

# **GANGADHAR MEHER UNIVERSITY**

**AMRUTA VIHAR, SAMBALPUR, ODISHA**



*Syllabus for*

**MASTER OF COMPUTER APPLICATIONS**

**(2-Year Programme)**

**Course Effective from Academic Year 2024-2025**

## DEPARTMENT OF MCA

### **Vision**

To create globally competent undergraduates and postgraduates in Computer Science by imparting training in emerging technologies and collaborative research through a conducive and disciplined academic environment, and orient them towards serving the society.

### **Mission Statements**

- M1:** To provide high quality professional training at the undergraduate and postgraduate level with an emphasis on basic principles of computer science and applications.
- M2:** To empower the students with the required skills to solve the complex technological problems of modern society and also provide them with a framework for promoting collaborative and multidisciplinary research.
- M3:** To strengthen the Industry-Academia interface by interacting with the industry, educational & research organizations and alumni that will help the students to emerge as leaders in academics or in entrepreneurship.
- M4:** To impart moral and ethical values, and interpersonal skills to the students for betterment of the society.

## **PROGRAM OUTCOMES(POs):**

- PO1. Knowledge and Understanding:** Develop an ability to understand the theoretical foundations of computer science for designing efficient methodologies along with the knowledge of limitations of computing.
- PO2. General, Technical and Professional Skills:** An ability to function effectively as an individual with diversified skills or as a part of a multi-disciplinary team setting to accomplish defined goals.
- PO3. Application of Knowledge and Skills:** Developing problem analysis skills and knowledge and applying the same in real life situation.
- PO4. Research Skills:** Explore research based knowledge and carry out academic investigations on the cutting edge technologies in allied subjects of Computer Science.
- PO5. General Learning Outcomes:** Create, select and apply advanced techniques and tools including modelling complex activities related to Computer Science.
- PO6. Constitutional, Humanistic, Ethical and Moral Values:** Design, develop and evaluate new system components or processes of computer science that meet the desired needs with appropriate considerations of industry, society, public health, safety, culture, environment and sustainable development sticking on to the ethics and values.
- PO7: Employability Job Skills and Entrepreneur Skills:** Prepare the students to take up a career as versatile contributors in industry, academia, research and development or entrepreneurship employing their expertise to advance personal growth while making meaningful contributions to societal progress

## **PROGRAM SPECIFIC OUTCOMES(PSOs):**

- PSO1.** To shield students from the rapid obsolescence of computer technology, the program focuses on imparting foundational knowledge, fostering critical thinking skills, and cultivating technical expertise.
- PSO2.** Analyze, design, and develop software applications with latest computing tools and technologies.
- PSO3.** Empowering the students to pursue careers in IT industry/ consultancy/ research and development, teaching and allied areas related to computer science.

## MCA Programme Structure

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

### Part-I: Semester-I

Papers		Duration (Hrs)	Credit
Paper No	Title		
<b>MCA101</b>	<b>Programming and Data Structure</b>	4	4
<b>MCA102</b>	<b>Data Communication and Networks</b>	4	4
<b>MCA103</b>	<b>Operating Systems</b>	4	4
<b>MCA104</b>	<b>Mathematical Foundations of Computer Science</b>	4	4
<b>MCA105</b>	<b>Lab I( Data Structure and Operating System)</b>	6	4
<b>Total</b>			<b>20</b>

### Part-I: Semester-II

Papers		Duration (Hrs)	Credit
Paper No	Title		
<b>MCA201</b>	<b>Object Oriented Programming using JAVA</b>	4	4
<b>MCA202</b>	<b>Computer Organization and Architecture</b>	4	4
<b>MCA203</b>	<b>Database Management Systems</b>	4	4
<b>MCA204</b>	<b>Formal Language and Automata Theory</b>	4	4
<b>MCA205</b>	<b>Lab II (OOP using Java and DBMS)</b>	6	4
	<b>DSE-I Papers</b>		
<b>MCA206 A</b>	<b>Data Warehousing and Mining</b>	4	4
<b>MCA206 B</b>	<b>Ecommerce</b>	4	4
<b>MCA206 C</b>	<b>Internet of Things</b>	4	4
<b>MCA206D</b>	<b>Mobile Application Development</b>	4	4
<b>MCA206E</b>	<b>Machine Learning</b>	4	4
<b>MCA206F</b>	<b>Real Time System</b>	4	4
<b>Total</b>			<b>24</b>

### Part-II: Semester-III

Papers		Duration (Hrs)	Credit
Paper No	Title		
<b>MCA301</b>	<b>Software Engineering and OOAD</b>	4	4
<b>MCA302</b>	<b>Web Technology</b>	4	4
<b>MCA303</b>	<b>Design and Analysis of Algorithms</b>	4	4
<b>DSE-II Papers</b>			
<b>MCA304A</b>	<b>Data Science</b>	4	4
<b>MCA304B</b>	<b>Compiler Construction</b>	4	4
<b>MCA304C</b>	<b>Information Security</b>	4	4
<b>MCA304D</b>	<b>Digital Image Processing</b>	4	4
<b>MCA304E</b>	<b>Soft Computing</b>	4	4
<b>MCA 304F</b>	<b>Simulation Modelling</b>	4	4
<b>MCA305</b>	<b>Lab III (Web Technology and Software Engineering)</b>	6	4
<b>IDSE Papers</b>			
<b>MCA306A</b>	<b>Network and Internet Technologies</b>	4	4
<b>MCA306B</b>	<b>Fundamentals of Computer</b>	4	4
<b>MCA306C</b>	<b>Python Programming</b>	4	4
<b>Total</b>			<b>24</b>

### Part-II: Semester-IV

Papers		Credit
Paper No	Title	
<b>MCA401</b>	<b>Industrial Project Work and VIVA VOCE</b>	20
	<b>MOOCs-1</b>	6
	<b>MOOCs-2</b>	
<b>Total</b>		<b>20+6*</b>
	<b>Grand Total</b>	<b>88+6*</b>

Value Added Course offered beyond the prescribed syllabus

Subject	Duration(Hrs)	Credit
<b>Web Designing</b>	40	4

\*Non-Divisional Credits

SEMESTER WISE CREDIT DISTRIBUTION					
Semester	I	II	III	IV	TOTAL
<b>Total Credit</b>	<b>20</b>	<b>24</b>	<b>24</b>	<b>20+6*</b>	<b>88+6*</b>

NB:

- The students are encouraged to take two extra MOOCs courses to earn a maximum of 6 Credits.
- Each theory paper consists of 100 marks(Mid Sem 30,End Sem 70).

- Lab Exam will be of 100 marks.

**Red colour within the uploaded softcopy of the syllabus indicates Employability.**

**Green colour within the uploaded softcopy of the syllabus indicates Entrepreneurship.**

**Blue colour within the uploaded softcopy of the syllabus indicates Skill Development.**

## Semester-I

Course Code	MCA101
Course Name	PROGRAMMING AND DATA STRUCTURE
Category	Programme Core Course
Prerequisite	Computer fundamentals

<b>Paper-MCA101</b>	
<b>Programming and Data Structure</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
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( )	
<b>UNIT-II:</b>	<b>10hrs</b>
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	
<b>UNIT-III:</b>	<b>10hrs</b>
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	
<b>UNIT-IV:</b>	<b>10hrs</b>
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,	
<b>Text Books:</b>	

1. E. Balagurusamy, Programming in Ansi C, 6<sup>th</sup> Edition, McGraw-Hill, 2012.
2. Reema Thareja, Data Structures Using C, 2<sup>nd</sup> Edition, Oxford University Press, 2014.
3. J. P. Tremblay and P. G. Sorenson, An Introduction To Data Structures With Applications, 2<sup>nd</sup> Edition, McGraw Hill, 1983.
4. Ellis Horowitz, SartajSahni, Susan, Derson-Freed, Fundamentals of Data Structures in C, 2<sup>nd</sup> Edition, Universities Press, 1982.

**Reference Books:**

1. B. Kernighan and D. Ritchie, The C Programming Language, 2<sup>nd</sup> Edition, Pearson, 1988.
2. Amiya kumar Rath, Data Structures Using C, 2<sup>nd</sup> Edition, Scitech Publications India Pvt. Ltd, 2011.

<b>COURSE OUTCOMES:</b>	
	After completion of this course successfully, the students will be able to-
<b>CO1</b>	Explain Linear data structure and their Linked Representation.
<b>CO2</b>	Perform operation on tree data structure and their operation.
<b>CO3</b>	Analyse performance of different Sorting Techniques.
<b>CO4</b>	Explain and represent B tree and AVL tree along with their operations.
<b>CO5</b>	Use both Linear and Nonlinear Data structure in Real time Application through Coding.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	1	3	3	2		1	1		
<b>CO2</b>	1	2	3	3	2		1	2	1	1
<b>CO3</b>	1	2	3	2	2		1	1	1	1
<b>CO4</b>	1	3	3	3	2		2	3	2	1
<b>CO5</b>	2	2	3	3	2		2	2	1	1

<b>Course Code</b>	<b>MCA102</b>
<b>Course Name</b>	<b>DATA COMMUNICATION AND NETWORKS</b>
<b>Category</b>	Programme Core Course
<b>Prerequisite</b>	Basics of Computer

<b>Paper-MCA102</b>	
<b>Data Communication and Networks</b>	
<b>UNIT :I</b>	<b>12hrs</b>
Overview of Data Communication and Networking. <b>Physical Layer:</b> Analog and Digital, Analog Signals, Digital signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals, <b>Digital Transmission:</b> 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.	
<b>UNIT:II</b>	<b>14hrs</b>
<b>Data Link Layer:</b> Error Detection and Correction: Types of errors, Detection, Error correction, 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, Multiple Access, 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.	
<b>UNIT:III</b>	<b>10hrs</b>
<b>Network Layer:</b> Host- to –Host Delivery: Internetworking, Addressing, Routing, Network Layer Protocols: ARP, RARP, NAT, BOOTP, DHCP, IPV4, IPV6, ICMP, ICMPV6 and Unicast Routing protocols, Transport Layer: Process to Process Delivery: UDP, TCP, congestion control and Quality of Service.	
<b>UNIT: IV</b>	<b>04hrs</b>
<b>Application Layer:</b> Client Server Model, Peer to Peer network, Domain Network System (DNS), Electronic Mail (SMTP), and file transfer (FTP), HTTP and WWW.	
<b>Text Book:</b>	
1. B.A. Forouzan, Data Communication And Networking, 4 <sup>th</sup> Edition, Tata McGraw Hill, 2007. 2. Peter Lars Dordal, An Introduction to Computer Networks, 2 <sup>nd</sup> Edition, Loyola University of Chicago, 2014.	
<b>Reference Books:</b>	
1. A. S. Tenenbaum, Computer Network, 5 <sup>th</sup> Edition, PHI, 2011.	



2. James F. Kurose & Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 3<sup>rd</sup> Edition, Pearson Education India, 2013.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Identify the networks with their related concepts.
<b>CO2</b>	Memorize the protocols at different layers of the network.
<b>CO3</b>	Compare the same concepts with different dimension.
<b>CO4</b>	Practice the numerical problems of the related concept.
<b>CO5</b>	Explain the signals with their differences.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	2	3	2	1	2	2	1	3	1
<b>CO2</b>	1	3	3	3	1	2	1	2	2	1
<b>CO3</b>	1	2	3	2	1	2	2	1	2	1
<b>CO4</b>	1	2	3	3	1	1	2	1	2	1
<b>CO5</b>	1	2	3	2	1	1	2	2	1	1

<b>Course Code</b>	<b>MCA103</b>
<b>Course Name</b>	<b>OPERATING SYSTEMS</b>
<b>Category</b>	Programme Core Course
<b>Prerequisite</b>	Computer Programming and Data Structures

<b>Paper-MCA103</b>	
<b>Operating Systems</b>	
<b>UNIT-I:</b>	<b>10 hrs</b>
<p><b>Operating System Overview:</b> -Introduction, The Need of Operating Systems, Evolution of Operating Systems, Types of Operating Systems, Simple Batch, Multi-programmed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls, Virtual Machines, System Design and Implementation.</p> <p><b>Process Management</b> – Process concepts, Life cycle, PCB, Schedulers, Process Scheduling, Threads, Scheduling Levels, CPU Scheduling: Scheduling-Criteria, Algorithms, Algorithm Evaluation.</p>	
<b>UNIT-II:</b>	<b>10hrs</b>
<p><b>Concurrency:</b>-Process synchronization, The Critical- Section Problem, Peterson’s Solution, synchronization Hardware, Semaphores, Classic problems of synchronization, Monitors.</p> <p><b>Deadlocks:</b> System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock detection, deadlock prevention, deadlock avoidance, Recovery from deadlock.</p>	
<b>UNIT-III:</b>	<b>10hrs</b>
<p><b>Memory Management:</b> Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.</p> <p><b>Virtual Memory:</b> Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files</p>	
<b>UNIT-IV:</b>	<b>10hrs</b>
<p><b>Mass-Storage Structure:</b> Overview, Disk Structure, Disk scheduling, disk management, Swap-space management, RAID structure.</p> <p><b>File Systems:</b> File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, Protection. File- System Structure and Implementation, Directory Implementation, Allocation Methods, Free-Space Management.</p>	
<b>Text Book:</b>	
1.A. Silberchatz, P. B. Galvin, G. Gagne, Operating System Concepts, 8 <sup>th</sup> Edition, Wiley India, 2010.	

**Reference Books:**

1. Charles Crowley, Operating Systems: A Design-Oriented Approach, 1<sup>st</sup> Edition, McGraw-Hill, 1996.
2. A. S. Tanenbaum and H. Bos, Modern Operating Systems, 4<sup>th</sup> Edition, Pearson, 2015.
3. W. Stallings, Operating Systems – Internals And Design Principles, 9<sup>th</sup> Edition, Prentice Hall, 2017.
4. D. M. Dhandhere, Operating Systems-A Concept Based Approach, 2<sup>nd</sup> Edition, McGraw-Hill, 2006.

	<b>COURSE OUTCOMES:</b>
	After completion of this course successfully, the students will be able to-
<b>CO1</b>	Explain the different types of Operating systems
<b>CO2</b>	Describe the lifecycle of a process and its attributes with its scheduling algorithms
<b>CO3</b>	Analyze the concept of Deadlock
<b>CO4</b>	Apply segmentation and paging techniques
<b>CO5</b>	Explain the structure and organization of the file systems and I/O systems

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1			1	1		1	1		
<b>CO2</b>	2	2	3	3	1		2	2	2	1
<b>CO3</b>	1	2	3	2	2		1	2	1	1
<b>CO4</b>	1	2	3	3			2	1		1
<b>CO5</b>	1	3	3	3	1		1	2	2	1

<b>Course Code</b>	<b>MCA104</b>
<b>Course Name</b>	<b>MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE</b>
<b>Category</b>	Programme Core Course
<b>Prerequisite</b>	Basics of set theory and combinatory

<b>Paper-MCA104</b>	
<b>Mathematical Foundations of Computer Science</b>	
<b>UNIT-I:</b>	<b>14hrs</b>
<p><b>Fundamentals of Logic:</b> Propositional Logic, Propositional Equivalences, Predicate and Quantifiers, nested Quantifiers, Rules of Inference.</p> <p><b>Set Theory:</b> Sets, Set Operations.</p> <p><b>Introduction to proofs:</b> proof by Induction, proof by contradiction, proof by cases with examples.</p> <p><b>Mathematical Induction:</b> Introduction to Induction, strong Induction, Recursion.</p> <p><b>Relations:</b> Relations and their properties, n-ary Relations and their applications, Representing relations, Closures of relations, Equivalence relations, and Partial Orderings, lattices, partial order set, properties of lattices.</p> <p><b>Functions:</b> Types of Functions, Composition of Functions, Invertible Functions, Recursive Functions, Pigeon-hole principle.</p>	
<b>UNIT-II:</b>	<b>06hrs</b>
<p><b>Discrete Numeric functions and Generating Functions:</b> Discrete Numeric Functions, Generating Functions, Recurrence relations and recursive algorithms, Linear recurrence relations, Solving Recurrence Relations by Generating Functions.</p>	
<b>UNIT-III:</b>	<b>10hrs</b>
<p><b>Graphs:</b> Graphs, Graph models, special types of graphs, Representing graphs, Graph Isomorphism, connectivity, Euler and Hamilton paths, Planar graphs, Graph Coloring, Matching problem.</p> <p><b>Trees:</b> Introduction to Trees, Applications of Trees, Binary Trees, n-ary Trees, Tree Traversal, Spanning Trees</p>	

<b>UNIT-IV:</b>	<b>10hrs</b>
<b>Algebraic Structures:</b> Group, Semi groups , monoids, subgroup, homomorphism, co-sets, normal subgroup, Lagrange's theorem, algebraic system of two binary operation,- Boolean algebra, Boolean function and simplification, group codes, parity check, single error correcting code,	
<b>Text Books:</b>	
<ol style="list-style-type: none"> <li>1. C.L.Liu, D. P. Mohapatra, Elements of Discrete Mathematics: A Computer Oriented Approach, 4<sup>th</sup> Edition, McGraw-Hill, 2016.</li> <li>2. K. H. Rosen, Discrete Mathematics &amp; Its Applications ( with Combinatorics and Graph Theory), 6<sup>th</sup> Edition, McGraw-Hill, 2007.</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill, 1997.</li> <li>2. R. L. Graham, D. E. Knuth, O. Patashnik, Concrete Mathematics: A Foundation for Computer Science, 2<sup>nd</sup> Edition, Pearson Education, 2007.</li> <li>3. D. B. West, Introduction to Graph Theory, 2<sup>nd</sup> Edition, PHI Learning, 2009.</li> <li>4. A. Brualdi, Introductory Combinatorics, 4<sup>th</sup> Edition, Pearson, 2004.</li> </ol>	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions.
<b>CO2</b>	To apply mathematical foundations, algorithmic principles, and computer science theory to the modelling and design of computer based systems.
<b>CO3</b>	Able to construct simple mathematical proofs and possess the ability to verify them.
<b>CO4</b>	Model problems in Computer Science using graphs and trees methods.
<b>CO5</b>	To Understand and prove fundamental results and solve algebraic problems using appropriate techniques

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	1	1	1	1		1	1		2
<b>CO2</b>	1	2	1	1	1		1	1		1
<b>CO3</b>	1	2	1	1	1		1	2	1	1
<b>CO4</b>	2	3	1	2	2		2	2	1	1
<b>CO5</b>	2	2	1	2	1		1	2	1	1

**Lab I: Data Structure and Operating System**

**C PROGRAMS:**

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. Implementations 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 student records 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, insert a node, delete a node, traverse and display preorder, in order and post order sequence of its nodes.
13. Implementation of Heap Sort.
14. Implementation of digraphs using adjacency matrix and find the transitive closure using Warshall's algorithm.
15. Implementation of a weighted graph and find minimal cost spanning tree using Prim's algorithm.

#### **OPERATING SYSTEM PROGRAMS:**

1. Implementation of FCFS Scheduling.
2. Implementation of Round Robin Scheduling.
3. Implementation of Shortest Job First Scheduling (Non Pre-emptive).
4. Implementation of Shortest Job First Scheduling (Pre-emptive).
5. Implementation of Priority Based Scheduling.
6. Implementation of Deadlock detection
7. Implementation of simple Thread and Multi-Threading.
8. Implementation of Paging techniques of Memory Management(FIFO,LRU,OPTIMAL)
9. Implementation of Semaphore.
10. Implementation of Peterson's Solution in Process Synchronization.

## Semester-II

Course Code	MCA201
Course Name	OBJECT ORIENTED PROGRAMMING USING JAVA
Category	Programme Core Course
Prerequisite	Basic procedural programming Language (like C-Programming)

<b>Paper-MCA201</b>	
<b>Object Oriented Programming using JAVA</b>	
<b>UNIT-I:</b>	<b>08hrs</b>
<b>Java Evolution and Environment:</b> 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. <b>Java Environment:</b> 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.	
<b>UNIT-II:</b>	<b>12 hrs</b>
<b>Classes, Objects and Methods:</b> Introduction, defining a class, creating objects, accessing class members, constructors, method overloading, static members. <b>Inheritance:</b> Defining a sub-class, sub-class constructor, multi-level variables, and final classes and finalize methods, abstract methods and classes, visibility control. <b>Arrays and Strings:</b> 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. <b>Managing Errors and Exceptions:</b> 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.	
<b>UNIT-III:</b>	<b>10 hrs</b>
<b>Interfaces, Package and Multi-threaded Programming:</b> Introduction, defining interfaces, extended interfaces, implementing interfaces. <b>Package:</b> Creation, importing a package and user-defined package. <b>Threads:</b> 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.	
<b>UNIT-IV:</b>	<b>10 hrs</b>



**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, Java The Complete References, 11<sup>th</sup> Edition, Tata McGraw Hill, 2019.

**Reference Books:**

1. Y. Daniel Liang, An Introduction to JAVA Programming, 10<sup>th</sup> Edition, Pearson.
2. K. Sierra, Head First Java, 2<sup>nd</sup> Edition, O'Reilly Media, Inc., , 2003.
3. E. Balaguruswamy, Programming with JAVA, 6<sup>th</sup> Edition, Tata McGraw Hill, 2014.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to
<b>CO1</b>	Explain the basic principles of object-oriented programming along with its strength and weakness
<b>CO2</b>	Identify Java standard libraries and classes
<b>CO3</b>	Apply the object-oriented programming techniques in developing small to medium-sized application programs
<b>CO4</b>	Identify Java code utilities in applets, Java packages, and classes
<b>CO5</b>	Design simple Graphical User Interface applications

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2		3	2	3		3	2	1	1
<b>CO2</b>	3	1	3	3		1	2	2	2	3
<b>CO3</b>	3	3	3	3	2	2	3	3	3	3
<b>CO4</b>	2	2	3	3	2	2	3	3	3	3
<b>CO5</b>	3	2	3	3	2	1	2	3	3	3

<b>Course Code</b>	<b>MCA202</b>
<b>Course Name</b>	<b>COMPUTER ORGANIZATION AND ARCHITECTURE</b>
<b>Category</b>	Programme Core Course
<b>Prerequisite</b>	Digital Logic

<b>Paper-MCA202</b>	
<b>Computer Organization and Architecture</b>	
<b>UNIT :I</b>	<b>10hrs</b>
<p><b>Introduction:</b> Basic Organization of Computers, Classification Micro, Mini, Mainframe and Super Computer. System Bus and Interconnection: Single and multi-bus, Computer Function Von-Neumann M/c: Structure of IAS.</p> <p><b>Computer Arithmetic:</b> Data Representation: Fixed Point Representation, Floating Point Representation. Addition and Subtraction, Multiplication (Booth Algorithm), Division Algorithm, Floating Point Arithmetic Operation, Decimal Arithmetic Operation</p>	
<b>UNIT:II</b>	<b>10hrs</b>
<p><b>Instruction Set Architecture:</b> Instruction Format: Three Address, Two Address, One Address and Zero Address Instruction, Addressing Modes: Types of Addressing modes, Numerical Examples, Program Relocation, Compaction, Data Transfer &amp; Manipulation: Data transfer, Data Manipulation, Arithmetic, Logical &amp; Bit Manipulation Instruction, Program Control: Conditional Branch Instruction.</p> <p><b>CPU Organization:</b> Fundamental Concepts: Instruction-cycle, Fetching and storing a word in Memory, Register Transfer, Performing an Arithmetic &amp; Logic Operation, Branching. Control word, Stack Organisation, Register Stack, Memory Stack, RPN, Evaluation of Arithmetic Expression using RPN, Subroutine, Control Unit Operation: Hardware Control &amp; Micro Programmed Control.</p>	
<b>UNIT:III</b>	<b>10hrs</b>
<p><b>Memory Organization:</b> Computers Memory System Overview, Characteristics of Memory System, The Memory Hierarchy, Semi Conductor Main Memory types, Organisation, Memory cell Operation. Cache Memory: Cache Principles, Elements of Cache Design, Cache Size, Cache Mapping function, Replacement Algorithm, LRU, FIFO, LFU, Write policy. Number of Caches: Single versus two level caches, Pentium Cache Organisation. Associative Memory: Hardware Organisation, Match Logic. Read Operation, Write Operation, Auxiliary Memory: Magnetic Disks, Magnetic Tape. Virtual Memory: Paging, Paging h/w, Address Mapping using pages, Segmentation h/w, Demand Paging, Memory Management h/w.</p>	
<b>UNIT: IV</b>	<b>10hrs</b>

<p><b>Input/Output Organization:</b> Peripheral Devices, Input – output Interface, I/O Bus, Interface Module, Asynchronous Data Transfer, Strobe Control, Handshaking, Asynchronous Serial Transfer, Asynchronous Communication Interface, Modes of Transfer: Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA), DMA Controller, I/O Channel &amp; Processor.</p> <p><b>Interrupt:</b> Class of interrupt, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt. Program Interrupt, Types of Interrupt, RISC &amp; CISC Characteristic. Parallel Processing: Flynn's Classification, Introduction to Pipelining and hazards, Speedup, Efficiency, Throughput</p>
<b>Text Book:</b>
1. William Stalling, Computer Organization and Architecture, 8 <sup>th</sup> Edition, PHI, 2010.
<b>Reference Books:</b>
1. Rajiv Chopra, Computer Architecture and Organization, 1 <sup>st</sup> Edition, S. Chand Publication, 2013.
2. Carl Hamacher, Zvonkoranesic, and SafwatZaky, Computer Organization, 5 <sup>th</sup> Edition, McGraw-Hill Education India, 2002.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Analyze the designing process of combinational and sequential circuits.
<b>CO2</b>	Identify the addressing modes used in macro instructions.
<b>CO3</b>	Describe the memory organization with the virtual memory concept along with the mapping and replacement technique.
<b>CO4</b>	Describe the input / output organization technique with its implementation.
<b>CO5</b>	Identify the interrupt of the system and characteristics of types of systems.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	1	3	1		1	1	1	1
<b>CO2</b>	2	1	1	2	1		2	2	2	2
<b>CO3</b>	3	2	2	2	1		1	1	1	1
<b>CO4</b>	3	2	3	3	1		1	1	1	1
<b>CO5</b>	3	2	3	2	1		1	1	1	1

<b>Course Code</b>	<b>MCA203</b>
<b>Course Name</b>	<b>DATA BASE MANAGEMENT SYSTEMS</b>
<b>Category</b>	Programme Core Course
<b>Prerequisite</b>	Basic Understanding of Algorithms and Data Structures

<b>Paper-MCA203</b>	
<b>Database Management Systems</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
<p><b>Introduction to DBMS:</b> 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.</p> <p><b>Relational Query Language:</b> Relational algebra, Tuple and Domain Relational Calculus, SQL.</p>	
<b>UNIT-II:</b>	<b>12hrs</b>
<p><b>Database Design and ER model:</b> Overview of Design Process, Entities, Attributes, Constraints, Weak Entities, ER diagram, Extended ER Features, Reduction to Relational Schemas.</p> <p><b>Relational Database Design:</b> 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, Multi-valued Dependencies &amp; 4NF. Performance tuning and De-normalization</p>	
<b>UNIT-III:</b>	<b>8hrs</b>
<p><b>Query Processing and Optimization:</b> Evaluation of Relational Algebra Expression, QueryEquivalence, Join strategy, Query optimization algorithms. <b>Storage Strategies:</b> Indices, B+Trees, Hashing</p>	
<b>UNIT-IV:</b>	<b>10hrs</b>
<p><b>Transaction Processing:</b> Transaction Concept, ACID Properties of Transaction, Serializability, Recoverability.</p> <p><b>Concurrency Control:</b> Overview, Lock-based Protocol, Timestamp ordering protocol, Multi version and Optimistic concurrency control techniques.</p> <p><b>Recovery Systems:</b> Database Failure and Recovery, Log based Recovery to preserve Atomicity and Durability</p>	
<b>Text Book:</b>	
1.A. Silberschatz, F. H. Korth, Database System Concepts, 6 <sup>th</sup> Edition, Mc Graw Hill, 2010.	
<b>Reference Books:</b>	
<p>1.R. Elmasri, Fundamental of Database Systems, 7<sup>th</sup>Edition, Pearson Education, 2016.</p> <p>2.B. Desai, An Introduction to Database System, 2<sup>nd</sup>Edition, Galgotia publication, 2012.</p> <p>3.C.J. Date, An Introduction to Database Systems, 8<sup>th</sup>Edition, Pearson Education, 2004.</p>	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to
<b>CO1</b>	Define the basics of databases, database management systems, architecture of database systems, and the role of database users. Explain effectively the features of database management systems and data models.
<b>CO2</b>	Construct formal queries using relational algebra and relational calculus and structured query languages to perform database operations.
<b>CO3</b>	Identify the attributes to code a real world entity and create E-R models for designing databases for real-world applications. Examine the database design to check for improvement using normalization.
<b>CO4</b>	Describe various indexing techniques and explain the basics of query evaluation mechanisms.
<b>CO5</b>	Recognize the state of a database instance. Apply concurrency control and recovery mechanisms to maintain the correctness and consistency in the database.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	3	1	2	2		2	1	2	1
<b>CO2</b>	2	3	1	2	2		1	2	3	1
<b>CO3</b>	1	2	1	2	3		2	1	3	1
<b>CO4</b>	1	2	1	1	1		1	1	3	1
<b>CO5</b>	2	3	1	2	1		1	2	2	2

<b>Course Code</b>	<b>MCA204</b>
<b>Course Name:</b>	<b>FORMAL LANGUAGE AND AUTOMATA THEORY</b>
<b>Category:</b>	Programme Core Course
<b>Prerequisite:</b>	Basics of computer programming

<b>Paper-MCA204</b>	
<b>Formal Language and Automata Theory</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
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 Epsilon Transition: Eliminating $\epsilon$ -transitions from NFA, Conversion from Epsilon-NFA to DFA, Minimization of DFA.	
<b>UNIT-II:</b>	<b>10hrs</b>
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, Pumping Lemma for Regular languages, Closure properties of Regular languages.	
<b>UNIT-III:</b>	<b>10hrs</b>
Introduction to Grammars: Definition, Derivation of string, Left and right linear 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 Greibach normal forms, Converting CFG to CNF & GNF, Closure properties of context free languages (CFL).	
<b>UNIT-IV:</b>	<b>10hrs</b>
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 enumerable sets, Chomsky's hierarchy of languages. Ackermann's function, Godel numbering; NP Completeness: P and NP, NP complete and NP Hard problems.	
<b>Text Books:</b>	
1.J. 1.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.	
<b>Reference Books:</b>	
1.M. 1.Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2012. 2.J. 2.C. Martin, Introduction to Languages and the Theory of Computation, 4th Edition, Tata McGraw-Hill, 2010. 3.K. 3.L. P. Mishra, and N. Chandrasekaran, Theory of Computer Science: Automata, Languages and Computation, 3rd Edition, PHI, 2012.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Develop and implement mathematical models with DFA, NFA for regular languages.
<b>CO2</b>	Design regular expression for regular sets.
<b>CO3</b>	Design and implement grammar and PDA for context free languages and demonstrate their properties. Construct Turing machines for context sensitive and un-restricted languages.
<b>CO4</b>	Describe the Chomsky hierarchy of Formal Languages and Grammar.
<b>CO5</b>	Explain the concept of decidability & recursive enumerability, and classify a given language to the P, NP or NPC complexity classes.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2	3	2	3	1		2	2	3	2
<b>CO2</b>	3	2	1	2	2			2	3	2
<b>CO3</b>	3	3	2	2	2			2	3	2
<b>CO4</b>	2	2	2	3	1		1		2	
<b>CO5</b>	2	3	2	3	3		2	1	3	3

**Lab II: OOP using Java and DBMS**

**JAVA PROGRAMS:**

1. Programs to illustrate class and objects
2. Programs to illustrate Overloading & Overriding methods in Java
3. Programs on Constructors
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 on JButtons, JTextBox, JTextButton etc.

**DBMS PROGRAMS:**

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 the user.
11. Write a PL/SQL block that handles all types of exceptions.



<b>Course Code</b>	<b>MCA206A</b>
<b>Course Name</b>	<b>DATA WAREHOUSING AND MINING</b>
<b>Category</b>	Program Elective Course
<b>Prerequisite</b>	Data Structure and Algorithm, Linear Algebra, Basics of Web programming

<b>DSE Paper – MCA206A</b>	
<b>Data Warehousing and Mining</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
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, Snowflakes and Fact constellations.	
<b>UNIT-II:</b>	<b>10hrs</b>
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.	
<b>UNIT-III:</b>	<b>10hrs</b>
Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data pre-processing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation.	
Decision Tree Induction - Bayesian Classification – Rule Based Classification –Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods.	
<b>UNIT-IV:</b>	<b>10hrs</b>

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 Micheline Kamber, Data Mining: Concepts and Techniques, 3<sup>rd</sup> Edition, Morgan Kaufmann Publishers, 2011.
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, 10<sup>th</sup> Edition, TataMcGraw Hill, 2007.
3. G. K. Gupta, Introduction to Data Mining with Case Studies, 3<sup>rd</sup> Edition, Eastern EconomyEdition, Prentice Hall of India, 2006.

**Reference Books:**

1. Mehmedkantardzic, DataMining: Concepts Models Methods and logarithms, 3<sup>rd</sup> Edition, Wiley Interscience, 2003.
2. Ian Witten, Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, 3<sup>rd</sup> Edition, Morgan Kaufmann, 2011.
3. George M Marakas, Modern Data Warehousing, Mining and Visualization, 1<sup>st</sup> Edition, Prentice Hall, 2003.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Describe the requirement of a data warehouse and its components.
<b>CO2</b>	Explain the data warehouse life cycle.
<b>CO3</b>	Explain the concepts of data mining and data pre-processing.
<b>CO4</b>	Analyze different classification algorithms and apply the same to real life problems.
<b>CO5</b>	Apply different clustering algorithms for solving problems in various domains.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
<b>CO1</b>		2		3	2			1	2	1
<b>CO2</b>	1	2		2	2	2		1	2	1
<b>CO3</b>	1	2		3	2	2	1	2	2	
<b>CO4</b>	1	1	2	3	3	3	2	2	2	2
<b>CO5</b>	1	2	2	3	3	3	3	2	2	2
<b>Course Code</b>	<b>MCA206B</b>									

<b>Course Name</b>	<b>ECOMMERCE</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Basic Business Knowledge

<b>DSE Paper – MCA206B</b>	
<b>E Commerce</b>	
<b>UNIT-I:</b>	<b>8hrs</b>
<p><b>Computer Systems in Electronic Business:</b> Motivation, brief history of e-commerce, Advantages and Disadvantages, Benefits to Organization, Benefits to society, Forces behind E commerce industry framework, Architectural framework.</p> <p><b>Traditional Commerce v/s E- Commerce:</b> Traditional business commerce, Rules for traditional commerce, Main difference between e-commerce and traditional commerce, Technical &amp; non-technical limitations, Enterprise Data Interchange.</p>	
<b>UNIT-II:</b>	<b>10hrs</b>
<p><b>E- Commerce Models:</b> Business - to - Business (B2B), Business - to - Consumer (B2C), Consumer - to - Consumer (C2C), Consumer - to - Business (C2B), Business - to - Government (B2G), Government - to - Business (G2B), Government - to - Citizen (G2C), Intra organizational ecommerce and Inter organization ecommerce.</p> <p><b>Network infrastructure for ecommerce:</b> Infrastructure for ecommerce, Meaning of I-Way, Market forces behind I-way, Market Drivers of I-Way, Component of I-way access equipment, The I-way Infrastructure and Strategic Alliances, Understanding the requirement and demands, Global information distributed network, Broadband Telecommunication.</p>	
<b>UNIT-III:</b>	<b>10hrs</b>
<p><b>Mobile Commerce:</b> Introduction to mobile commerce, Advantage of M-Commerce, History of M-Commerce, M-Commerce Versus E-Commerce, Mobile computing application, Wireless application protocols, WAP Architecture, WAP Technology, Mobile information devices.</p> <p><b>Electronic Payment System:</b> Overview of Electronics Payments, Types of Electronic Payment Systems, Digital Token-Based Electronic Payment Systems, Smarts Cards, Credit Card, Debit Card Emerging financial Instruments, Home Banking, Online Banking, Wallet.</p>	
<b>UNIT-IV:</b>	<b>12hrs</b>
<p><b>Security in E-Commerce:</b> Client-Server network, Emerging client server security threats, Threats to Servers, Trust-Based Security, Security Through Obscurity(STO), Password Schemes, Biometric Systems, Software Agents and Malicious code Threat, Trojan horses, Malwares, Worms, Viruses, Introduction to Cryptography.</p> <p><b>Legal Issues related to E-commerce in India:</b> E- Governance of India, Cyber Law in India, Computer Crime, Types of Crimes, Introduction to Ethics, Cyber laws, Types of Cyber Crimes, Characteristics of Cyber crimes, Purpose of Cyber law, Legal Framework in India, IT Acts in India, Amendments.</p>	
<b>Text Book:</b>	
1. P.T. Joseph, S.J., E-commerce & Managerial Perspective, 3 <sup>rd</sup> Edition, PHI, 2008.	

**Reference Books:**

1. Janice Raynolds, The Complete E-commerce Book, 2<sup>nd</sup> Edition, Taylor & Francis Group, 2017.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Explain the need of e-commerce and its impact on society.
<b>CO2</b>	Describe the types of e-commerce and its related network infrastructure.
<b>CO3</b>	Analyse the mobile-commerce with e-commerce.
<b>CO4</b>	Explain different payment systems used in e-commerce.
<b>CO5</b>	Describe the security and security related threats in e-commerce.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>		2	3	2		3				
<b>CO2</b>		2	3	2		3				
<b>CO3</b>		2	2							
<b>CO4</b>	2	2		3			2		3	
<b>CO5</b>		3		3		3	2	2	2	2

<b>Course Code</b>	<b>MCA206C</b>
<b>Course Name</b>	<b>INTERNET OF THINGS</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Basic Idea of Computer Networks

<b>DSE Paper –MCA206C</b>	
<b>Internet of Things</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
<p>Introduction to IoT, Basic requirements for building an IoT system, IoT reference framework, IoT network level – performance criteria.</p> <p>IoT devices: Sensors, Types of sensors and their functions: temperature, pressure, air pollution, proximity, infrared, moisture &amp; humidity, flow, level, noise, and speed sensors. Characteristics of sensors. Use of RFID</p> <p>Actuators, Types of actuators and their functions: electrical, mechanical, and hydraulic actuators, controlling IoT devices</p>	
<b>UNIT-II:</b>	<b>10hrs</b>
<p>IoT requirements for networking protocols, device addressing, credential management, wireless spectrum, determinism, security and privacy, application interoperability, semantic interoperability. IoT Protocol Stack: layered view.</p> <p>Link layer: IEEE 802.15.4 technology, LoRaWAN end-to-end architecture, Time-Sensitive Networking</p> <p>Internet Layer: Routing Protocol for Low-Power and Lossy Networks.</p>	
<b>UNIT-III:</b>	<b>10hrs</b>
<p>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</p> <p>IoT Application Protocols: CoAP, XMPP, MQTT, AMQP, SIP, IEEE 1888, and DDS RTPS.</p> <p>Application Services Layer: ETSI M2M network architecture, oneM2M standards.</p> <p>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</p>	
<b>UNIT-IV:</b>	<b>10hrs</b>
<p>IoT security and Privacy: challenges, requirements, IoT Three-Domain Architecture, Attacks and Countermeasures for each domain.</p> <p>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</p>	
<b>Text Book:</b>	
1. A. Rayes and S. Salam, Internet of Things from Hype to Reality: The Road to Digitization, 2 <sup>nd</sup> Edition, Springer, 2019.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Describe basic concepts of IoT, its architecture and system design.
<b>CO2</b>	Employ the communication mechanisms between sensors and systems using various protocols and network models.
<b>CO3</b>	Explain IoT with respect to machine to machine and design IoT systems with data synchronization and resource manipulation. Explore various application protocols.
<b>CO4</b>	Discuss and describe different security issues and challenges.
<b>CO5</b>	Identify real world applications of IoT in multidisciplinary domains.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	2	1	3	2	1	2	3	2	1
<b>CO2</b>	1	2	1	2	3	1		3	2	
<b>CO3</b>	2	2		1	2	1	1	2	1	1
<b>CO4</b>	2	1		1	1	1	2	2	2	
<b>CO5</b>	2	2	1	3	2	1	2		1	1

<b>Course Code</b>	<b>MCA206D</b>
<b>Course Name</b>	<b>MOBILE APPLICATION DEVELOPMENT</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Data Communication and Computer Networks

<b>DSE Paper-MCA206D</b>	
<b>Mobile Application Development</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
<b>Introduction to Android Operating System:</b>	
<p>Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools</p> <p>Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes</p>	
<b>UNIT-II:</b>	<b>10hrs</b>
<b>Android User Interfaces:</b>	
<p>Measurements – Device and pixel density independent measuring UNIT - s Layouts – Linear, Relative, Grid and Table Layouts</p> <p>User Interface (UI) Components – Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers</p> <p>Event Handling – Handling clicks or changes of various UI components</p> <p>Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities</p>	
<b>UNIT-III:</b>	<b>10hrs</b>
<b>Intents and Broadcasts:</b>	
<p>Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS</p> <p>Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding</p>	

and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

**UNIT-IV:**

**10hrs**

**Persistent Storage and Database**

Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

**Text Books:**

1. Google Developer Training, Android Developer Fundamentals Course – Concept Reference, Google Developer Training Team, 2017.
2. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013.

**Reference Books:**

1. Erik Hellman, Android Programming – Pushing the Limits, 1st Edition, Wiley India Pvt Ltd, 2014.
2. J F DiMarzio, Beginning Android Programming with Android Studio, 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
3. Anubhav Pradhan, Anil V Deshpande, Composing Mobile Apps using Android, 1<sup>st</sup> Edition, Wiley, 2014
4. <https://www.gitbook.com/book/google-developer-training/android-developerfundamentals-course-concepts/details>.



	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Create, test and debug Android application by setting up Android development environment.
<b>CO2</b>	Implement adaptive, responsive user interfaces that work across a wide range of devices.
<b>CO3</b>	Infer long running tasks and background work in Android applications.
<b>CO4</b>	Demonstrate methods in storing, sharing and retrieving data in Android applications.
<b>CO5</b>	Describe the steps involved in publishing Android application to share with the world.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2	1	1		2	2	1	1	2	3
<b>CO2</b>	1	1	1	1	2		2	2	2	3
<b>CO3</b>		1				2	2	1	2	3
<b>CO4</b>	1		1		2	1	1	1	2	3
<b>CO5</b>			1	3		2	3	2	3	3

<b>Course Code</b>	<b>MCA206E</b>
<b>Course Name</b>	<b>MACHINE LEARNING</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Basic knowledge of Mathematics

<b>DSE Paper-MCA206E</b>	
<b>Machine Learning</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
Introduction to machine Learning (Supervised, Unsupervised and Reinforcement learning), Learning Models (Classification, Regression, Clustering). Cluster Analysis, Partitioning Methods (k-Means, k-Medoids), Hierarchical Methods, Density-Based Methods, Evaluation of Clustering.	
<b>UNIT-II:</b>	<b>10hrs</b>
Conditional Probability, Bayes' Theorem, Naïve Bayes Classifier, K-nearest neighbour, Multiple linear regression, Shrinkage method, Ridge regression, Logistic regression, Linear Discriminant Analysis	
<b>UNIT-III:</b>	<b>10hrs</b>
Neural Networks - Introduction, McP Neural Network, Perceptron Learning, Neural Networks - Backpropagation, Neural Networks - Initialization, Training & Validation. Decision Tree, Decision Tree Induction, Attribute Selection Measures, Information Gain, Gain Ratio, ID3, C4.5, Gini Index, CART	
<b>UNIT-IV:</b>	<b>10hrs</b>
Support Vector Machine for linearly separable data, Kernel function, Support Vector Machine for linearly non-separable data. Dimensionality reduction, Feature selection, Feature extraction, Principal Component Analysis. Model Cross-validation, Performance of Classification algorithms (Confusion Matrix, Precision and Recall).	
<b>Text Books:</b>	
1. T. Hastie, R. Tibshirani, and J. Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, 2 <sup>nd</sup> Edition, Springer Verlag, 2009. 2. S. Haykin, Neural Networks and Learning Machines, 3 <sup>rd</sup> Edition, Pearson Education, 2009.	
<b>Reference Books:</b>	
1. Y. G. James, D. Witten, T. Hastie and R. Tibshirani, An introduction to Statistical learning with Applications in R, Springer, 2013. 2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Explain the concepts of supervised machine learning and its functionalities.
<b>CO2</b>	Perform classification using Bayes classifier, SVM, Decision Tree, and Random Forest.
<b>CO3</b>	Reduce dimension of feature space using feature selection and feature extraction.
<b>CO4</b>	Explain the concepts of unsupervised machine learning and its functionalities.
<b>CO5</b>	Apply supervised and unsupervised machine learning methods to solve real life problems.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	1		1	1			2	3	1
<b>CO2</b>	3	1		1	1			2	3	1
<b>CO3</b>	3	2		1	2			3	3	2
<b>CO4</b>	3	2		1	2			3	3	2
<b>CO5</b>	3	1	1		1			1	3	3

<b>Course Code</b>	<b>MCA206F</b>
<b>Course Name</b>	<b>REAL TIME SYSTEM</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Operating System

<b>DSE Paper-MCA206F</b>	
<b>Real Time System</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.	
<b>UNIT-II:</b>	<b>10hrs</b>
Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization	
<b>UNIT-III:</b>	<b>10hrs</b>
Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.	
<b>UNIT-IV:</b>	<b>10hrs</b>
Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Realtime Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.	
<b>Text Books:</b>	
1. Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication, 2008.	
<b>Reference Books:</b>	
2. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.	
3. C.M. Krishna and K.G. Shin, Real-Time Systems, TMH.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Explain the concepts of Real Time Systems.
<b>CO2</b>	Able to schedule the jobs in RTOS.
<b>CO3</b>	Handle allocation of resources.
<b>CO4</b>	Real-time scheduling and schedulability analysis.
<b>CO5</b>	Real-time communication.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2	2	2	2	2		2	2	1	1
<b>CO2</b>	2	1	1	2	1		1	2	1	2
<b>CO3</b>	2	2	1	1	2		1	2	1	1
<b>CO4</b>	2	1	2	2	2		1	2	1	2
<b>CO5</b>	2	1	1	2	1		1	1	1	2

## Semester-III

Course Code	MCA301
Course Name	SOFTWARE ENGINEERING AND OOAD
Category	Programme Core Course
Prerequisite	Knowledge of software, object oriented concepts and databases

<b>Paper-MCA301</b>	
<b>Software Engineering and OOAD</b>	
<b>UNIT-I:</b>	<b>10 hrs</b>
<p><b>Introduction to Software and Software Engineering:</b> Basic concepts about software and program, the nature of software, Evolution of Software Engineering, Stakeholders in software engineering, Software quality, Software engineering projects, Activities common to software projects, Basic concepts on process and life cycle models.</p> <p><b>Models:</b> Waterfall, Prototype, Evolutionary, Incremental, Spiral, Agile, V-model</p>	
<b>UNIT-II:</b>	<b>08hrs</b>
<p><b>Requirement Analysis:</b> System and software requirements, Types of software requirements, Functional and non-functional requirements, Domain requirements, User requirement Elicitation and analysis of requirements, Overview of requirement techniques, Viewpoints, Interviewing, Scenario, Requirement validation, Requirement specification, Software requirement Specification (SRS)Structure and contents, SRS format.</p>	
<b>UNIT-III:</b>	<b>10hrs</b>
<p><b>Introduction to Object Oriented Technology:</b> Development and OO Modelling History, Modelling Concepts.</p> <p><b>Object Oriented Analysis:</b> Identifying Use-Cases, Complexity in Object Oriented Analysis, Business Process Modelling and Business Object Analysis, Use-Case Driven Object Oriented Analysis, Use-Case Model.</p> <p><b>Class Modelling:</b> Object and class concepts, link and association, Generalization and Inheritance, Advanced class modelling- aggregation, state diagram, state diagram behaviour, Relation of Class and State models. Interaction Modelling: Sequence models, Activity Diagrams.</p>	
<b>UNIT-IV:</b>	<b>12hrs</b>
<p><b>Software Project Management:</b> Overview of Project Management, Responsibilities of Project Manager, Project Planning , Metrics for Project Size Estimation, Factors Influencing Project Management, Project Estimation Techniques, COCOMO Model, Scheduling, Work Breakdown Structures (WBS); Activity Network, Critical Path Method(CPM), Program Evaluation and Review Technique (PERT), GANTT Chart, Risk Management.</p> <p><b>Software Testing:</b> Testing overview, concepts, Scope of Testing, Testing Constraints, Testing Life Cycle, Levels of Testing, System Testing, Blackbox Testing, Whitebox Testing, Integration Testing, Acceptance Testing,Performance Testing (Load testing, Stress testing, Scalability Testing, Stability Testing, Volume Testing, Smoke Testing). Basic Concepts of Regression Testing(Need of Regression Testing, How to perform Regression Testing, Testing Tools).</p>	



<b>Course Code</b>	<b>MCA302</b>
<b>Course Name</b>	<b>WEB TECHNOLOGY</b>
<b>Category</b>	Programme Core Course
<b>Prerequisite</b>	Knowledge of Internet basics, Database and object oriented programming

<b>Paper-MCA302</b>	
<b>Web Technology</b>	
<b>UNIT-I:</b>	<b>8hrs</b>
<p><b>Web Essentials: Clients, Servers, and Communication.</b> The Internet-Basic Internet Protocols - The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. <b>Markup Languages: XHTML.</b> 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.</p>	
<b>UNIT-II:</b>	<b>8hrs</b>
<p><b>Style Sheets:</b> CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML Style Rule Cascading and Inheritance-Text Properties-Box Model-Normal Flow Box Layout-Beyond the Normal Flow-Other Properties-Case Study. <b>Client-Side Programming:</b> 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.</p>	
<b>UNIT-III:</b>	<b>12hrs</b>
<p><b>PHP:</b> 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. <b>Strings</b>–Creating and Accessing Strings, Searching Strings, Replacing Text with strings, Dealing with Upper and Lowercase, Formatting Strings. <b>Arrays</b>–Creating Arrays, Accessing Array Elements, Looping Through Arrays with for-each, Working with Multidimensional Arrays, Manipulating Arrays. <b>Functions</b>, writing your own Functions, Working with References, Writing Recursive Functions. <b>Objects</b>–Introduction OOP Concepts, Creating Classes and Objects in PHP, Creating and using Properties, Working with Methods.</p>	
<b>UNIT-IV:</b>	<b>12hrs</b>
<p><b>PHP MySQL:</b> Handling HTML 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. <b>Introducing Databases and SQL</b>–Deciding How to Store Data, Understanding Relational Databases, Setting Up MySQL, A Quick Play with MySQL, Connecting MySQL from PHP. <b>Retrieving Data from MySQL with PHP</b>–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.</p>	
<b>Text Books:</b>	



1. M. Doyle, Beginning PHP 5.3, 1<sup>st</sup>Edition, John Wiley & Sons,2011.
2. J. Duckett, Beginning HTML, XHTML, CSS and JavaScript, 1<sup>st</sup>Edition, John Wiley & Sons,2011.

**Reference Book:**

1. L. Welling, L. Thomson, PHP and My-SQL Web Development, 1<sup>st</sup>Edition, Sams Publishing,2003.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Identify basic HTML elements, XML elements and develop static web-pages.
<b>CO2</b>	Describe different styles in web page design. Apply style sheets and java script to prepare elegant web-pages with client side validations.
<b>CO3</b>	Implement server side business logic into dynamic web pages using PHP.
<b>CO4</b>	Use PHP to design user interactive forms for data entry with proper validation.
<b>CO5</b>	Develop aesthetic web applications with database connectivity using PHP.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	3	1	1			1	1	1	1
<b>CO2</b>	2	3	2	2	1				1	1
<b>CO3</b>	2	3	1	2	1		1	1	2	2
<b>CO4</b>	2	3	2	3	2		1	1	2	2
<b>CO5</b>	2	3	2	3	2		1	1	1	2

<b>Course Code</b>	<b>MCA303</b>
<b>Course Name</b>	<b>DESIGN AND ANALYSIS OF ALGORITHMS</b>
<b>Category</b>	Programme Core Course
<b>Prerequisite</b>	Data Structure

<b>Paper-MCA303</b>	
<b>Design and Analysis of Algorithms</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
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.	
<b>UNIT-II:</b>	<b>10hrs</b>
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.	
<b>UNIT-III:</b>	<b>10hrs</b>
Greedy Algorithms: Activity Selection Problem, Elements of Greedy Strategy, Fractional Knapsack Problem, Huffman Codes. Graph Algorithm - BFS and DFS, Minimum Spanning Trees, Kruskal's algorithm, Prim's Algorithm, Single Source Shortest paths, Bellman Ford Algorithm, Dijkstra's Algorithm.	
<b>UNIT-IV:</b>	<b>10hrs</b>
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.	
<b>Text Book:</b>	
1. T.H.Coreman et.al, Introduction to Algorithms, 3 <sup>rd</sup> Edition, MIT press Cambridge,2010.	
<b>Reference Books:</b>	
1. M. R. Kabat, Design and Analysis of Algorithms, 1 <sup>st</sup> Edition, PHI,2013. 2. S. Sridhar, Design and Analysis of Algorithms, 1 <sup>st</sup> Edition, Oxford University Press,2015. 3. E. Horowitz, S. Sahni, Fundamentals of Computer Algorithms, 2 <sup>nd</sup> Edition, Computer Science press,2010.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to
<b>CO1</b>	Describe asymptotic notation, its properties and use it in measuring algorithm behaviour
<b>CO2</b>	Apply mathematical principles in analysis of algorithms
<b>CO3</b>	Analyze and apply the complexities of various algorithms and select the best
<b>CO4</b>	Know the different strategies that are known to be useful in finding efficient algorithms to solve problems and to be able to apply them
<b>CO5</b>	Choose appropriate data structures and algorithms and use it to design algorithms for a specific problem

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	2		2	3	2	1	3	3	3
<b>CO2</b>	2	2	3	2	3	2	1	2	2	2
<b>CO3</b>	2	2	3	3	2	1	2	3	3	3
<b>CO4</b>	2	3	3	3	2	3	2	2	2	3
<b>CO5</b>	2	3	2	3	2	3	2	3	3	3

<b>Course Code</b>	<b>MCA304A</b>
<b>Course Name</b>	<b>Data Science</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Statistics, Mathematics, Programming Knowledge

<b>Paper-MCA304A</b>	
<b>Data Science</b>	
<b>UNIT-I:</b>	<b>8hrs</b>
Brief Introduction to Data Science. Descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, hypothesis testing	
<b>UNIT-II:</b>	<b>8hrs</b>
Introduction to Machine Learning: Supervised Learning, Decision Tree Induction, Naïve Bayes Classification, Rule based Classification, K-Nearest Neighbour, Unsupervised Machine learning, Clustering, K-Means, Association rule mining, Apriori, FP-Tree.	
<b>UNIT-III:</b>	<b>12hrs</b>
Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures, Data pre-processing: Data cleaning, Data transformation, Data reduction. Predictive Modelling: Regression, Decision Tree, SVM.	
<b>UNIT-IV:</b>	<b>12hrs</b>
Feature selection (Filters; Wrappers), Dimensionality reduction: PCA and LDA. Ensemble Learning, Bagging, Boosting, Gradient Boosting (Random Forest, Adaptive Boosting) Time Series Data Analysis: Introduction to Time Series, Correlation, Forecasting (Univariate): Autoregressive Moving Average (ARMA) models, Autoregressive Integrated Moving Average (ARIMA) models, Introduction to Deep Learning	
<b>Text Books:</b>	
<ol style="list-style-type: none"> <li>1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.</li> <li>2. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer, 2013. Joel Grus, Data Science from Scratch: First Principles with Python. 1st Edition.</li> <li>3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson.</li> <li>4. Laura Igual and Santi Seguí, Introduction to Data Science, Springer.</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.</li> <li>2. "Practical Data Science with R". Nina Zumel, John Mount. Manning, 2014.</li> <li>3. Davy Cielin, Arno Meysman, Mohamed Ali, Introducing Data Science, Manning</li> <li>4. Andreas, Practical Data Science, Apress</li> </ol>	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modelling, and statistics.
<b>CO2</b>	Practice problem analysis and decision-making.
<b>CO3</b>	Gain practical, hands-on experience with statistical programming languages and tools through coursework and applied research experiences.
<b>CO4</b>	Analyze and interpret data using an ethically responsible approach.
<b>CO5</b>	Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	1	1	1	1			1	1	3
<b>CO2</b>	3	1	1	1	1			1	1	3
<b>CO3</b>	3	1	2	1	1			1	1	3
<b>CO4</b>	1	3	1	2	1			1	1	3
<b>CO5</b>	1	3	3	3	1			1	1	3

<b>Course Code:</b>	<b>MCA304B</b>
<b>Course Name:</b>	<b>COMPILER CONSTRUCTION</b>
<b>Category:</b>	Programme Core Course
<b>Prerequisite:</b>	Theory of Computation / Automata theory

<b>Paper-MCA304B</b>	
<b>Compiler Construction</b>	
<b>UNIT-I:</b>	<b>12 hrs</b>
Introduction: Overview and Phases of compilation. Lexical Analysis: Non-Deterministic and Deterministic Finite Automata (NFA & DFA), Regular grammar, Regular expressions and Regular languages, Design of a Lexical Analyzer as a DFA, Lexical Analyzer generator, Lex.	
<b>UNIT-II:</b>	<b>14 hrs</b>
Syntax Analysis: Context free grammars and Context free languages, Parse trees and derivations, Ambiguous grammar. Parser, Top down Parsing: Recursive descent parsing, LL (1) grammars, Non-recursive Predictive Parsing, Error reporting and Recovery.	
Bottom Up Parsing: Handle pruning and shift reduces Parsing, SLR parsers and construction of SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, Parsing using Ambiguous grammars, Error detection, Parser generator.	
<b>UNIT-III:</b>	<b>08 hrs</b>
Syntax Directed Translation – Syntax Directed Definitions. Evaluation Orders for SDDs. Applications of Syntax Directed Translation. Symbol Table Organization - Structure of Symbol table, Symbol Table organization, Data Structures of symbol Table.	
Intermediate code generation: Intermediate code (IC), IC for various constructs in programming language.	
<b>UNIT-IV:</b>	<b>06 hrs</b>
Machine code generation, Issues in the design of a code Generator, Machine code generation scheme. Elements of code optimization, Peephole Optimization, Elimination of redundant loads and stores, Elimination of unreachable code, Elimination of jump over jumps, Elimination of local common sub-expressions, Basics of flow of control optimization.	
<b>Text Book:</b>	
1. A. V. Aho, M. S. Lam, R. Sethi and J. D. Ullman, Compilers: Principles, Techniques & Tools , 2 <sup>nd</sup> Edition, Pearson Education, 2007.	
<b>Reference Book:</b>	
1. K. D. Cooper and L. Tarezon T. Munakata, Engineering a Compiler, 2 <sup>nd</sup> Edition, Elsevier, 2011.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Identify phases of a compiler, process of designing lexical analyzer, and apply LEX tool.
<b>CO2</b>	Construct parsing tables and implement parser using BISON tool.
<b>CO3</b>	Understand use of symbol table and design SDT as semantic analyzer for a language.
<b>CO4</b>	Generate intermediate code using lexical analyzer, parser and semantic analyzer.
<b>CO5</b>	Translate intermediate code to machine code, handle run-time environment, and apply code optimization techniques.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	3	2	1	1			2	3	1
<b>CO2</b>	3	3	2	1	1			2	3	1
<b>CO3</b>	3	3	2	1	2			3	3	2
<b>CO4</b>	3	2	2	1	2			3	3	2
<b>CO5</b>	3	3	1		1			1	3	3

<b>Course Code</b>	<b>MCA304C</b>
<b>Course Name</b>	<b>INFORMATION SECURITY</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Computer Network

<b>Paper-MCA304C</b>	
<b>Information Security</b>	
<b>UNIT-I:</b>	<b>8hrs</b>
<p><b>Attacks on Computers and Computer Security:</b> Introduction, The need for security, Security goals, Security attacks(Attack on Confidentiality,Integrity,Availability)Security Services and Mechanisms, Techniques(Cryptography,Steganography).</p> <p>Introduction to plain text and cipher text, encryption and decryption. substitution techniques, transposition techniques, symmetric and asymmetric key cryptography, steganography, possible types of cryptanalysis attacks.</p>	
<b>UNIT-II:</b>	<b>12hrs</b>
<p><b>Symmetric key Ciphers:</b> Block Cipher principles &amp;Algorithms(DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers RC4,Location and placement of encryption function.</p> <p><b>Introduction to number theory</b>-Prime numbers,Euler's Phi-Function,Fermat's and Euler's theorem, Chinese Remainder Theorem,Generating Primes(MersennePrime,Fermat Prime),Primality testing(Deterministic algorithms,Probabilistic algorithms)</p> <p><b>Asymmetric key Ciphers:</b> Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman), Key Distribution.</p>	
<b>UNIT-III:</b>	<b>10hrs</b>
<p><b>Message Authentication Algorithms and Hash Functions:</b>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.</p>	
<b>UNIT-IV:</b>	<b>10hrs</b>
<p><b>E-Mail Security:</b> Pretty Good Privacy, S/MIME <b>IP Security:</b>IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, key management.</p> <p><b>Web Security:</b> Web security considerations, Secure Socket Layer and Transport Layer Security,</p>	



Secure electronic transaction. Intrusion Detection System(types, techniques). <b>Intruders, Virus and Firewalls:</b> Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.
<b>Text Book:</b>
1. B. A. Forouzan,D.Mukhopadhyay,Cryptography and Network Security, 2 <sup>nd</sup> Edition, McGraw Hill, 2008.
<b>Reference Books:</b>
1. A. Kahate, Network Security, 2 <sup>nd</sup> Edition, McGraw Hill, 2008. 2. W. Stalling, Cryptography and Network Security, 7 <sup>th</sup> Edition, Pearson Education

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Analyze the working of various Symmetric and Asymmetric key cryptographic algorithms for information security purpose
<b>CO2</b>	Identify the basic categories of threats in a networks
<b>CO3</b>	Able to demonstrate the design and use of hash functions, digital signatures, and key distribution with a wide range of key types
<b>CO4</b>	Discuss about Web security and Firewalls
<b>CO5</b>	Discuss about Intrusion Detection system.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2	3	2	1	1			2	3	3
<b>CO2</b>	2	3	2	1	1			2	3	3
<b>CO3</b>	2	2	2		3			2	1	2
<b>CO4</b>	2	3	1	1	1			2	2	3
<b>CO5</b>	2	2	1		1			2	2	3

<b>Course Code</b>	<b>MCA 304D</b>
<b>Course Name</b>	<b>DIGITAL IMAGE PROCESSING</b>
<b>Category</b>	Program Elective Course
<b>Prerequisite</b>	Basics of Digital Electronics and Basic understanding of calculus

<b>Paper-MCA304D</b>	
<b>Digital Image Processing</b>	
<b>UNIT-I:</b>	<b>08hrs</b>
<b>Digital Image Fundamentals and Transforms:</b> Elements of visual perception: Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Image sampling and quantization Basic relationship between pixels: Basic geometric transformations-Introduction to Fourier Transform and DFT : Properties of 2D Fourier Transform , FFT, Separable Image Transforms ,Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loevetransforms.Perspective Projection, Spatial Domain Filtering, sampling and quantization	
<b>UNIT-II:</b>	<b>08hrs</b>
<b>Image Enhancement Techniques:</b> Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters,Laplacian filters, Frequency domain filters : Smoothing, Sharpening filters,Homomorphic filtering.	
<b>UNIT-III:</b>	<b>16hrs</b>
<b>Image Restoration and Image Compression:</b> Model of Image Degradation/restoration process: Noise models, inverse filtering, least mean square filtering, constrained least mean square filtering, blind image restoration, Pseudo inverse, Singular value decomposition. Lossless compression: Variable length coding: LZW coding, Bit plane coding- predictive coding, DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization	
<b>UNIT-IV:</b>	<b>08hrs</b>
<b>Image Segmentation and Representation:</b> Edge detection: Thresholding, Region Based segmentation, Boundary representation: chain codes, Polygonal approximation, Boundary segments: boundary descriptors: Simple descriptors, Fourier descriptors, Regional descriptors, Simple descriptors, Texture.	
<b>Text Books:</b>	
1 . Rafael C Gonzalez and Richard E Woods, Digital Image Processing, 4 <sup>th</sup> Edition, Pearson Education.	

**Reference Books:**

1. Anil K Jain, Fundamentals of Digital Image Processing, Pearson, 1989.
2. William K Pratt, John Willey ,Digital Image Processing, 4<sup>th</sup> Edition, CRC Press,2001.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing Analysis and Machine Vision, 4<sup>th</sup> Edition.
4. B. Chanda, D. DuttaMagundar ,Digital Image Processing and Analysis, 2<sup>nd</sup> Edition, Prentice Hall of India, 2000.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Understand the need for image transforms different types of image transforms and their properties
<b>CO2</b>	Develop any image processing application.
<b>CO3</b>	Understand the rapid advances in Machine vision
<b>CO4</b>	Learn different techniques employed for the enhancement of images
<b>CO5</b>	Understand a digital image and different processing techniques for the better analysis of an image

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2			1	1		2	3	3	3
<b>CO2</b>	3	3	2	2	2	1	3	2		
<b>CO3</b>	2	3	1	3	2	1	2		2	3
<b>CO4</b>	2			3	3	1	3		2	3
<b>CO5</b>	2	1	3	3	3	3	3	2	3	3

<b>Course Code</b>	<b>MCA304E</b>
<b>Course Name</b>	<b>SOFT COMPUTING</b>
<b>Category</b>	Programme Elective Course
<b>Prerequisite</b>	Basic Mathematics

<b>Paper-MCA304E</b>	
<b>Soft Computing</b>	
<b>UNIT-I:</b>	<b>8hrs</b>
Fuzzy Logic: Basic definition and terminology of fuzzy set, set theoretic operations, T-norm, T-conorm, Membership function formulation and parameterization, Extension Principle, Fuzzy relations, Linguistic variables, fuzzy if then rules, Compositional rule of inference, fuzzy reasoning, fuzzy inference systems, Mamdani fuzzy model.	
<b>UNIT-II:</b>	<b>8hrs</b>
Neural Network: Evolution of Artificial Neural Network (ANN), McP neural network, Perceptron, Perceptron convergence theorem, Perceptron learning, Multilayer perceptron, Back-propagation algorithm, Radial Basis Function, Radial Basis Function Network.	
<b>UNIT-III:</b>	<b>12hrs</b>
Genetic Algorithm: Introduction to Genetic Algorithm (GA), Working cycle of a GA, Binary coded GA, GA-parameter setting, Constraint handling, Advantages and disadvantages of GA.	
<b>UNIT-IV:</b>	<b>12hrs</b>
Simulated Annealing, Ant-Colony Optimization, Particle Swarm Optimization, Multi-objective optimization techniques and evolutionary computing.	
<b>Text Books:</b>	
<ol style="list-style-type: none"> <li>1. J. Shing, R. Jang, C. T. Sun, and E. Mizutani, Neuro Fuzzy And Soft Computing - A Computational Approach to Learning and Machine Intelligence, 3rd Edition, Pearson Education, 2008.</li> <li>2. D. K. Pratihar, Soft Computing, 2nd Edition, Narosa Publishing House, 2009.</li> <li>3. S. Haykin, Neural Network - A Comprehensive Foundation, 2nd Edition, Pearson Education, 2006.</li> </ol>	
<b>Reference Books:</b>	

1. T. Munakata, Fundamentals of the New Artificial Intelligence - Neural, Evolutionary, Fuzzy and More, 2nd Edition, Springer, 2014.
2. F. O. Karray and C. De Silva, Soft Computing and Intelligent System Design - Theory, Tools and Applications, 1st Edition, Pearson Education, 2009.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to
<b>CO1</b>	Apply fuzzy logic and fuzzy inference system concept to design automation system for real life problems
<b>CO2</b>	Apply the concepts of genetic algorithm to solve engineering optimization problems.
<b>CO3</b>	Train the Artificial Neural Network for decision making in real life environment.
<b>CO4</b>	Use the concepts of Artificial Neural Network (ANN) to solve real life engineering and societal problems.
<b>CO5</b>	Apply the concepts of Simulated Annealing, Ant-Colony Optimization, Particle Swarm Optimization, Multi-objective optimization techniques to solve engineering optimization problems.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>			2	2	2	2		1	3	
<b>CO2</b>			2	3	2	2	1	2	3	2
<b>CO3</b>			3	1		2	3		3	3
<b>CO4</b>	2		3	3	2	3	3	2	3	2
<b>CO5</b>	2		3	3	2	2	3	2	3	2

<b>Course Code</b>	<b>MCA 304F</b>
<b>Course Name</b>	<b>SIMULATION MODELLING</b>
<b>Category</b>	Program Elective Course
<b>Prerequisite</b>	Basic knowledge of Computer Fundamentals, Mathematics, Probability and Statistics.

<b>MCA304F</b>	
<b>Simulation Modelling</b>	
<b>UNIT-I:</b>	<b>08hrs</b>
<b>System Model:</b> System definition and components, System Environment, Stochastic Activities, Continuous and Discrete Systems, System Modelling, Types of models, Static and Dynamic Physical Models, Static and Dynamic Mathematical Models, Principles used in Modelling, System Studies, Types of system study.	
<b>UNIT-II:</b>	<b>10hrs</b>
<b>System simulation:</b> why & when to simulate, nature and techniques of simulation, Monte Carlo Method, Comparison of simulation and analytical methods, Types of system simulation, Numerical Computation Technique for Continuous Models, Numerical Computation Technique for Discrete Models, Single-server queuing system, Distributed Lag models, Cobweb model, Progress of a Simulation study.	
<b>UNIT-III:</b>	<b>10hrs</b>
<b>Continuous System Simulation and Probability Concept:</b> Continuous System Simulation, Analog vs. Digital Simulation, Hybrid Computers, Continuous System Simulation Languages (CSSLs), CSMP-III, Hybrid Simulation, water reservoir system, simulation of an autopilot, Real time Simulation. Discrete system simulation, fixed time-step, generation of random numbers, Simulation of a telephone System, Simulation Programming Tasks, test for randomness, Discrete simulation languages.	
<b>UNIT-IV:</b>	<b>12hrs</b>
System Dynamic, GPSS AND SIMSCRIPT: System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams. Introduction to GPSS, simulation of Manufacture Shop, Gathering Statistics, Data structure in GPSS, Evaluation of Simulation Algorithm in GPSS. Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model, Data structure in SIMSCRIPT, Evaluation of Simulation Algorithm in SIMSCRIPT.	
<b>Text Book:</b>	
1. Geoffrey Gordon, "System Simulation", 2/e, PHI	

**Reference Books:**

1. Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event System Simulation", Pearson Education.
2. NarsinghDeo, System Simulation with Digital Computer, PHI.
3. V P Singh, "System Modeling and simulation", New Age International.
4. Averill M. Law, W. David Kelton, "System Modeling and simulation and Analysis", TMH.

	<b>COURSE OUTCOMES:</b>
	After completion of this course successfully, the students will be able to-
<b>CO1</b>	Remember and understand the basic concepts/Principles of SIMULATION MODELING
<b>CO2</b>	Analyze the Various Concepts to understand them through case studies
<b>CO3</b>	Apply the knowledge in understanding practical problems
<b>CO4</b>	Execute/Create the Project or field assignment as per the knowledge gained in the course
<b>CO5</b>	Build tools to view and control simulations and their results

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2	2	2	1	3	1	2	2	1	1
<b>CO2</b>	2	2	2	1	3	1	2	2	2	2
<b>CO3</b>	3	3	3	1	3	1	3	2	3	2
<b>CO4</b>	3	2	1	1	3	1	2	2	2	1
<b>CO5</b>	3	2	3	2	2	1	2	2	2	2

**Lab III: Web Technology and Software Engineering**

**WEB TECHNOLOGYPROGRAMS :**

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. Store 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

**SOFTWARE ENGINEERING PROGRAMS:**

1. 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



**IDSE PAPERS:**

<b>Course Code</b>	<b>MCA306A</b>
<b>Course Name</b>	<b>NETWORK AND INTERNET TECHNOLOGIES</b>
<b>Category</b>	IDSE course
<b>Prerequisite</b>	Basic Mathematics

**IDSE-Paper-MCA306A****Network and Internet Technologies****UNIT-I: 10hrs**

**Computer Networks:** Introduction to computer network, data communication, 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, layers and functionalities.

**UNIT-II: 10hrs**

**Transmission Media:** Introduction, Guided Media: Twisted pair, Coaxial cable, Optical fibre. Unguided media: Microwave, Radio frequency propagation, Satellite. **LAN Topologies:** Ring, bus, star, mesh and tree topologies. **Network Devices:** NIC, repeaters, hub, bridge, switch, gateway and router. **Internet Terms:** Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online and offline.

**UNIT-III: 10hrs**

**Introduction to Web Design:** Introduction to hypertext mark-up language (html) Document type definition, creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames, hosting options and domain name registration.

**UNIT-IV: 10hrs**

**Style Sheets:** CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets 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, 1<sup>st</sup>Edition, BPB Publications,

2007.

**Reference Books:**

1. B. A. Forouzan, Data Communication and Networking, 5<sup>th</sup>Edition, Tata McGrawHill, 2008.
2. D.R. Brooks, An Introduction to HTML and JavaScript for Scientists and Engineers, 1<sup>st</sup>Edition, Springer, 2007.
3. Wendy Willard, HTML A Beginner's Guide, 4<sup>th</sup>Edition, Tata McGraw-Hill Education, 2009.
4. J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, 1<sup>st</sup>Edition, BPB Publications, 2007.

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Understand the fundamental concepts of Computer networks with architecture.
<b>CO2</b>	Basic Concept of various Network Devices
<b>CO3</b>	Understand the basic concept of transmission media, LAN topology.
<b>CO4</b>	Understand Fundamentals of Web Design
<b>CO5</b>	Develop Web Applications using Web Technologies

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	3	2	2	2		1			1
<b>CO2</b>	1	2	1			1		1	1	1
<b>CO3</b>	1	2	1			1		1	1	1
<b>CO4</b>	1	3	1	3	3	3	1	1	2	1
<b>CO5</b>	2	3	2	3	3	3	1		2	1

<b>Course Code</b>	<b>MCA306B</b>
<b>Course Name</b>	<b>FUNDAMENTALS OF COMPUTER</b>
<b>Category</b>	IDSE course
<b>Prerequisite</b>	Basic Mathematics

<b>IDSE Paper-MCA306B</b>	
<b>FUNDAMENTALS OF COMPUTER</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
<b>Computer Basics:</b> Simple model of computer, Problem solving using computer (flowchart, program, working of a computer, hardware and software). <b>Data Representation:</b> Character representation, representation of integers and fractions, Decimal to Binary conversion. Input / Output Units.	
<b>UNIT-II:</b>	<b>10hrs</b>
<b>Memory System:</b> Basics concepts (RAM, ROM, Speed, Size and Cost) Cache Memory concepts, Cache Memory mapping technique, Virtual Memory concepts, Secondary Storage, Processor: Structure of Instructions, Description of a processor, Machine Language program, Algorithm to simulate the hypothetical computer.	
<b>UNIT-III:</b>	<b>10hrs</b>
<b>Binary Arithmetic:</b> 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.	
<b>UNIT-IV:</b>	<b>10hrs</b>
<b>Logic circuit:</b> Switching circuits, AND, OR, NOT operation, Boolean functions, canonical forms of Boolean function, Logic circuits, <b>Computer Architecture:</b> Interconnection of Units, Processor to Memory communication, I/O devices to processor communication, Bus Architecture of personal Computers. Introduction to Programming Language, Operating System.	
<b>Text Books:</b>	
1. V. Rajaraman and N. Adabala, <b>Fundamental of Computers</b> , 6 <sup>th</sup> Edition, PHI.	
2. A. Goel, <b>Computer Fundamentals</b> , 1 <sup>st</sup> Edition, Pearson Education.	
<b>Reference Books:</b>	
1. P.Aksoy, L.DeNardis, <b>Introduction to Information Technology</b> , 2 <sup>nd</sup> Edition, Cengage Learning.	
2. P.K.Sinha, P.Sinha, <b>Fundamental of Computers</b> , 8 <sup>th</sup> Edition, BPB Publishers, 2007.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Describe the basic of computer.
<b>CO2</b>	Classify the architectural level of the system
<b>CO3</b>	Explain the memory and its related concepts of the system.
<b>CO4</b>	Evaluates the complements of the numbers both for positive and negative numbers.
<b>CO5</b>	Discuss the concepts of Programming languages and its basic classifications.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	1		1			1	1	1	1
<b>CO2</b>	1	1	2	2	1	1			1	1
<b>CO3</b>	1	1		1				1	1	1
<b>CO4</b>										
<b>CO5</b>	1	1	1	1	1	1			3	1

Course Code	MCA306C
Course Name	PYTHON PROGRAMMING
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.

<b>IDSE Paper-MCA306C</b>	
<b>INTRODUCTION TO PROGRAMMING USING PYTHON</b>	
<b>UNIT-I:</b>	<b>10hrs</b>
<b>Introduction:</b> 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.	
<b>UNIT-II:</b>	<b>10hrs</b>
<b>Standard Data Types:</b> Numbers, Strings, Lists, Tuples, Dictionary; Data type conversion; <b>Basic Operators:</b> Arithmetic, Comparison, Assignment, Bitwise; Operators: Logical, Membership, Identity; Operators Precedence; Python Numbers & Mathematical functions. <b>Data type conversion:</b> Basic operators: Arithmetic, Comparison, Assignment, Bitwise; Basic Operators, Python Numbers & Mathematical functions, Python Strings.	
<b>UNIT-III:</b>	<b>12hrs</b>
<b>Python Statement and Loops:</b> if, if-else, while, for loop, break, continue, pass, python function; Files I/O. <b>Functions:</b> 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.	
<b>UNIT-IV:</b>	<b>08hrs</b>
<b>Object Oriented Programming :</b> classes and objects, Inheritance –Polymorphism overloading, Error handling and Exceptions – try, except and raise- exception propagation <b>File Processing:</b> reading and writing files.	
<b>Text Book:</b>	
1. Nischay Kumar Hegde, <b>Python Programming Fundamentals - A Beginner's Handbook</b> , 1 <sup>st</sup> Edition, Educreation Publishing.	
<b>Reference Books:</b>	
1. Martin C. Brown, <b>Python: The Complete Reference</b> , 2 <sup>nd</sup> Edition, Mc-Graw Hill.	

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Operate the installation of the software and its operation.
<b>CO2</b>	Memorize the concepts of Python language.
<b>CO3</b>	Breakdown the problems and Model according to that.
<b>CO4</b>	Design the programs according the given problems.
<b>CO5</b>	Compare this language with other language with its benefits.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>		1		2	3		1	2		
<b>CO2</b>		2	1	2	3		1	2	1	
<b>CO3</b>	2	2	1	2	3		1	2	1	
<b>CO4</b>	1	2	2	2	2		1	2		
<b>CO5</b>		2		1	3		1	2		1

## Semester-IV

### MCA401

#### 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

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

#### MOOCs-1/MOOCs-2

Students are required to complete any **two** of the following MOOCs courses of to earn a maximum of 6 credits 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. Quantum Algorithms and Cryptography	2.Big Data Computing
3. Computer Graphics	4. Natural Language Processing
5.Introduction to Machine Learning	6.Google Cloud Computing Foundations
7. Data Analytics with Python	8.Privacy and Security in Online Social Media
9. Linux Operating System	10.Computer Application in Business
11.Peer to Peer Networks	12.Animations
13. Embedded System Design	14.Data Science for Engineers

15. Pattern Recognition	16. Introduction to Internet of Things
17. Blockchain and its Applications	18. Advanced Graph Theory
19. Deep Learning	20. Software Testing
21. Ethical Hacking	22. Android app using Kotlin
23. Introduction to Haskell programming	24. User Centric Computing for Human-Computer Interaction
25. Arduino	26. Reinforcement Learning
27. Introduction to Soft Computing	28. Computer Vision and Image Processing
29. Matlab Programming for Numerical Computation	30. Cloud Computing and Distributed Systems

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



Part A Introduction		
<b>Program:</b> Value Added Course	<b>Year:</b> First Year	<b>Session:</b> 2023-24
<b>Course Code</b>	<b>GMU-MCA-VAC-WD</b>	
<b>Course Title</b>	<b>Web Designing</b>	
<b>Course Type</b>	<b>Value Added Course (VAC)</b>	
Pre-requisite (if any)	Open for All	
Course Learning outcomes (CLO)	<p>After studying this Course the student will be able to —</p> <ul style="list-style-type: none"> <li>Code a handful of useful HTML &amp; CSS examples</li> <li>Build semantic, HTML &amp; CSS web page</li> <li>Write basic scripts</li> <li>Use Names, Objects, and Methods</li> <li>Add Interactivity to a Web Page</li> <li>Create Dynamic Web Pages using Java Script in HTML forms.</li> </ul>	
Expected Job Role / Career opportunities	<p>Job Role - Web Designer / Front End Developer/ Creative Ad Designer</p> <p>Job Description — Web designers develop functional and appealing web pages, websites, web applications, online advertisements for individuals, businesses and government agencies to establish their online presence. They use knowledge of computer programming and graphic design to create websites that meet client needs.</p> <p>Career Opportunities —</p> <p>Typical employers of web designers are —</p> <ul style="list-style-type: none"> <li>Software companies</li> <li>• IT consultancies</li> <li>Specialist web design companies</li> <li>•3 Large corporate organisations</li> <li>Any organisation that uses computer systems</li> <li>•3 Self-employment/freelance work is often possible for individuals with appropriate experience.</li> </ul> <p>Vacancies are advertised online, by career services and by recruitment agencies.</p>	
<b>Credit Value</b>	<b>4 (Theory — 2 Practical — 2)</b>	

Part B- Content of the Course		
Total No. of Lectures + Practical (in hours per week): L-2 Hrs / P-2 Hrs		
Total No. of Lectures/ Practical: L-30hrs/P-30hrs		
Module	Topics	Hours
I	<p>Introduction to Internet- World Wide Web, Internet Addressing, Browser, URL, Web server, website, homepage, Domain Name. Basic concepts.</p> <p>Softwares for Web Designing - Notepad/Notepad+, Dreamweaver, Blue Griffon, Net beans, Sea Monkey, Word press, Sublime.</p> <p>Introduction to HTML: HTML Tags and Attributes, HTML Basic Tags, Formatting Tags, HTML Color Coding, Div and Span Tags for Grouping. Lists: Unordered Lists, Ordered Lists, Definition list. Images: Image and Image Mapping</p> <p>Hyperlink: URL - Uniform Resource Locator, URL Encoding. Table: &lt;table&gt;, &lt;th&gt;, &lt;tr&gt;, &lt;td&gt;, &lt;caption&gt;, &lt;thead&gt;, &lt;tbody&gt;, &lt;tfoot&gt;, &lt;colgroup&gt;, &lt;col&gt;. Attributes Using Iframe as the Target</p> <p>Form: &lt;input&gt;, &lt;textarea&gt;, &lt;button&gt;, &lt;select&gt;, &lt;label&gt;</p> <p>Headers: Title, Base, Link, Styles, Script</p> <p>HTML Meta Ta , XHTML, HTML Deprecated Tags &amp; Attributes</p>	10
11	<p>CSS: Introduction, Features and benefits of CSS, CSS Syntax, External Style Sheet using &lt;link&gt;, Multiple Style Sheets, Value Lengths and Percentages.</p> <p>Selectors: ID Selectors, Class Selectors, Grouping Selectors, Universal Selector, Descendant / Child Selectors, Attribute Selectors, CSS — Pseudo Classes.</p> <p>Color Background Cursor: background-image, background-repeat, backgroundposition, CSS Cursor</p> <p>Text Fonts: color, background-color, text-decoration, text-align, vertical-align, text-indent, text-transform, white-space, letter-spacing, word-spacing, line-height, font-family, font-size, font-style, font-variant, font-weight.</p> <p>Lists Tables: list-style-type, list-style-position, list-style-image, list-style, CSS Tables (border, width &amp; height, text-align, vertical-align, padding, color)</p> <p>Box Model: Borders &amp; Outline, Margin &amp; Padding, Height and width, CSS Dimensions.</p> <p>Display Positioning: CSS Visibility, CSS Display, CSS Scrollbars, CSS</p>	10

	Positioning (Static Positioning, Fixed Positioning, Relative Positioning, Absolute Positioning), CSS Layers with Z-Index.	
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III	<p>The JavaScript: Nature of JavaScript, Script Writing Basics, Enhancing HTML Documents with JavaScript, The Building Blocks.</p> <p>Introduction to JavaScript, JavaScript Engines, Values, Variables and Operators, Variable Mutation, Basic Operators, Operator Precedence, JavaScript Types, Types Definition, Types in JavaScript, Objects, Type Conversion and Coercion, Static vs Dynamic Type Checking.</p> <p>JavaScript Conditionals: Introduction to Conditionals, Conditionals in JavaScript, Ternary Operators and Conditionals. Conditional Ladder &amp; Switch statement.</p> <p>JavaScript Arrays: Introduction to Arrays, Declaring and Mutating Arrays, Array Methods and Properties, Replication with Array Methods, Multi-dimensional Arrays.</p>	10
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IV	<p>JavaScript Loops: Introduction to Loops, Loops in JavaScript, While and Do/While Loops, For Loops, Break and Continue in Loops, Iterating Arrays, Iterating Objects.</p> <p>JavaScript Functions: Introduction to Functions, Functions in JavaScript, Nested Functions in JavaScript, Arrow Functions in JavaScript, Function as an Argument, Function as the Returned Object,</p> <p>JavaScript Scope: Scope Introduction, Scope in JavaScript, Lexical Scope, Module Scope.</p> <p>Method of Adding Interactivity to a Web Page, Creating Dynamic Web Pages; Concept of Java Scripting the Forms.</p> <p>Java Scripting the Forms, Basic Script Construction, Talking to the Form Objects, Organizing the Objects and Scripts, Field-Level Validation, Check Required Fields like Validating Zip Code, Automated Formatting, Format Phone, Format Money, Automatic Calculation, Calculate Expiration Date, Calculate Amount etc</p>	10
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	<b>Practicals</b>	
	<ol style="list-style-type: none"> <li>1. Design a home page which displays information about your college department using headings, HTML entities and paragraphs.</li> <li>2. Implement different type of list tags in the college department homepage.</li> <li>3. Create a webpage for any clinic using marquee and HTML formatting tags.               <ol style="list-style-type: none"> <li>4. Create 3 Hyperlinks in home page connecting it to 3 different pages.</li> </ol> </li> <li>5. Create 3 hyperlinks in a page, which jumps to 3 different headings on same page.</li> <li>6. Insert image(s) and iframe in a webpage.</li> <li>7. Design a page with image of block diagram of computer, mapping each component as area with specific co-ordinates which when clicked may give their detail.</li> <li>8. Create a web page having two frames, Frame 1 containing links and another with contents of the link. When link is clicked appropriate contents should be displayed on Frame 2.</li> <li>9. Design a timetable and display it in tabular format.</li> <li>10. Demonstrate difference between "get" and "post" method of form tag in a form with name and password text fields.</li> <li>11. Design an admission form for any course in your college with text, password fields, drop-down list, check-boxes, radio buttons, submit and reset button etc.</li> <li>12. Create a website for online book store with Home, Login, Catalogue, Registration page with links to all these pages in a menu on top of every page. Embed heading, paragraph, images, video, iframe, form controls, table, list in this website.</li> <li>13. Write a CSS style specification rule that would make all unordered lists (&lt;ul&gt; tags) have square bullets and a purple background.</li> <li>14. Create a HTML form with the use of cascading style sheets.</li> <li>15. Design a web page of your Home town with a attractive background color, text color, an image, font face by using Inline CSS formatting.</li> <li>16. Create a catalog for an online shopping company that sells music records using style sheets.</li> <li>17. Create a sample code to illustrate the Inline style sheet for your web page.</li> <li>18. Create a sample code to illustrate the External style sheet for your web page</li> <li>19. Design a web page by using different CSS border styles.</li> <li>20. Demonstrate the use of CSS Box Model.</li> <li>21. Change the color of all elements with the class "colortext" to "Blue"</li> <li>22. Set different margins for all four sides of paragraph.</li> </ol>	15

1. Write a JavaScript program to display the current day and time .
2. Write a JavaScript program to remove a character at the specified position of a given string and return the new string.
3. Write a JavaScript program to get the current date.
4. Write a JavaScript program to find the area of a triangle.
5. Write a JavaScript program to determine whether a given year is a leap year.
6. Write a JavaScript program to calculate multiplication and division of two numbers. .
7. Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit.
8. Write a JavaScript program to check whether a given positive number is a multiple of 3.
9. Write a JavaScript program to change the case of a string.(i.e upper case to lower case and vice-versa).
10. Write a JavaScript program to compute the sum of elements of given array of integers.
11. Develop and demonstrate a HTML file that includes JavaScript script for taking a number n as input using prompt and display first n Fibonacci numbers in a paragraph.
12. Develop and demonstrate a HTML file that includes JavaScript script for taking full name in a text field and display first, middle, last name in 3 different labels. Middle and last name may be optional, thus message like "NA" should be displayed in corresponding labels. If input contains 2

words, then they should be considered as first and last name.

13. Develop and demonstrate a HTML file that includes JavaScript script for switching an image source for a image on click of "change" and "original" button.
14. Design HTML form for keeping student record, apply JavaScript validation in it for restriction of mandatory fields, numeric field, email-address field, specific value in a field etc.
15. Write a JavaScript code that displays text "Bigger Text" with increasing font size in the interval of .10ms in red color, when the font size reaches 50pt it displays "Smaller Text" in green color. Then the font size should decrease to 5pt and then stop.

## Part C-Learning Resources

Text Books, Reference Books, Other resources

### 1. Suggested Readings:

Jon Duckett, HTML And CSS: Design And Build Websites, Wiley ° Jon Duckett, JavaScript And JQuery: Interactive Front-End Web Development, Wiley ° Jennifer Niederst Robbins, Learning Web Design: A Beginner's Guide To HTML, CSS, JavaScript, And Web Graphics, O'reilly

Steven M. Schafer, Html, XHTML, And CSS Bible, Wiley

Felke-Morris, Basics Of Web Design: Htm15 & Css3, 5th Edition, Pearson Education, 2019. Felke-Morris, Web Development & Design Foundations With Htm15, 10th Edition, AddisonWesley, 2020.

° Ian Pouncey, Richard York, Beginning CSS: Cascading Style Sheets For Web Design, Wiley India.

Thomas A Powell, The Complete Reference To Html

Lee Anne Philips, Using Html, PHI

C. Xavier, World Wide Web Design With Html,

Xavier C, Web Technology And Design, New Age International

Laura Lemay, Mastering Html, CSS & JavaScript Web Publishing

Dt Editorial Sewicés, Html 5 Black Book - Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, DreamTech Press Publication

### 2. Suggestive digital platforms web links:

- <https://www.w3schools.com/>
- <https://spoken-tutorial.org/>
- <https://www.doc-developpement-durable.org/file/Projets-informatiques/cours-&-manuelsinformatiques/htm-html-xml-200ne.pdf> (PDF: 608 pages)
- <http://www.nematrian.com/Pages/HTMLCSSJSCombined.pdf> (PDF: 514 pages)
- [https://www.daoudisamir.com/references/vs\\_ebooks/htm15\\_css3.pdf](https://www.daoudisamir.com/references/vs_ebooks/htm15_css3.pdf) DF: 681 pages



Suggested equivalent online courses:

<https://nptel.ac.in/courses/106/105/106105084/> (NPTEL Course: Internet Technology — Part of the Course) [https://onlinecourses.swayam2.ac.in/aic20\\_spl\\_1/preview](https://onlinecourses.swayam2.ac.in/aic20_spl_1/preview) (HTML and CSS) <https://www.coursera.org/learn/html-css-javascript-for-web-developers#syllabus> (HTML, CSS, and JavaScript for Web Developers) <https://www.classcentral.com/course/html-css-javascript-for-web-developers-4270> (HTML, CSS, and JavaScript for Web Developers) <https://www.classcentral.com/course/duke-programming-web-4256> <https://www.coursera.org/learn/duke-programming-web> (Programming Foundations with JavaScript, HTML and CSS)

	<b>COURSE OUTCOMES:</b> After completion of this course successfully, the students will be able to-
<b>CO1</b>	Code a handful of useful HTML & CSS examples
<b>CO2</b>	Build semantic, HTML & CSS web page
<b>CO3</b>	Write basic scripts, Use Names, Objects, and Methods
<b>CO4</b>	Add Interactivity to a Web Page
<b>CO5</b>	Create Dynamic Web Pages using Java Script in HTML forms.

**Mapping of COs to POs (1: Low, 2: Medium, 3: High)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	1	1	3	2	3		3	1	2	2
<b>CO2</b>	2	2	3	1	3		3	1	2	2
<b>CO3</b>	1	1	3	1	3		3	1	2	2
<b>CO4</b>	1	1	3	1	3		3	1	2	2
<b>CO5</b>	1	1	3	1	3		3	1	2	2