Team Planning and Costing: The Process of Making Multimedia - Scheduling - Estimating - RFPs and Bid Proposals. (12L)

**UNIT V**

Designing and Producing: Designing – Producing - Content and Talent: Acquiring Content - Ownership of Content Created for Project - Acquiring Talent Delivering: Testing – Preparing for Delivery - Delivering on CD-ROM - Delivering on DVD – Wrapping it Up – Delivering on World Wide Web. (12L)

**Text Book**

1. "Multimedia: Making It Work", 8th Edition - Tay Vaughan, Osborne/McGraw- Hill, 2001.

**Reference Book**

1. "Multimedia Computing, Communication & Applications"- Ralf Steinmetz & Klara Nahrstedt, Pearson Education, 2012.
2. “Multimedia Technology and Applications” – David Hillman, Galgotia Publications Pvt Ltd (19 February 1998