GANGADHAR MEHER UNIVERSITY

AMRUTA VIHAR ,SAMBALPUR,ODISHA

Syllabus for

MASTER OF COMPUTER APPLICATIONS

(2-Year Programme)

Course Effective from Academic Year 2020-2021

MCA
Programme Structure

Year	Semesters	
First Year	Semester I	Semester II
Second Year	Semester III	Semester IV

Part-I: Semester-I

Papers		Marks		Total Marks	Duration (Hrs)	Credit
Paper No	Title	Mid Term	End Term			
MCA101	Programming and Data Structures	20	80	100	4	4
MCA102	Computer Architecture	20	80	100	4	4
MCA103	Data Communication & Networks	20	80	100	4	4
MCA104	Operating Systems	20	80	100	4	4
MCA105	Computer Based Numerical Methods	20	80	100	4	4
MCA106	Lab (Problem Solving and Data Structures using C)	20	80	100	6	4
Total				**600**		**24**

Part-I: Semester-II

Papers		Marks		Total Marks	Duration (Hrs)	Credit
Paper No	Title	Mid Term	End Term			
MCA201	Object Oriented Programming using JAVA	20	80	100	4	4
MCA202	Design and Analysis of Algorithms	20	80	100	4	4
MCA203	Database Management Systems	20	80	100	4	4
MCA204	Theory of Computation	20	80	100	4	4
MCA205	Lab (Java and Database)	20	80	100	4	4
DSE Papers						
MCA206 A	**Data Warehousing and Mining**	20	80	100	4	4
MCA206 B	**Wireless Sensor Networks**	20	80	100	4	4
MCA206 C	**Internet of Things**	20	80	100	4	4
MCA206D	**Mobile Computing**	20	80	100	4	4
Total				**600**		**24**

Part-II: Semester-III

Papers		Marks		Total Marks	Duration (Hrs)	Credit
Paper No	Title	Mid Term	End Term			
MCA301	Information Security	20	80	100	4	4
MCA302	Artificial Intelligence	20	80	100	4	4
MCA303	Software Engineering & OOAD	20	80	100	4	4
MCA304	Web Technology	20	80	100	4	4
MCA305	Lab(Web Technology and Software Engineering)	20	80	100	4	4
IDSE Papers						
MCA306A	**Network and Internet Technologies**	20	80	100	4	4
MCA306B	**Fundamentals of Computer**	20	80	100	4	4
MCA306C	**Introduction to Programming Using Python**	20	80	100	4	4
Total				**600**		**24**

Part-II: Semester-IV

Papers		Marks		Total Marks	Duration	Credit
Paper No	Title	Mid Term	End Term			
MCA401	MOOCs-1					3
MCA402	MOOCs-2					3
MCA403	Industrial Project Work and VIVA VOCE			400		16
Total				**400**		**22**
21 Papers	**Grand Total**			**2200**		**94**

SEMESTER WISE CREDIT DISTRIBUTION					
Semester	**I**	**II**	**III**	**IV**	**TOTAL**
Total Credit	**24**	**24**	**24**	**22**	**94**

Semester-I

Course Name: **PROGRAMMING AND DATA STRUCTURE**

Category: Programme Core Course

Prerequisite: **Computer fundamental**

Learning Objective:

- To understand the various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs
- To learn to write programs (using structured programming approach) in C to solve problems.
- Familiar with basic data structure of algorithms
- To make the student understand simple sorting and searching methods.

Learning Outcome:

- This course enables us to understand the concepts of Data structure and also ability to apply solving and logical skills to programming in C language and also in other languages.

Paper-MCA101
Programming and Data Structures
UNIT-I:
Review of C programming, Control structures: conditional and looping statements, Arrays. Multi-dimensional arrays, Structures, Functions, Recursive functions, use of pointers, Dynamic memory allocation using malloc( ) and calloc( )
UNIT-II:
Linear data structures and their sequential storage representation, Stack, Queues, Circular Queues and Dequeues, Operations on these data structures, Applications of Stack and Queue, Priority Queue. Linear data structures and their linked representation: Singly linked, Circularly linked and doubly linked lists, insertion and deletion operations on these data structures, Representation of sparse matrix using linked list
UNIT-III:
Non-linear data structures: Binary tree representation, Tree traversal: Inorder, Preorder, Postorder (recursive and non-recursive algorithms), Conversion of general tree to Binary tree, Binary search tree, Representations of graph: adjacency matrix, adjacency list, multi list, Graph traversal: Depth first and Breadth first
UNIT-IV:
Performance analysis of Searching techniques such as Sequential and Binary search. Performance analysis of Sorting techniques such as Insertion, Selection, Bubble, Quick, Radix, Merge, and Heap sort. Representation of B-tree and AVL tree, creation, insertion and deletion operations on these trees,

Text Books:

1. E. Balagurusamy, **Programming in ANSI C**, McGraw-Hill, 2012.
2. A. M. Tanenbaum, **Data Structure using C,**Pearson Education India, 1990.
3. An Introduction to data structures with applications, J. P. Tremblay and P. G. Sorenson, McGraw Hill.
4. Fundamentals of Data Structures in C - Horowitz, Sahni, Anderson-Freed, Universities Press

Reference Books:

1. B. Kernighan and D. Ritche, **The C Programming Language**, prentice-Hall, 1988
2. A. K. Rath and A. K. Jagadev, **Data Structures Using C**, Second Edition.
3.Data Structures using C - ReemaThareja, Oxford University Press

Course Name: **COMPUTER ARCHITECTURE**

Category: Programme Core Course

Prerequisite: **Digital Logic**

Learning Objective:

- To study design of an elementary basic computer
- To have a better understanding of a hardwired and microprogrammed control unit.
- To introduce the concept of memory hierarchy and pipelining to speed-up the processor

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Learning Outcome:

- After this course students understand in a better way to design and interconnection of various modules of a system, the I/O and memory organization in depth.

Paper-MCA102

Computer Architecture

UNIT-I:

Register Transfer and Micro-operations:
Register Transfer Language, Register transfer, Bus and memory transfer, Arithmetic, Logical and Shift Micro Operation, Arithmetic Logic Shift Unit

Basic Computer Organization and Design:
Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle & Register Reference Instructions, Memory Reference Instructions, Input-Output and Interrupt. Design of Basic Computer.

UNIT-II:

Basic Processing Unit:
Some Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a Word from Memory, Storing a word in Memory, Execution of Complete Instruction, Branch Instructions, Multiple Bus Organization

Micro-Programmed Control:
Control Memory, Address Sequencing: Conditional branching, Mapping of Instruction, Subroutine; Micro Program Example: Computer configuration, Microinstruction format, Symbolic Microinstruction, The fetch routine, Symbolic Microprogram, Binary Microinstruction; Design of Control Unit: Microprogram Sequencer.

UNIT-III:

Memory Organization:
Memory Hierarchy, Associative Memory: Hardware Organisation, Match Logic, Read Operation, Write Operation; Cache Memory: Associative Mapping, Direct Mapping, Set Associative Mapping, Write into Cache Memory, Cache Initialization; Virtual Memory: Address Space and Memory Space, Address mapping Using Pages, Associative Memory Page Table, Page Replacement

UNIT-IV:

Pipeline and Vector Processing:

Parallel Processing, Pipelining: General Considerations; Arithmetic Pipeline, Instruction Pipeline: Four-segment Instruction Pipeline Example, Data Dependency, Handling of Branch Instructions; Vector Processing; Array Processors

Multiprocessors:

Characteristics of Multiprocessors, Interconnection structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache coherence

Text Books:

1. Computes Organization & Architecture-William Stallings,8th Edition (PHI)

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Reference Books:

1. Computer Architecture and Organization- Rajiv Chopra (S. Chand)

2.Computes Organization- Carl Hamacher, ZvonkoVranesic, SafwatZaky 5th Edition, McGraw-Hill Education India

Course Name: **DATA COMMUNICATION & NETWORKS**

Category: Programme Core Course

Prerequisite: **Basics of Computer**

Learning Objective:

- The objective of the course is to provide an overview of communication network functions and a good foundation for further studies in the subject. It involves understanding and application of design principles and methods for systems development and review of the underlying systems, and communications technologies and significant standardized systems.

Learning Outcome:

- Understand and be able to explain the principles of layered protocol architecture; be able to identify and describe the system functions in the correct protocol layer and further describe how the layers interact.

Paper-MCA103

Data Communication & Networks

UNIT-I:

Overview of Data Communications and Networking.**Physical Layer**: Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, TransmissionImpairment, More about signals. Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing: FDM , WDM , TDM , Transmission Media:Guided Media, Unguided media (wireless) Circuit switching and Telephone Network: Circuit switching, Telephone network.

UNIT-II:

Data Link Layer: Error Detection and correction: Types of Errors, Detection, ErrorCorrection Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point –to- Point Protocol, MultipleAccess, Random Access, Controlled Access, Channelization. Local area Network: Ethernet,Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LANs: IEEE 802.11,Bluetooth virtual circuits: Frame Relay and ATM.

UNIT-III:

Network Layer: Host to Host Delivery: Internetworking, addressing, Routing. Network Layer Protocols: ARP, RARP, NAT, BOOTP, DHCP, IPV4, ICMP, IPV6, ICMPV6 and Unicast routing protocols Transport Layer: Process to Process Delivery: UDP, TCP, congestioncontrol and Quality of service.

UNIT-IV:

Application Layer: Client Server Model, Peer to peer network, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:

1. B. A. Forouzan, **Data Communications and Networking**, 4th Edition, Tata McGraw-Hill 2007.

Reference Books:

1.Computer Networks -A S Tenenbaum (PHI)
2. Computer Networking: A Top-Down Approach Featuring the Internet, 3/e - James F. Kurose & Keith W. Ross (Pearson Education India)

Course Name: **OPERATING SYSTEMS**

Category: Programme Core Course

Prerequisite:

- Computer Programming and Data Structures
- Computer Organization and Architecture

Learning Objective:

- Provide an introduction to operating system concepts (i.e., processes, threads, scheduling,
- synchronization, deadlocks, memory management, file and I/O subsystems and protection)
- Introduce the issues to be considered in the design and development of operating system

Learning Outcome

- To master the concepts of a process and how the processes are scheduled and synchronized.
- To develop the understanding of detecting a deadlock situation and be able to recovery from it.
- To understand the different approaches to memory management and disk management.
- To understand the structure and organization of the file systems and I/O systems

Paper-MCA104
Operating Systems
UNIT-I:
Operating System Overview: -Introduction, The Need of Operating Systems, Evolution of Operating Systems, Types of Operating Systems, Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls, Virtual Machines, System Design and Implementation. **Process Management** – Process concepts, Life cycle, PCB, Schedulers, Process Scheduling, Threads, Scheduling Levels, CPU Scheduling: Scheduling-Criteria, Algorithms, Algorithm Evaluation.
UNIT-II:
Concurrency:-Process synchronization, The Critical- Section Problem, Peterson's Solution, synchronization Hardware, Semaphores, Classic problems of synchronization, Monitors. **Deadlocks**: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock detection, deadlock prevention, deadlock avoidance, Recovery from deadlock.
UNIT-III:
Memory Management: Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. **Virtual Memory**: Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files

UNIT-IV:
Mass-Storage Structure: Overview, Disk Structure, Disk scheduling, disk management, Swap-space management, RAID structure. **File Systems**: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, Protection. File- System Structure and Implementation, Directory Implementation, Allocation Methods, Free-Space Management.
Text Book:
1. A. Silberchatz, P. B. Galvin, G. Gagne, **Operating System Concepts**, 7th Edition, John Wiley, 2003.
Reference Books:
1. Charles Crowley,**Operating systems : a design-oriented approach**, McGraw-Hill, 1996. 2. A. S. Tanenbaum and H. Bos, **Modern Operating Systems**, Pearson, 2015. 3. W. Stallings, **Operating Systems – Internals and Design Principles**, Prentice Hall, 2009. 4. D. M. Dhandhere, **Operating Systems-A Concept Based Approach**, McGraw-Hill, 2006.

Course Name: **Computer Based Numerical Methods**

Category: Programme Core course

Prerequisite: **Agood knowledge of number systems, calculus and matrices.**

Learning Objective:

- aware of different error calculations in numerical computations, Polynomial interpolation, Numerical differentiation and Integration.
- know Numerical solution of differential equations and system of linear equations.
- study concept of Eigen vectors & Eigen values of matrices.

Learning Outcome:

- Understand the concepts of error in numerical computations, its control and methods of root fining.
- Acquire numerical skills and concepts of computation of matrix inverse and solution of linear systems.
- Understand and apply the concepts of interpolation for approximating functions.
- Perform differentiation and integration using various numerical methods.
- Study and use the eigen values and eigen vectors of matrices, its properties and applications.

Paper-MCA105

Computer Based Numerical Methods

UNIT-I:

Fixed point arithmetic, rounding error, truncation error, loss of significance and error propagation and stability, computational methods for error estimation, convergence of sequences, some mathematical preliminaries.

UNIT-II:

Roots of f(x) by bisection method, method of false position, secant method, Newton-Raphson methods, fixed point iteration method.

Solution of Ax = b: Solution of simultaneous liner equations by Cramer's rule, Gauss' ellmination method, Grauss-Jordan method, Gauss-Seidel method, matrix inversion by Gauss-Jordan method.

Curve Fitting: Least square approximation of functions by liner regressing, polynomial regression..

UNIT-III:

Numerical differentiation and integration: Differentiation formulae, integration by trapezoidal rule, Simpson's 1/3 rule and 3/8 rule.

Numerical solution of Ordinary Differential Equation:

Euler's method, modifications of Euler's, Runge-Kulta methods of the third and fourth order, Predictor-corrector methods.

UNIT-IV:

Miscellaneous topics: Determination of eigen values and eigen vectors of a matrix by iteration, Inverse of a matrix.

Text Book:

1. S.C. Chopra and R.P. Canole,Numerical Methods for Engineers, McGraw-Hill, 2010.

Reference Book:

1. S.D. Conte and C. De Boor, Elementary Numerical Analysis: an algorithmic approach, SIAM, 2017.

Paper-MCA106

Lab (Problem Solving and Data Structures using C)

LAB PROGRAMS ON C:

1. Simple Programs using C :Find Area, Perimeter of Square & Rectangle, Find max. Among 3 nos, Check leap year
2. Programs using Loop :Factorial of Number, Prime Number, Perfect Number, Armstrong Number, Floyd's Triangle
3. Function Programs : Simple Function Problems, Function with call by reference, Recursion function e.g. sum of digit, reverse of digit, Fibonacci Series, Inter conversion of Decimal, Binary & Hexadecimal no, LCM & GCD of numbers
4. Array & Structure Operations: Insert & Delete an element at given location in array, Transpose of matrices, Multiplication of matrices, Display upper & lower diagonal of matrices

Array of Structure e.g. student result, Employee pay slip , Phone bill

DATA STRUCTURE PROGRAMS:

1. Implementation of sparse matrix
2. Implementation of linear search, binary search, bubble sort, insertion sort, selection sort
3. Implementation of single linked list and its operations
4. Design a doubly linked list to hold strings and use it for organizing a sequence of cities
5. Repeat Q4 using doubly circular linked list
6. Create a polynomial using single linked list and perform addition operation of two polynomials
7. Implement a stack,use stack for conversion of infix to postfix and evaluation of postfix expression.
8. Implementation of circular queue (using array) with menu options like insert, delete,display and exit.
9. Implementation of a priority queue and use it to organize studentrecords prioritized by marks.
10. Recursive implementation of quick sort and merge sort. Generate 10 random integers in a given range and apply sorting mechanisms.
11. Implement linear search and binary search to find out whether a given element is present or not in the array. Compare two search mechanisms based on number of comparisons required for a successful as well as unsuccessful search.
12. Implementation of a binary search tree with menu options: Construct a tree, insertanode, delete anode, traverse and display preorder, in order and post order sequenceof its nodes.
13. Implementation of Heap Sort.
14. Implementation of digraphs using adjacency matrix and find the transitive closureusingWarshall's algorithm.
15. Implementation of a weighted graph and find minimal cost spanning tree usingPrim's algorithm.

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Semester-II

Course Name: **OBJECT ORENTED PROGRAMMING USING JAVA**

Category: Programme Core Course

Prerequisite: **Basic procedural programming Language (like C-Programming)**

Learning Objective:

- Introduces object oriented programming concepts using the Java language.
- Introduces the principles of inheritance and polymorphism; and demonstrates howthey relate to the design of abstract classes.
- Introduces the implementation of packages and interfaces.
- Introduces exception handling, event handling and multithreading.
- Introduces the design of Graphical User Interface using applets and swings.

Learning Outcome:

- Develop applications for a range of problems using object-oriented programming techniques
- Design simple Graphical User Interface applications

Paper-MCA201

Object Oriented Programming using JAVA

UNIT-I:

Java Evolution and Environment: Java evolution, overview of java language, java history, features of java, how java differs from C and C++, java and World Wide Web, web browser.

Java Environment: Java Development Kit(JDK), Application Programming Interface(API), java programming structure, java tokens, constants, variables, expressions, decision making statements and looping, java statements, overview of arrays and strings, machine neutral, Java Virtual Machine(JVM), Command Line Arguments.

UNIT-II:

Classes, Objects and Methods: Introduction, defining a class, creating objects, accessing class members, constructors, method overloading, static members. Inheritance: Defining a sub-class, sub-class constructor, multi-level variables, final classes and finalize methods, abstract methods and classes, visibilitycontrol.**Arrays and Strings:** One-dimensional arrays, creating an array, declaration of arrays, initialization of arrays, two-dimensional arrays, string arrays, string methods, string buffer class, vectors, wrapper classes, Basic I/O Streams: Scanner, buffered reader, Collection classes. **Managing Errors and Exceptions**: Introduction, types of errors: compile time and run-time errors, exceptions, types of exceptions, syntax of exception handling code, multiple catch statements, using finally statement, throwing our own exceptions.

UNIT-III:

Interfaces, Package and Multi-threaded Programming: Introduction, defining interfaces, extended interfaces, implementing interfaces.**Package:** Creation, importing a package and user-defined package.**Threads:** Introduction to threads, creating threads, extending the thread class, implementing the 'runnable' interface, life-cycle of a thread, priority of a thread, synchronization, and deadlock.

UNIT-IV:

Applet programming: Introduction, how applets differ from applications, building applet code, applet life cycle, about HTML, designing a web page, passing parameters to applets, getting

input from the user.**Graphics Programming:** Introduction, abstract window toolkit class hierarchy, frames, event-driven programming, layout managers, panels, canvases, drawing geometric figures.**Introduction to Swings:** Introduction to Swings, overview of Swing components: Jbutton, JCheckBox, JRadioButton, JLabel, JTextField, JTextArea, JList.

Text Book:

1. H. Schildt, **The Java Complete References**, 9th Edition, Tata McGraw Hill, 2014.

Reference Books:

1. Y.Daniel Liang, **An Introduction to JAVA Programming**, Tata McGraw Hill, 2009.
2. K. Sierra, **Head First java**, 2nd Edition, Shroff Publishers, 2012.
3. 3. E. Balaguruswamy, Programming with JAVA, 2/e, Tata McGraw Hill

Course Name: **DESIGN AND ANALYSIS OF ALGORITHMS**

Category: Programme Core Course

Prerequisite: **Data Structure**

Learning Objective:

- Learn the algorithm analysis techniques.
- Become familiar with the different algorithm design techniques.
- Understand the limitations of Algorithm power.

Learning Outcome:

- Design algorithms for various computing problems and analyze the time and space complexity of algorithms.
- Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Understand the necessary mathematical abstraction to solve problems and come up with analysis of efficiency and proofs of correctness.
- Comprehend and select algorithm design approaches in a problem specific manner and also modify existing algorithms to improve efficiency.

Paper-MCA202

Design and Analysis of Algorithms

UNIT-I:

Introduction to Design and analysis of algorithms, Growth of Functions (Asymptotic notations), Recurrences, Solution of Recurrences by substitution, Recursion tree method, Master Method, Analysis of Searching and Sorting Techniques: Brute Force Technique, Selection sort, Bubble sort.

UNIT-II:

Divide and Conquer: Merge sort, Quick sort, Time complexity analysis for Merge and Quick sort. Transform and Conquer: Balanced search tree, Heaps and Heap sort. Dynamic Programming algorithms: Matrix Chain Multiplication, Elements of Dynamic Programming, Longest Common Subsequence, 0/1 Knapsack problem.

UNIT-III:

Greedy Algorithms: Activity Selection Problem, Elements of Greedy Strategy, Fractional Knapsack Problem, Huffman Codes. Graph Algorithm - BFS and DFS, Minimum Spanning Trees, Kruskal algorithm, Prim's Algorithm, Single Source Shortest paths, Bellmen Ford

Algorithm, Dijkstra's Algorithm.
UNIT-IV:
String matching, Rabin-Karp Algorithm, KMP Algorithms. Theory of NP-completeness: Complexity classes of P, NP, NP-Hard, NP complete. Polynomial reduction, Cook's theorem, discussion on SAT, CNF-SAT, Min vertex cover, max clique, Graph coloring.
Text Book:
1. T.H.Coreman et.al. **Introduction to Algorithms**,MIT press Cambridge, 2001.
Reference Books:
1.M. R. Kabat, **Design and Analysis of Algorithms**, PHI, 2013. 2. S. Sridhar, **Design and Analysis of Algorithms**, Oxford University Press 3. E. Horowitz, S. Sahni, **Fundamentals of Computer Algorithms**, computer science press, 1978.

Course Name:	**DATABASE MANAGEMENT SYSTEMS**
Category:	Programme Core Course
Prerequisite:	**Basic Knowledge of Computer Programming and Data structures**
Learning Objective:	• Classify modern and futuristic database applications based on size and complexity; design a database from understanding an Universe of Discourse, using ER diagrams; map ER model into Relational model and to normalize the relations; create a physical database from a design using DDL statements with appropriate key, domain and referential integrity constraints; analyze different ways of writing a query and justify which is the effective and efficient way; and compare and contrast various indexing strategies in different database systems and list key challenges in advanced database systems and to critique how they differ from traditional database systems.
Learning Outcome:	• To study the concepts of databases especially Relational Database design and query languages.

Paper-MCA203

Data Base Management Systems

UNIT-I:

Introduction to DBMS: Characteristics, Purpose, Application of the Database approach, Advantages of using DBMS approach upon file structure, Three-schema Architecture, Data Abstraction, Data Independence, Data base languages, DBMS Architecture, Data Models overview, Introduction to ER model and Relational data model.
Relational Query Language: Relational algebra, Tuple and Domain Relational Calculus, SQL.

UNIT-II:

Database Design and ER model: Overview of Design Process, Entities, Attributes, Constraints, Weak Entities, ER diagram, Extended ER Features, Reduction to Relational Schemas.
Relational Database Design: Feature of Good Relational Design, Atomic Domain and First Normal Form, Functional Dependency Theory, Decomposition of Schemas, Properties of Relational Decompositions, Normal forms and Normalization, 2NF, 3NF, BCNF, Multivalued Dependencies & 4NF. Performance tuning and Denormalization

UNIT-III:

Query Processing and Optimization: Evaluation of Relational Algebra Expression, QueryEquivalence, Join strategy, Query optimization algorithms. **Storage Strategies**: Indices, B+Trees, Hashing

UNIT-IV:

Transaction Processing: Transaction Concept, ACID Properties of Transaction, Serializability, Recoverability.
Concurrency Control: Overview, Lock-based Protocol, Timestamp ordering protocol, Multi version and Optimistic concurrency control techniques.
Recovery Systems: Database Failure and Recovery, Log based Recovery to preserve Atomicity and Durability

Text Book:

1. A. Silberschatz, F. H. Korth, **Database System Concepts**, 6th Edition, MGH, 2010.

Reference Books:

1. R. Elmasri, Fundamental of Database Systems, Pearson Education, 2008.
2. B. Desai, An Introduction to Database System, Galgotia publication.
3. C.J. Date, An Introduction to Database Systems, Pearson Education

Course Name: **THEORY OF COMPUTATION**

Category: Programme Core Course

Prerequisite: **Fundamental of computer science and mathematics**

Learning Objective:

- To introduce concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships.
- To design grammars and recognizers for different formal languages.

Learning Outcome:

- This course enables us to understand the concepts of theory of Computation and its applications.

Paper-MCA204

Theory of Computation

UNIT-I:

Introduction: Automata theory, Computability theory, Complexity theory,Mathematical notations & terminology, Alphabet, String, Languages &operations on strings; Finite Automata (Deterministic): Formal definition,Transition function, Extended transition function, Language of DFA,Design of DFA; Finite Automata (Non-deterministic): Formal definition,Language of NFA, Equivalence of DFA & NFA; NFA with EpsilonTransition: Eliminating "-transitions from NFA, Conversion from Epsilon-NFA to DFA, Minimization of DFA.

UNIT-II:

Moore machines, Mealy machines; Regular expressions: Regular operators and their precedence, Building regular expressions, DFA to Regular expressions, Regular expressions to DFA, Arden's theorem, PumpingLemma for Regular languages, Closure properties of Regular languages.

UNIT-III:

Introduction to Grammars: Definition, Derivation of string, Left and rightlinear grammars, Regular grammars; Context Free Grammars (CFG): Definition,Derivation of string, Language of CFG, Parse Tree, Ambiguity in grammar,Elimination of ambiguity, Normal forms of CFG: Chomsky and Greibachnormal forms, Converting CFG to CNF & GNF, Closure properties of context free languages (CFL).

UNIT-IV:

Push Down Automata(PDA): PDA Components, Moves of a PDA, Design of a PDA, PDA to CFG and CFG to PDA conversion, Pumping lemma for CFL;

Turing Machines (TM): Design of a TM, Variation of TM, Recursively Enumerable Languages and undecidable problems.Church Turing hypothesis, Recursive and recursively enumerablesets, Chomsky's hierarchy of languages. Ackermann's function, Godel numbering; NP Completeness: P and NP, NP complete andNP Hard problems.

Text Books:

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, **Introduction to Automata Theory, Languages and Computation**, 3rd Edition, Pearson Education, 2007.
2. P. Linz, **An Introduction to Formal Languages and Automata**, 4th Edition, Jones &Bartlett

Learning, 2006.

Reference Books:

1. M. Sipser, **Introduction to the Theory of Computation**, 3rd Edition, Cengage Learning, 2012.
2. J. C. Martin, **Introduction to Languages and the Theory of Computation**, 4th Edition, Tata McGraw-Hill, 2010.
3. K. L. P. Mishra, and N. Chandrasekaran, **Theory of Computer Science: Automata, Languages and Computation**, 3rd Edition, PHI, 2012.

Paper -MCA205

Lab:Java and DBMS

EXPERIMENTS ON JAVA

1. Programs to illustrate class and objects
2. Programs to illustrate Overloading & Overriding methods in Java
3. Programs on Constructers
4. Programs Illustrate the Implementation of Various forms of Inheritance. (Ex. Single, Hierarchical, Multilevel inheritance….)
5. Program which illustrates the implementation of multiple Inheritance using interfaces in Java.
6. Program to illustrate the implementation of abstract class.
7. Programs to illustrate Exception handling
8. Programs to create packages in Java.
9. Program to Create Multiple Threads in Java.
10. Program to Implement Producer/Consumer problem using synchronization
11. Developing a simple paint like program using applet
12. Developing programs onJButtons,JTextBox,JTextButtonetc

EXPERIMENTS ON DBMS:

1. Creation of a tables using create command and writing SQL queries to retrieve information from the tables.
2. Implement data definition languages (Create, Alter, Drop, Truncate, and Rename) &data manipulation languages (Insert, Update, and Delete) for updating and viewing records.
3. Implement SELECT command with different clauses (where clause, having clause, group by clause, order by clause).
4. Implement Single Row function (character, numeric, data functions).
5. To implement Group function (AVG, MIN, MAX, SUM).
6. Implement various types of integrity constraints (NOT NULL Constraint, DEFAULT Constraint, UNIQUE Constraint, PRIMARY Key, FOREIGN Key, CHECK Constraint).
7. Creation of Views, Synonyms, Sequence, Indexes, Save point.
8. Creating relationship between tables.
9. Implementation of PL/SQL block.
10. Write a PL/SQL block to satisfy some conditions by accepting input from theuser.
11. Write a PL/SQL block that handles all types of exceptions.

Course Name: **DATA WAREHOUSING AND MINING**

Category: Programme Elective Course

Prerequisite: **Data Structure and Algorithm, Linear Algebra, Basics of Web programming**

Learning Objective: This course deals with evolving multidimensional intelligent model from a typical system, representation of multi dimensional data for a data warehouse, discovering the knowledge imbibed in the high dimensional system, fiding the hidden interesting patterns in data, and gives the idea to evaluate various mining techniques on complex data objects.

Learning Outcome: This course enables us to understand the concepts of Data Mining and its applications.

DSE Paper – MCA206A

Data Warehousing and Mining

UNIT-I:

Evolution of Decision Support Systems- Data warehousing Components –Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflkes and Fact constellations.

UNIT-II:

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications.

UNIT-III:

Data mining-KDD versus datamining, Stages of the Data Mining Process-task premitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation.

Decision Tree Induction - Bayesian Classifiation – Rule Based Classifiation –Classifiation by Back propagation – Support Vector Machines – Associative Classifiation – Lazy Learners – Other Classifiation Methods.

UNIT-IV:

Clustering techniques – , Partitioning methods- k-means Hierarchical Methods - distance-based agglomerative and divisible clustering,

Mining complex data objects, Spatial databases, temporal databases, Multimedia databases, Time series and Sequence data; Text Mining –Graph mining-web mining-Application and trends in data mining

Text Books:

1. Jiawei Han and MichelineKamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition2011, ISBN: 1558604898.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMc

Graw Hill Edition, Tenth Reprint 2007.
3.G. K. Gupta, “Introduction to Data Min Data Mining with Case Studies”, Easter EconomyEdition, Prentice Hall of India, 2006

Reference Books:

1. Mehmedkantardzic,“Dataminingconcepts,models,methods, and lgorithms”, Wiley Interscience, 2003.
2. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.
3.George M Marakas, Modern Data Warehousing, Mining and Visualization, Prentice Hall, 2003

Course Name: **WIRELESS SENSOR NETWORKS**

Category: Programme Elective Course

Prerequisite: **Basic Computer Network**

Learning Objective: The purpose of this course is to introduce students to
Obtain a broad understanding about the network architecture of wireless sensor network.Understand all basic characteristics of wireless sensor networks and sensor nodes.The principles of data transmission, clustering algorithm and routing protocols.Design and development of new network architecture and MAC protocols.

Learning Outcome: This course enables us to understand the concepts of wireless sensor network and its applications.

DSE Paper – MCA206B

Wireless Sensor Networks

UNIT-I:

Introduction: Networked wireless sensor devices, Applications: Habitat Monitoring, Smart Transportation, Key design challenges. **Network deployment:** Structured versus randomized deployment, Network topology, Connectivity. Introduction to cloud system,Sensor Cloud Systems, Challenges in Sensor Cloud Systems.

UNIT-II:

Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization. **Wireless characteristics:** Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.

UNIT-III:

Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques.
Classification of Energy Management Schemes **Sleep-based topology control:** Constructing topologies for connectivity, constructing topologies for coverage.

UNIT-IV:

Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing. Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.

Text Books:

1. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli, TaiebZnati , Wiley Inter Science.
2. Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press

Reference Books:

1. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati , Springer.

3. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and MilindTambe , Kluwer Publications.

4.Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.

Course Name: **INTERNET OF THINGS**

Category: ProgrammeElective Course

Prerequisite: **Knowledge of Computer Networks**

Learning Objective:

- To learn the concepts behind IoT and different application areas where sensors can be effectively used to capture real-time data for monitoring and control functions.
- To understand various protocols that govern the functioning of an IoT System

.

Learning Outcome:

- . Understand general concepts of Internet of Things (IoT)

• Recognize various devices, sensors and applications

DSE Paper –MCA 206C
Internet of Things
UNIT-I:
Introduction to IoT, Basic requirements for building an IoT system, IoT reference framework, IoT network level – performance criteria. IoT devices: Sensors, Types of sensors and their functions: temperature, pressure, air pollution, proximity, infrared, moisture & humidity, flow, level, noise, and speed sensors. Characteristics of sensors. Use of RFID Actuators, Types of actuators and their functions: electrical, mechanical, and hydraulic actuators, controlling IoT devices
UNIT-II:
IoT requirements for networking protocols, device addressing, credential management, wireless spectrum, determinism, security and privacy, application interoperability, semantic interoperability. IoT Protocol Stack: layered view. Link layer: IEEE 802.15.4 technology, LoRaWAN end-to-end architecture, Time-Sensitive Networking Internet Layer: Routing Protocol for Low-Power and Lossy Networks.
UNIT-III:
Application Protocols Layer: Data Serialization Formats, Communication Paradigms: Request/Response Versus Publish/Subscribe, Blocking Versus Non-blocking, QoS: Resource Utilization, Data Timeliness, Data Availability, Data Delivery IoT Application Protocols: CoAP, XMPP, MQTT, AMQP, SIP, IEEE 1888, and DDS RTPS. Application Services Layer: ETSI M2M network architecture, oneM2M standards. IoT Services Platform: Functions and Requirements, IoT Platform Manager, Discovery, Communication Manager, Data Management, Management of IoT Devices, Configuration and Fault Management, Performance Management and measures
UNIT-IV:
IoT security and Privacy: challenges, requirements, IoT Three-Domain Architecture, Attacks and Countermeasures for each domain. Applications of IoT in areas like Smart home, Agriculture, Healthcare, Industry, Transportation, Retail, Oil and Gas, Energy etc. IoT Service Model: Anything as a Service, IoT Connected

Ecosystems Models
Text Books:
1.Internet of Things from Hype To Reality: The Road to Digitization (2nd ed), AmmarRayes and Samer Salam, Springer, 2019.

Course Name: **MOBILE COMPUTING**

Category: Programme Elective Course

Prerequisite: **Data communication and Computer Networks**

Learning Objective:

- Describe wireless and mobile communications systems and be able to choose an appropriate mobile system from a set of requirements.

Learning Outcome:

- Be able to avoid or work around the weaknesses of mobile computing, or to reject mobile computing as a solution.
- Interface a mobile computing system to hardware and networks.
- Program applications on a mobile computing system and interact with servers and database systems.

DSE Paper-MCA206D

Mobile Computing

UNIT-I:

Introduction to mobile computing, mobile computing architecture, mobile devices, mobile system networks:Cellular Network and frequency reuse, Channel Assignment, Handoff Strategies, Interferences and System Capacity, Improving coverage and capacity in Cellular Systems – Cell Splitting, Sectoring, Repeaters and Range Extension, Limitations of Mobile Computing.
.

UNIT-II:

Personal Communications Services (PCS): PCS Architecture, mobility management, Global System for Mobile Communication (GSM). System overview: GSM Architecture, Mobility management, Network signalling. General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes

UNIT-III:

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunnelling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).
Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT-IV:

Mobile Data Communication: WLANs (Wireless LANs), IEEE 802.11 standards.
Mobile Satellite Communication Networks: Case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, VPN, Mobile Ad-hoc networks, 4G Technology, Long Term Evolution (LTE).
.

Text Book:

1. R. Kamal, **Mobile Computing**, 1st Edition, Oxford University Press, 2006.
2.Mobile Computing Technology, Applications & Service Creation, A K Talukder& R RYavagal (TMH)
3.Wireless Communication, T. S Rappaport, Pearson

Reference Books:

1. Mobile Communications - Jochen Schiller (Addison-Wesley, Second Edition, 2009)
2. Principles of Mobile Computing - UWE Hansmann, LotherMerk, Martin S. Nicklaus, Thomas Stober (Second Edition, Springer)

3.Third Generation Mobile Telecommunication Systems, by P.Stavronlakis, Springer Publishers

Semester-III

Course Name:	**INFORMATION SECURITY**
Category:	Programme Core Course
Prerequisite:	**Computer Network**
Learning Objective:	• Explain the objectives of information security • Explain the importance and application of each of confidentiality, integrity, authentication and availability • Understand various cryptographic algorithms. • Understand the basic categories of threats to computers and networks • Describe public-key cryptosystem. • Describe the enhancements made to lPv4 by IPSec • Understand Intrusions and intrusion detection • Discuss the fundamental ideas of public-key cryptography. • Discuss aboutWeb security and Firewalls.
Learning Outcome:	• Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues. • Ability to identify information system requirements for both of them such as client and server. • Ability to understand the current legal issues towards information security.

Paper-MCA301

Information Security

UNIT-I:

Attacks on Computers and Computer Security: Introduction, The need for security, Security goals, Security attacks(Attack on Confidentiality,Integrity,Availability)Security Services and Mechanisms, Techniques(Cryptography,Steganography).

Introduction to plain text and cipher text, encryption and decryption. substitution techniques, transposition techniques, symmetric and asymmetric key cryptography, steganography, possible types ofcryptanalysis attacks.

UNIT-II:

Symmetric key Ciphers: Block Cipher principles &Algorithms(DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers RC4,Location and placement of encryption function.

Introduction to number theory-Prime numbers,Euler's Phi-Function,Fermat's and Euler's theorem, Chinese Remainder Theorem,Generating Primes(MersennePrime,Fermat Prime),Primality testing(Deterministic algorithms,Probalistic algorithms)

Asymmetric key Ciphers: Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman), Key Distribution.

UNIT-III:

Message Authentication Algorithms and Hash Functions: Message authentication

(MDC,MAC)Nested MAC,HMAC,CMAC,Whirlpool. Hash functions: MD5 Message Digest algorithm,SHA-1. Digital signatures, Authentication Applications: Kerberos, X.509 Authentication Service, Public — Key Infrastructure, Biometric Authentication.

UNIT-IV:

E-Mail Security: Pretty Good Privacy, S/MIME IP **Security:lP** Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, key management.

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction. Intrusion Detection System(types, techniques).

Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.

Text Book:

1. B. A. Forouzan, D.Mukhopadhyay, **Cryptography and Network Security**, 2nd Edition, McGraw Hill, 2007.

Reference Books:

1. A. Kahate, **Network Security**, 2nd Edition, McGraw Hill, 2008.
2. W. Stalling, **Cryptography and Network Security**, 4th Edition, Pearson Education, 2006.

Course Name: **ARTIFICIAL INTELLIGENCE**

Category: Programme Core Course

Prerequisite: **Linear Algebra, Programming Language**

Learning Objective

- To learn the difference between optimal reasoning VS human like reasoning.
- To understand the notions of state space representation and heuristic search.
- To learn different knowledge representation techniques.
- To understand the applications of AI: namely Game playing, Theorem Proving. Expert systems , machine learning and Natural language Processing.

Learning Outcome:

- Understand different types of AI agents.
- Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms).
- Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving.
- Know how to build simple knowledge-based systems.

Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Paper-MCA302

Artificial Intelligence

UNIT-I:

Introduction to Artificial Intelligence, AI Problems, AI Techniques,Problems ,Problem Space and Search, Defining the problem as a state space search, Production system, Problem characteristics, **Heuristic search Technologies:** Generate and Test, Hill Climbing, Best First Search, Problem Reduction, means-end-analysis, optimal and A*,AND-OR Graphs, AO* Algorithms.

UNIT-II:

Representation Knowledge using Predicate Logic, Representing simple facts in logic, Representing Instance and ISA relationships, Computable functions and Predicates, Resolution, Representing Knowledge using Rules, Forward Vs Backward Reasoning, Matching , Control Knowledge, , Weak slot and Filter structures, Semantic nets, Frames

UNIT-III:

Strong slot and Filter structures, Conceptual Dependencies, Scripts. Introduction to Non monotonic reasoning ,Logics for Non monotonic reasoning, Implementation : Depth First Search, Dependency-Directed Back Tracking, Justification based Truth Maintenance Logic based Truth Maintenance systems,Statistical Reasoning, Probability and Bayes Theorem,Certainty factors, Rule based Systems, Beyesian Networks, Dempster-Shaffer Theory

UNIT-IV:

Minmax search, alpha-beta cutoffs, Planning system, Goal stack planning, Hierarchical Planning, Natural Language Processing., Syntactic Analysis, Semantic Analysis, Discuses and Pragmatic Processing. Introduction and Fundamentals of Artificial Neural Networks, Biological Prototype, Artificial Neuron, Single Layer Artificial Neural Networks, Multilayer Artificial Neural Networks, Training of Artificial Neural Networks,Genetic Algorithms

Text Books:

1.Elaine Rich, Kevin Knight and ShivashankarB . Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008.

2.Neural Computing: Theory and practice- Waserman

Reference Books:

1. Artificial Intelligence Structures and Strategies complex problem solving-George F. Lugar Pearson Education
2. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education, 2010.
3. Dan W. Patterson, Artificial Intelligence and Expert Systems, PHI.

Neural Networks: A Comprehensive Foundation 2/e- Symen Pearson Education.

Course Name: **SOFTWARE ENGINEERING& OOAD**

Category: Programme Core Course

Prerequisite: **Knowledge on programming and data structure**

Learning Objective:

- To understand common cycle process life processes.
- To understand the basic concepts in Requirement engineering,software design, coding, testing and maintenance
- To learn about the role of project management including scheduling, planning, risk management etc.
- To have a basic knowledge about software quality,how to ensure good quality software.

Learning Outcome:

- After successful completion of the course the students will be able to demonstrate basic software engineering methods and practices, and their appropriate application.

Paper-MCA303

Software Engineering& OOAD

UNIT-I:

Software and software engineering: Basic concepts about software and program, the nature ofsoftware, Evolution of Software Engineering, Stakeholders in software engineering, Softwarequality, Software engineering projects, Activities common to software projects, Basic conceptson process and life cycle models.

UNIT-II:

Models: Waterfall, Prototype, Evolutionary, Incremental, Spiral, V-model, RAD.
RequirementAnalysis: System and software requirements, Types of software requirements, Functional andnon-functional requirements, Domain requirements, User requirement Elicitation and analysisof requirements, Overview of requirement techniques, Viewpoints, Interviewing, Scenario,Requirement validation, Requirement specification, Software requirement Specification (SRS)Structure and contents, SRS format

UNIT-III:

Introduction to Object Orientated Technology: Development and OO Modeling History, Modeling Concepts,
Object Oriented Analysis: Identifying Use-Cases, Complexity in ObjectOriented Analysis, Business Process Modeling and Business Object Analysis, Use-Case DrivenObject Oriented Analysis, Use-Case Model.
Class Modeling: Object and class concepts, linkand association, Generalization and Inheritance, Advanced class modeling- aggregation,Abstract class, constraints. State Modeling: Event, state, Transition and conditions, statediagram, state diagram behaviour,concurrency, Relation of Class and State models. InteractionModeling: sequence models, activity diagrams

UNIT-IV:

Software Project Management: Overview of Project Management,Responsibilities of ProjectManager, Project Planning , Metrics for Project Size Estimation, Factors Influencing Project Management, Project Estimation Techniques, COCOMO Model and its versions, Scheduling,Work Breakdown Structures (WBS), Activity Network, Critical Path Method(CPM), Program Evaluation and Review Technique (PERT) Chart, GANTT Chart, Risk Management,

Configuration Management

Software Testing: Testing overview, concepts, Scope of Testing, Testing Constraints, TestingLife Cycle, Levels of Testing, Blackbox Testing, Whitebox Testing, Integration Testing, Testing Object Oriented Programs

Text Books:

1. R.S. Pressman, "Software Engineering", A Practitioner's Approach, 7/e, McGraw-Hill, 2009
2. Timothy C. Lethbridge, Robert Laganière, "Object-Oriented Software Engineering Practical Software development using UML and Java", McGraw-Hill, Second Edition.

Reference Books:

1. Sommerville, "Software Engineering", 9/e, Addison Wesley.
2. R. Mall, "Fundamentals of Software Engineering", 3/e, PHI

Course Name: **WEB TECHNOLOGY**

Category: ProgrammeCore Course

Prerequisite:

- Good understanding of object oriented programming
- Basic programming skills

Learning Objective:

- Understand the principles of creating an effective web page, including an in-depth consideration of information architecture.
- Become familiar with graphic design principles that relate to web design and learn how to implement theories into practice.
- Learn the language of styling the web page using HTML and CSS.
- Acquire knowledge to develop valid and well-formed XML document.
- Learn techniques of responsive web application design.
- Develop basic programming skills using JavaScript and PHP.

Learning Outcome:

- Design and implement dynamic websites with good aesthetic sense of designing.
- Have a Good grounding of web application terminologies and web development tools.
- Develop multiplatform interactive and dynamic web applications.
- Outline the key components that facilitate the interoperability nature of web services.

Paper-MCA304
Web Technology
UNIT-I:
Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols - The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. **Markup Languages: XHTML**. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-XML Creating HTML Documents-Case Study.
UNIT-II:
Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-StyleSheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model-Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. **Client-Side Programming:** The JavaScript Language-History and Versions Introduction to JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

UNIT-III:

PHP: Introducing PHP, PHP Language Basics–Using variables, Understanding Data Types, Operators and Expressions, Constants. Decisions and Loops–Making Decisions, Doing Repetitive Tasks with Looping, Mixing Decisions and Looping with HTML.**Strings**–Creating and Accessing Strings, Searching Strings, Replacing Text with strings, Dealing with Upper and Lowercase, Formatting Strings.**Arrays**–Creating Arrays, Accessing Array Elements, Looping Through Arrays with for-each, Working with Multidimensional Arrays, Manipulating Arrays.**Functions**, writing your own Functions, Working with References, Writing Recursive Functions.

Objects–Introduction OOP Concepts, Creating Classes and Objects in PHP, Creating and using Properties, Working with Methods.

UNIT-IV:

PHP MySQL: HandlingHTML Forms with PHP–How HTML form works,Capturing Form Data with PHP, Dealing with Multi-Value Fields, Generating Web Forms with PHP, Storing PHP Variables in Forms, Creating File Upload Forms, Redirecting After a Form Submission.**IntroducingDatabasesand SQL**–Deciding How to Store Data, Understanding Relational Databases, SettingUpMySQL, AQuick Play with MySQL, Connecting MySQL from PHP.**Retrieving Data from MySQL with PHP**–Setting Up the Book Club Database, Retrieving Data with SELECT, Creating a Member Record Viewer. Manipulating MySQL Data with PHP–Inserting, Updating, and Deleting Records.

Text Books:

1. M. Doyle, **Beginning PHP 5.3**, 1st Edition, John Wiley & Sons, 2011.
2. J.Duckett,**Beginning HTML, XTML, CSS and JavaScript**, 1st Edition,John Wiley & Sons, 2011

Reference Book:

1. L. Welling, L. Thomson, **PHP and MySQL Web Development**, 1st Edition, Sams Publishing, 2003.

Paper-MCA305

Lab: Web Technology and Software Engineering

EXPERIMENTS ON WEB TECHNOLOGY:

1. Design a web page for your college containing a description of courses, departments, faculties using different HTML elements.
2. Customize the HTML page using CSS.
3. Create a login form which will check for username and password. If login successful then goto next form(Student registration form) that contains form with fields Name, Email, Mobile No ,Gender and a button .write a JavaScript code to validate data of above form.
4. Develop simple calculator for addition, subtraction, and multiplicationanddivisionoperation using JavaScript.
5. Design a web page to create your resume usecolor, textcolor, an Image, font etc. You may use CSS to format web page.
6. Create user Student registrationform (use textbox, checkbox, radiobutton, select box etc.)
7. Design an examination registration form using HTML. Sore the required data in a database (create it using MySQL) using PHP and also display message regarding status of registration (Success or Unsuccess).
8. Create a database through PHP and MySQL, and create, delete and modify data on database.
9. Store the data from a HTML form designed for registering a webinar and using PHP and MySQL, store, and update the data. Display the database data in HTML form.
10. Create anapplication using HTML, PHP. Create login form using HTML and checkusername and password using PHP, if login successful it will go on next HTML page and if failure again goesback to login page

EXPERIMENTS ON SOFTWARE ENGINEERING:

Develop requirements specification for a given problem (The requirements specification Should include both functional and non-functional requirements. For a set of about 20 sample problems, see the questions section of Chap 6 of Software Engineering book of Rajib Mall)

2: Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required)

3: Develop structured design for the DFD model developed

4: Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)

5: Develop Sequence Diagrams.
6: Develop Class diagrams.
7: Develop code for the developed class model using Java.
8: Use testing tool such as Junit.
9: Use a configuration management tool.
10: Use any one project management tool such as Microsoft Project or Gantt Project, etc

Course Name:NETWORK AND INTERNET TECHNOLOGIES

Category:IDSE Course

Prerequisite: Basic knowledge of a computer system and Internet is required.

Learning Objective:

- study the fundamental concepts of computer networks.
- Introduce the fundamental concepts of Web Design.
- expose students to develop basic web applications.

Learning Outcome:

- describe the basics of computer networks topology.
- understand the basic concept of transmission media, LAN topology and network devices,
- develop web applications using web technologies

IDSE-Paper-MCA306A
Network and Internet Technologies
UNIT-I:
Computer Networks: Introduction to computer network, datacommunication, components of data communication, data transmission mode, data communication measurement, LAN, MAN, WAN, wireless LAN, internet, intranet,extranet.**Network Models:** Client/ server network and Peer-to-peer network, OSI, TCP/IP, layersandfunctionalities.
UNIT-II:
Transmission Media: Introduction, Guided Media: Twisted pair, Coaxial cable, Opticalfiber. Unguided media: Microwave, Radio frequency propagation,Satellite.**LAN Topologies:** Ring, bus, star, mesh and treetopologies.**Network Devices:** NIC, repeaters, hub, bridge, switch, gateway androuter.**Internet Terms:** Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online andoffline.
UNIT-III:
Introduction to Web Design: Introduction to hypertext markup language (html) Document type definition, creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames, hosting options and domain name registration.
UNIT-IV:
Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-StyleSheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model-Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. **Client-Side Programming:** The JavaScript Language-History and Versions Introduction to JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

Text Book:

1. J. A. Ramalho, **Learn Advanced HTML 4.0 with DHTML**, BPB Publications,2007

Reference Books:

1. B. A. Forouzan, Data Communication and Networking , Tata McGrawHill, 2008.
2. D.R. Brooks, An Introduction to HTML and Javascript for Scientists and Engineers, Springer, 2007.
3. HTML A Beginner's Guide, Tata McGraw-Hill Education,2009.
4. J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications,2007

Course Name **COMPUTER FUNDAMENTALS**

Category **IDSE Course**

Prerequisite: Basic mathematics

Learning Objective:

- To make students understand and learn the basics of computer.
- To make them familiar with the parts and functions of computer.

Learning Outcome: Identify and describe the functionality of various parts of digital computer. Describe the working principle of Computer. Perform various binary arithmetic operations. Describe the use of different type of memory used in computer

IDSE-Paper-MCA306B
Computer Fundamentals
.
UNIT-I:
Computer Basics: Simple model of computer, Problem solving using computer (flowchart, program, working of a computer, hardware and software). **Data Representation**: Character representation, representation of integers and fractions, Decimal to binary conversion. **Input / Output Units**.
UNIT-II:
Memory System: Basic Concepts RAM, ROM,Speed, size and cost, Cache Memory concepts, Cache Memory mappingtechniques, Virtual Memory concepts,SecondaryStorage.**Processor**: Structure of instructions, Description of a processor, Machine language program, Algorithm to simulate the hypothetical computer.
UNIT-III:
Binary Arithmetic: Addition, subtraction, signed numbers, Two's complement representation of numbers, addition/subtraction of numbers in 2's complement notation, binary multiplication, binary division, floating point representation of numbers, arithmetic operation with normalized floating point numbers.
UNIT-IV:
Logic circuits: switching circuits, AND, OR, NOT operation, Boolean functions, canonical forms for Boolean function, logic circuits. Computer Architecture: Interconnection of of Units, Processor to memory communication, I/O devices to processor communication, Bus architecture of personal computers; **Introduction to Programming Language, Operating system.**.
Text Book:
1. V. Rajaraman, and N. Adabala, **Fundamentals of computers**, PHI, 2014. 2. A. Goel, **Computer Fundamentals**, Pearson Education, 2010.
Reference Book:
1. P. Aksoy, L. DeNardis, **Introduction to Information Technology**, Cengage Learning, 2006. 2. P. K. Sinha, P. Sinha, **Fundamentals of Computers**, BPB Publishers, 2007.

Course Name: **INTRODUCTION TO PROGRAMMING USING PYTHON**

Category:IDSE Course

Prerequisite: Basic analytical and logical understanding including basic knowledge and usage of computers is required for this course. Prior experience with any other programming language will be beneficial.

Learning Objective:

- Introduce Python programming to students.
- Apply problem solving techniques to solve computational problems using python.
- Expose students to develop application for solving computational problems.

Learning Outcome::

- Able to install and set the python environment in their PC and execute python programs.
- Proficiently use functions and core data structure like list, dictionaries, tuple.
- Understand Python syntax, flow control, and functions to solve real life application.
- Develop application using Object Oriented Programming concepts of Python.

IDSE-Paper-CSC306C
Introduction to Programming Using Python
UNIT-I:
Introduction: Installation, First Python Program: Interactive Mode Programming, Script Mode Programming; Identifiers, Reserved Words, Lines and Indentation, Multi-Line Statements, Quotation & Comments; Assigning Values to Variables, Multiple Assignment.
UNIT-II:
Standard Data Types: Numbers, Strings, Lists, Tuples, Dictionary; Data Type Conversion; Basic Operators: Arithmetic, Comparison, Assignment, Bitwise; Operators: Logical, Membership, Identity; Operators Precedence; Python Numbers & Mathematical functions **Data Type Conversion:** Basic Operators: Arithmetic, Comparison, Assignment, Bitwise; Basic Operators, Python Numbers & Mathematical functions; Python Strings.
UNIT-III:
Python statements and Loops: if, if-else, While, for loops, break, continue, pass, Python Function; Files I/O. **Functions**: Definition, call, positional and keyword parameter. Default parameters, variable number of arguments. Modules - import mechanisms. Functional programming - map, filter, reduce, max, min. lambda function - list comprehension
UNIT-IV:
Object Oriented Programming: classes and objects - Inheritance – Polymorphism overloading;

Error handling & Exceptions - try, except and raise - exception propagation **File Processing:** reading and writing files.
Text Book:
.1. Python Programming Fundamentals - A Beginner's Handbook, NischaykumarHegde
Refrence Book:
1.Python: The Complete Reference by Martin C.Brown

Semester-IV

MCA 401/402

Students are required to complete any **two** of the following MOOCs courses of minimum 8 weeks duration anytime during his/her entire two years of MCA from **https://swayam.gov.in**. aswellas **https://nptel.ac.in**.The course completion certificate of below said courses need to be submitted in the final year at the time of Project Viva.

1.An Introduction to Coding Theory	2.Big Data Computing
3.Cloud Computing	4.Computer Graphics
5.Data Science for Engineers	6.Google Cloud Computing Foundations
7.Image Signal Processing	8.Scalable Data Science
9.Applied Natural Language Processing	10.Introduction to Machine Learning
11.Peer to Peer Networks	12.Animations
13. Parallel Algorithms	14. Distributed Computing systems
15.Pattern Recognition	16.Real Time Systems
17.Microprocessors and Microcontroller	18.Computational Complexity Theory
19.Deep learning	20.Data Analytics with Python
21.Embedded System Design	22.Android app using Kotlin

23.Introduction to Haskell programming	24. Human-Computer Interaction
25.Arduino	26.Blockchain Architecture Design and Use cases
27.Introduction to Soft computing	28.Computer Vision
29.Digital image processing	30.Virtual Reality

Apart from the above courses if any student wishes to do any course fromhttps://swayam.gov.in.aswellas https://nptel.ac.in(but it should not be in there course curriculum of 1st ,2nd and 3rd Semesters) they are allowed to do so with a prior approval of Coordinator MCA.

MCA403

Industrial Project Work / Internship

Students are expected to undertake a software development project (preferably a real-life project) and implement the same by following a software engineering approach.

Students will analyze a system, understand, design, write code, test, and implement the software system as an end-product.

Student has to work under the guidance of a supervisor

S/he has to submit a project report and give a presentation along with a viva voce.