M.Sc. (COMPUTER SCIENCE) 1ST SEM.

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
MCAP3- 101	Information Management	4	1	0	40	60	100	5
MCAP3- 102	Object Oriented Programming Using C++	4	1	0	40	60	100	5
MCAP3- 103	Computer Organization and Assembly Language	4	1	0	40	60	100	5
MCAP3- 104	Operating System	4	1	0	40	60	100	5
MCAP3- 105	Professional Communication	3	1	0	40	60	100	4
MCAP3- 106	Software Lab. – I (Based on MCAP3-102)	0	0	4	60	40	100	2
MCAP3- 107	Software Lab. – II (Based on MCAP3- 104)	0	0	4	60	40	100	2
	Total	15	5	8	320	380	700	28

M.Sc. (COMPUTER SCIENCE) 2ND SEM.

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
MCAP3- 208	Data Communication and Networks	4	1	0	40	60	100	5
MCAP3- 209	Relational Database Management System	4	1	0	40	60	100	5
MCAP3- 210	Data Structures and Algorithms	4	1	0	40	60	100	5
MCAP3- 211	Web Technologies	4	1	0	40	60	100	5
MCAP3- 212	Software Lab – III (Based on MCAP3-209)	0	0	4	60	40	100	2
MCAP3- 213	Software Lab – IV (Based MCAP3-210)	0	0	4	60	40	100	2
MCAP3- 214	Software Lab – V (Based on MCAP3-211)	0	0	4	60	40	100	2
	Total	16	4	12	340	360	700	26

M.Sc. (COMPUTER SCIENCE) 3RD SEM.

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
MCAP3- 315	Computer Graphics	4	1	0	40	60	100	5
MCAP3- 316	Software Engineering	4	1	0	40	60	100	5
MCAP3- 317	OOPs Using JAVA Programming	4	1	0	40	60	100	5
MCAP3- 318	Data Analytics	4	1	0	40	60	100	5
MCAP3- 319	Software Lab – VI (Based on MCAP3-315)	0	0	4	60	40	100	2
MCAP3- 320	Software Lab – VII (Based on MCAP3-317)	0	0	4	60	40	100	2
MCAP3- 321	Minor Project	0	0	8	60	40	100	4
	Total	**16**	**4**	**16**	**340**	**360**	**700**	**28**

M.Sc. (COMPUTER SCIENCE) 4TH SEM.

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
MCAP3-422	Programming with Python	4	1	0	40	60	100	5
MCAP3-423	Information Security	4	1	0	40	60	100	5
MCAP3-424	Theory of Computation	4	1	0	40	60	100	5
MCAP3-425	Data Warehousing & Mining	4	1	0	40	60	100	5
MCAP3-426	Software Lab – VIII (Based on MCAP3-422)	0	0	4	60	40	100	2
MCAP3-427	Major Project	0	0	8	120	80	200	4
	Total	**16**	**4**	**12**	**340**	**360**	**700**	**26**

Total Credits: 28 + 26 + 28+ 26 = 108

INFORMATION MANAGEMENT

Subject Code: MCAP3-101   **L T P C**   **Duration: 55 Hrs.**
                                     4 1 0 5

Unit-I (12 Hrs.)

Introduction to Information Technology: Definition, Applications in various sectors, Different types of software, Generations of Computers, Input and output Devices, Various storage devices like HDD, Optical Disks, Flash Drives. Different Types of data file formats: Types and Applications.

Unit-II (15 Hrs.)

IT Infrastructure in India: Telecommunication, Internet research and Broadband Data Collection and Data Management, Data Models, Information vs. Knowledge, Various techniques to derive information, Information Management.

Unit-III (15 Hrs.)

Management Information System: Definition, Strategic Management of Information, Decision Making, Development Process of MIS, Strategic Design of MIS, Business Process Reengineering.

Unit-IV (13 Hrs.)

Understanding Knowledge Management: Designing a Knowledge Management System, Nature and Scope of Business Intelligence, Information Security- Meaning and Importance, Organizational Security Policy and Planning, Access Control and Operations Security. Office Automation (Word processing, Spreadsheet, Presentation, E-Mail Clients), Content Management System and Architecture.

Recommended Books:

1. Turban, Efraim, Rex Kelly Rainer and Richard E. Potter, 'Introduction to Information Technology', John Wiley & Sons, New York, NY, **2001**.
2. Ponniah, Paulraj, 'Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals', John Wiley & Sons, **2004**.
3. Schou, Corey and Daniel Paul Shoemaker, 'Information Assurance for the Enterprise: A Roadmap to Information Security', McGraw Hill, Inc., **2006**.
4. Jawadekar, Waman S. 'Management Information Systems: Text and Cases: A Global Digital Enterprise Perspective', Tata McGraw Hill Education, **2013**.

OBJECT ORIENTED PROGRAMMING USING C++

Subject Code: MCAP3-102   **L T P C**   **Duration: 55 Hrs.**
                                     4 1 0 5

Unit-I (13 Hrs.)

Evolution of OOP, OOP Paradigm, advantages of OOP, Comparison between functional programming and OOP Approach, Characteristics of object oriented language- objects, classes, inheritance, reusability, user defined data types, polymorphism, overloading. Introduction to C++, Identifier and keywords, constants, C++ operators, type conversion, Variable declaration, statements, expressions, features of iostream.h and iomanip.h input and output, conditional expression loop statements, breaking control statements.

Unit-II (15 Hrs.)

Defining function, types of functions, storage class specifiers, recursion, preprocessor, header files and standard functions, Arrays, pointer arithmetic's, structures, pointers and structures, unions, bit fields typed, enumerations, Passing array as an argument to function.

Unit-III (15 Hrs.)

Classes, member functions, objects, arrays of class objects, pointers and classes, nested classes, constructors, destructors, inline member functions, static class member, friend functions, dynamic memory allocation. Inheritance, single inheritance, types of base classes, types of derivations, multiple inheritance, container classes, member access control.

Unit-IV (12 Hrs.)

Function overloading, operator overloading, polymorphism, early binding, polymorphism with pointers, virtual functions, virtual destructors, late binding, pure virtual functions, opening and closing of files, stream state member functions, binary file operations, structures and file operations, classes and file operations, random access file processing. Exception Handling.

Recommended Books:

1. Lafore, Robert. 'Object-Oriented Programming in Turbo C++'. Galgotia Publications, **2001**.
2. Stroustrup, Bjarne. 'The design and evolution of C++', Pearson Education India, **1994**.
3. Balagurusamy, Entrepreneurial. 'Object Oriented Programming with C++', 6th Edn., Tata McGraw Hill Education, **2001**.
4. S. Hallada and M. Wiebel, 'Object Oriented Software Engineering', BPB Publications, **1995**.

COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE

Subject Code: MCAP3-103   **L T P C**   **Duration: 55 Hrs.**
                                    4 1 0 5

Objectives: The objective of the course is to provide students with a solid foundation in computer design. Examine the operation of the major building blocks of a computer system. To introduce students to the design and organization of modern digital computers & basic assembly language.

Unit-I (13 Hrs.)

Computer Organization: Basic Computer Organization, Bus & Memory Transfer, Stored Program Organization, Computer Registers, Computer Instructions, Timing and Control, Hardwired based design of Control Unit, Instruction Cycle, Formats of Various types of Instructions- Memory Reference Instructions, Register Reference Instructions & I/O Instructions, General Register Organization-Control word, Design of Adder & Logic Unit, Stack Organization-Register Stack, Memory Stack, Reverse Polish Notation Addressing Modes, RISC vs CISC Architectures, Interrupts & types.

Unit-II (15 Hrs.)

Pipeline & Vector Processing: Parallel Processing, Pipelining-Arithmetic & Instruction Pipeline, Vector Processing-Vector operations, Memory Interleaving, Array Processors. Input – Output Organization: Input-Output Interface- I/O vs Memory Bus, Isolated vs Memory mapped I/O, Synchronous Data Transfer, Asynchronous Data Transfer-Strobe Control, Handshaking, Asynchronous Communication Interface, Modes of Transfer-Programmed I/O, Interrupt Initiated I/O, Interrupt Cycle, Priority Interrupt Controller, and DMA Controller & DMA Transfer.

Unit-III (14 Hrs.)

Memory Organization: Main Memory-Memory Address Map, Memory connection to CPU, Associative Memory-Hardware organization, Match Logic, Cache Memory-Levels of Cache, Associative Mapping, Direct Mapping, Set-Associative Mapping, writing into Cache, Cache coherence, Virtual Memory-Address space & Memory space, Address mapping using pages,

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Associative memory page table, Page replacement, Memory Management Hardware – Segmented page mapping, Multiport memory, Memory protection.

Unit-IV (13 Hrs.)

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures-Time Shared Common Bus, Crossbar switch, Multistage Switching Network, Hypercube interconnection, Interprocessor communication & synchronization.

Assembly Language Programming: Example of a typical 8-bit processor (8085 microprocessor)-Registers, addressing modes, Instruction Set-Data Transfer Instructions, Arithmetic Instructions, Logical Instructions, Program Control Instructions, Machine Control Instructions, Use of an Assembly Language for specific programmes: Simple numeric manipulations, sorting of a list and use of I/O instructions.

Recommended Books:

1. Car Hamacher, Zvonks Vranesic, Safwat Zaky 'Computer Organization', 5th Edn., McGraw Hill.
2. M.M. Mano, 'Computer System Architecture', Prentice Hall of India, **1986**.
3. John Paul Hayes, 'Computer Architecture and Organization', McGraw Hill International Edn.
4. A.S. Tanenbaum, 'Structured Computer Organization', Prentice Hall of India.

OPERATING SYSTEM		

Subject Code: MCAP3-104	L T P C	Duration: 55 Hrs.
	4 1 0 5	

Unit-I (13 Hrs.)

Basics of Operating Systems: Definition, Types of Operating Systems: Mainframe, Desktop, Multiprocessor, Distributed, Clustered, Real time, Embedded and Time sharing. Simple, Layered, Monolithic and Microkernel Operating Systems. Virtual systems.

Operating System Components: Process Management, Memory Management component, I/O Management, File Management, Protection System and Network management.

Operating System Services: Process Execution, I/O operations, File manipulations, Communications, Error detection and recovery, Resource allocation, Accounting, System, Protection, System Calls and System Call Execution; API.

Unit-II (15 Hrs.)

Process: Definition, Process Relationships, Process states, Process State transitions, Process Control Block, Context switching. Threads - Concept, Types and advantages of Multithreads.

Process Scheduling: Definition, Scheduling objectives, Types of Schedulers, Scheduling criteria, CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time, Scheduling algorithms - Pre-emptive and Non pre-emptive, FCFS, SJF and RR. Multiprocessor schedulers. Performance evaluation of schedulers.

Inter-process Communication and Synchronization: Definition, Shared Memory System, Message passing, Critical section, Mutual Exclusion, Semaphores.

Deadlocks: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance, Deadlock detection and Recovery.

Unit-III (14 Hrs.)

Basic Memory Management: Definition, Logical and Physical address map, Memory allocation, Contiguous, Fixed and variable partition. Internal and External fragmentation and Compaction; Paging - Principle of operation, Page allocation, Hardware support, Protection and sharing; Segmentation, Segmentation with Paging.

Virtual Memory Management: Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault, Working Set, Dirty page/Dirty bit; Demand paging, Page

replacement policies - Optimal (OPT), First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit-IV (13 Hrs.)

Device Management: Hardware I/O organization, I/O control, Port and memory mapped I/O, DMA. Buffering and Caching. Device Drivers.

Disk Management: Disk Structure, Disk Formatting, Disk Scheduling and its algorithms, RAID.

Security: Authentication; Types of Threats, Detection, Prevention and correction of Threats.

File Management: File concept, File attributes - Name, Identifier, Type, Location, Size, Time, Date, user identification, File Operations, Directory Structure - Single level, two level, Tree Structure. Disk space allocation methods - Contiguous, Linked, Indexed. Access Methods - Sequential, Indexed, Random access, File system structure, Byte sequence, Record sequence and Tree-based. Disk formatting.

Security and Protection: Security   threats, Security Policies and Mechanisms, Authentications.

Recommended Books:

1. William Stalling, 'Operating System Internals and Design Principle', 6th Edn., Pearson Education, India, **2009**.
2. Peterbears Galvin, 'Operating System Principle', 7th Edn., Wiley India, **2009**.
3. J. Harris, 'Operating System SCHAUM'S OUTLINE', Tata McGraw Hill, Special Indian Edn., **2008**.
4. Pramod Chandra, 'An Introduction to Operating System', 3rd Edn., PHI, **2010**.

PROFESSIONAL COMMUNICATION

Subject Code: MCAP3-105   **L T P C**   **Duration: 45 Hrs.**
                               3 1 0 4

Unit-I (10 Hrs.)

Basics of Technical Communication: Functions of Communication-Internal & External Functions, Models-Shannon & Weaver's model of communication, Flow, Networks and importance, Barriers to Communication, Essential of effective communication (7 C's and other principles), Non-verbal Communication.

Unit-II (13 Hrs.)

Basic Technical Writing: Paragraph writing (descriptive, Imaginative etc.), precise writing, reading and comprehension, Letters – Format & various types.

Unit-II (12 Hrs.)

Advanced Technical Writing: Memos, Reports, E-Mails & Net etiquettes, Circulars, Press Release, Newsletters, Notices. Resume Writing, Technical Proposals, Research Papers, Dissertation and Thesis, Technical Reports, Instruction Manuals and Technical Descriptions, Creating Indexes, List of References and Bibliography.

Unit-IV (10 Hrs.)

Verbal Communication: Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences.

Technical Communication: MS-Word, Adobe Frame maker and ROBO Help.

Recommended Books:

1. Vandana R. Singh, 'The Written Word', Oxford University Press, New Delhi.
2. K.K. Ramchandran, et al, 'Business Communication', Macmillan, New Delhi.
3. Swati Samantaray, 'Business Communication and Communicative English', Sultan Chand, New Delhi.
4. S.P. Dhanavel, 'English and Communication Skills for Students of Science and

Engineering (with audio CD)'.

SOFTWARE LAB.-I (BASED ON MCAP3-102)

Subject Code: MCAP3-106   **L T P C**
                                 0 0 4 2

Note: Program should be fully documented with simple I/O data. Flow charts should be developed wherever necessary.

Write program in 'C++' language:
Using input and output statements using control statements.
Using functions.
Using array
Using Classes and implementation of Constructor and Destructor. Using files.
Using OOP's Concepts (Inheritance, Polymorphism, Encapsulation, Friend and Static Functions)

SOFTWARE LAB.-II (BASED ON MCAP3-104)

Subject Code: MCAP3-107   **L T P C**
                                 0 0 4 2

This laboratory course will mainly comprise of exercises of the Course MCAP-104.

DATA COMMUNICATION AND NETWORKS

Subject Code: MCAP3-208   **L T P C**   **Duration: 55 Hrs.**
                                 4 1 0 5

Objectives: As part of this course, students will be introduced to Computer Networks and Data Communication paradigms, about Network models and standards, Network protocols and their use, wireless technologies.

UNIT-I (13 Hrs.)

Introduction to Data Communication: Components of Data Communication, Data Representation, Transmission Impairments, Switching, Modulation, Multiplexing.
Review of Network Hardware: LAN, MAN, WAN, Wireless networks, Internetworks.
Review of Network Software: Layer, Protocols, Interfaces and Services.
Review of Reference Models: OSI, TCP/IP and their comparison.
Physical Layer
Transmission Media: Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (Radio, Microwave, Infrared). Introduction to ATM, ISDN, Cellular Radio and Communication Satellites.

UNIT-II (15 Hrs.)

Data Link Layer
Services provided by DLL: FRAMING, ERROR CONTROL, FLOW CONTROL, MEDIUM ACCESS
Medium Access Sub Layer
Channel Allocation, MAC protocols – ALOHA, CSMA protocols, Collision free protocols, Limited Contention Protocols, Wireless LAN protocols, IEEE 802.3, 802.4, 802.5 standards and their comparison.

UNIT-III (15 Hrs.)

Network Layer

Design Issues, Routing Algorithms (Shortest Path, Flooding, Distance Vector, Hierarchical, Broadcast, Multicast). Congestion Control Algorithms (Leaky bucket, Token bucket, Load shedding), Internetworking, IP Protocol, ARP, RARP.

Network Trouble Shooting

Using Ping, Traceroute, IPconfig, Netstat, nslooku.

UNIT-IV (12 Hrs.)

Transport Layer

Addressing, Establishing and Releasing Connection, Flow Control, Buffering, Internet Transport Protocol (TCP and UDP).

Application Layer

Domain name system, E-mail, File transfer protocol, HTTP, HTTPS, World Wide Web. Suggested.

Recommended Books:

1. Tanenbaum, Andrew S., 'Computer Networks', 4th Edn., PHI, **2009**.
2. B.A. Forouzan, 'Data Communications and Networking', 4th Edn., Tata McGraw Hill, **2009**.
3. Douglas E. Comer, 'Internetworking with TCP/IP (Vol.1, 4thEdition)', CPE 2004.
4. Stallings, William, 'Data and Computer Communications', 8th Edn., PHI, **2008**.
5. Nance, Bary, 'Introduction to Networking', 4th Edn., PHI, **1997**.

RELATIONAL DATABASE MANAGEMENT SYSTEMS

Subject Code: MCAP3-209	L T P C	Duration: 55 Hrs.
	4 1 0 5	

Unit-I (14 Hrs.)

Review of DBMS:

Basic DBMS terminology; Architecture of a DBMS: Data Independence - Physical and Logical Independence, Degree of Data Abstraction, Initial Study of the Database, Database Design, Implementation and Loading, Testing and Evaluation, Operation, Maintenance and Evaluation.

Conceptual Model:

Entity Relationship Model, Importance of ERD, Symbols (Entity: Types of Entities, week Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality).

Unit-II (12 Hrs.)

Database Models and Normalization:

Comparison of Network, Hierarchical and Relational Models, Object Oriented Database, Object Relational Database, Comparison of OOD & ORD; Normalization and its various forms, De- Normalization, Functional Dependencies, Multi-valued Dependencies, Database Integrity: Domain, Entity, Referential Integrity Constraints.

Transaction Management and Concurrency Control:

Client/ Server Architecture and implementation issues, Transaction: Properties, Transaction Management with SQL, Concurrency; Concurrency Control: Locking Methods: (Lock Granularity, Lock Types, Two Phase Locking, Deadlocks), Time Stamping Method, Optimistic Method, Database Recovery Management.

Unit-III (15 Hrs.)

Distributed Databases:
Centralized Verses Decentralized Design; Distributed Database Management Systems (DDBMS): Advantage and Disadvantages; Characteristics, Distributed Database Structure, Components, Distributed Database Design, Homogeneous and Heterogeneous DBMS.

Levels of Data and Process Distribution:
SPSD (Single–Site Processing, Single-Site Data), MPSD (Multiple-Site Processing, Single Site Data), MPMD (Multiple –Site Processing, Multiple-Site Data), Distributed Database Transaction Features, Transaction Transparency, Client/ Server Vs DDBMS.

Unit-IV (14 Hrs.)

Business Intelligence and Decision Support System:
The need for Data Analysis, Business Intelligence, Operational Data vs. Decision Support Data, DSS Database properties and importance, DSS Database Requirements.

OLAP and Database Administration:
Introduction to Online Analytical Processing (OLAP), OLAP Architecture Relational, Star Schemas, Database Security, Database administration tools, developing a Data Administration Strategy.

Recommended Books:
1. Peter Rob Carlos Coronel, 'Data Base Systems', 8th Edn., Cengage Learning.
2. Henry F. Korth, Abraham, 'Database System Concepts', 4th Edn., McGraw Hill,
3. C.J. Date, 'An Introduction to Database Systems', 8th Edn., Pearson Education.
4. Ullman, 'Principles of Database Systems', 3rd Edn., Galgotia Publication.
5. Bipin C. Desai, 'An Introduction to Database Systems', Galgotia Publication.

DATA STRUCTURES		
Subject Code: MCAP3-210	**L T P C** **4 1 0 5**	**Duration: 55 Hrs.**

Unit-I (13 Hrs.)

Introduction to Data Structure: Concept of data, problem analysis, data structures and data structure operations, notations, mathematical notation and functions, algorithmic complexity, Big-O Notation and time space trade off.
Overview of Arrays, Recursion, Pointers, Pointer Arithmetic, Array of pointers, Arrays in terms of pointers, Static and Dynamic Memory Management, Garbage Collection.
Understanding and Implementation of various Data Structures with applications
Stack: Operations like push, pop and various applications like conversion from infix to postfix and prefix expressions, evaluation of postfix expression using stacks.
Queues: Operations like enqueue, dequeue on simple, circular and priority queues. Linked Lists: operations like creations, insertion, deletion, retrieval and traversal on single, circular and doubly linked list.

Unit-II (15 Hrs.)

Trees Definitions and Concepts: Root, Node, Leaf Node, Level, Degree, Height and Tree representation using Linked List and Array
Types of Trees: Binary trees, Binary search tree, Height balanced (AVL) tree, B- trees, B+ Tree.
Tree Operations: Creation, insertion, deletion and traversals (Preorder, In-order, Post-ordered) and searching on various types of trees.
Heap: Definition, Structure, Algorithms and applications.

Unit-III (15 Hrs.)

Graph definitions and Concepts: Edge, Vertices and Graph representation using Adjacency matrix, Adjacency lists.

Types of Graphs: Weighted, Unweighted, Directed, Undirected Graphs.

Graph Operations: Creation, insertion, deletion, traversals and searching (depth-first, breadth-first) of various types of graphs and Dijkstra's algorithm for shortest distance calculation.

Unit-IV (12 Hrs.)

Searching: Concept and efficiency of linear and binary search algorithms.

Sorting: Concepts, Order, Stability, Efficiency of various algorithms (Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Radix Sort).

Hashing: Definition, Implementation and applications**.**

Note: Programs are to be implemented in C++.

Recommended Books:

1. Gilberg and Forouzan, 'Data Structures - A Pseudo Code Approach with C++', Cengage.
2. Hubbard John R., 'Schaum's Outline of Data Structures with C++', Tata McGraw Hill.
3. Langsam, Augenstein, Tanenbaum, 'Data Structures Using C and C++', Pearson Education.

WEB TECHNOLOGIES

Subject Code: MCAP3-211   L T P C   **Duration: 55 Hrs.**
                                  4 1 0 5

Unit-I (15 Hrs.)

Internet and World Wide Web: Introduction, Internet Addressing, ISP, types of Internet Connections, Introduction to WWW, WEB Browsers, WEB Servers, URLs, HTTP, WEB Applications, Tools for web site creation.

HTML5: Introduction to HTML5, Lists, adding graphics to HTML5 page, creating tables, linking documents, forms, frames, Cascading Style sheets.

Unit-II (13 Hrs.)

Java Script: Introduction, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, introduction to Cookies, Jquery.

Unit-III (15 Hrs.)

AJAX: Introduction, HTTP Request, XML Http Request, AJAX Server Script.

Unit-IV (12 Hrs.)

PHP: Introduction, syntax, statements, operators, PHP and MySQL, PHP and AJAX.

Recommended Books:

1. Deitel, Deitel, Nieto, Lin and Sadhu, 'XML How to Program', Pearson Education.
2. Ivan Bayross, 'Web Enabled Commercial Application Development using HTML, DHTML, JavaScript, Perl CGI', BPB.
3. Steven M. Schafer, 'HTML, CSS, JavaScript, Perl, Python and PHP', Wiley India.
4. Paul S. Wang, G. Keller, S. Katila, 'An Introduction to Web Design + Programming', Cengage Learning.
5. Jeffery C. Jackson, 'Web Technologies: A Computer Science Perspective', Pearson Education.
6. Robin Nixon, 'Learning PHP, MySQL and JavaScript', Shroff/O'Reilly.

SOFTWARE LAB. –III (BASED ON MCAP3-209)

Subject Code: MCAP3-212　　　　**L T P C**
　　　　　　　　　　　　　　　　　　0 0 4 2

1. Comparative study of various Database Management Systems.
2. Data Definition Language (DDL), Data Manipulation Language (DML) and Data Control Language (DCL).
3. How to apply constraints at various levels?
4. View data in the required form using Operators, Functions and Joins.
5. Creating different types of Views for tailored presentation of data.
6. How to apply Conditional Controls in PL/SQL.
7. Error Handling using Internal Exceptions and External Exceptions.
8. Using various types of Cursors.
9. How to run Stored Procedures and Functions.
10. Creating Packages and applying Triggers.
11. Creating Arrays and Nested Tables.

SOFTWARE LAB. – IV (BASED ON MCAP3-210)

Subject Code: MCAP3-213　　　　**L T P C**
　　　　　　　　　　　　　　　　　　0 0 4 2

1. Selecting suitable Data Structures for specific tasks.
2. Understanding various traversing techniques on various data structures.
3. Inserting and deleting elements in required data structures.
4. Searching data stored within various data structure using various search techniques.
5. Understanding memory-space trade off.
6. Sorting various data structures using different techniques.

SOFTWARE LAB. –V (BASED ON MCAP3-211)

Subject Code: MCAP3-214　　　　**L T P C**
　　　　　　　　　　　　　　　　　　0 0 4 2

1. Creation of Web pages using HTML5.
2. Creation of Web pages using JavaScript.
3. Creation of Web pages using AJAX.
4. Creating web pages using PHP.