GANGADHAR MEHER UNIVERSITY
AMRUTA VIHAR, SAMBALPUR, ODISHA

Syllabus for

MASTER OF COMPUTER APPLICATIONS

(2-Year Programme)

Course Effective from Academic Year 2022-2023

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		
MCA101	Programming and Data Structure	4	4
MCA102	Data Communication and Networks	4	4
MCA103	Operating Systems	4	4
MCA104	Mathematical Foundations of Computer Science	4	4
MCA105	Lab I(Data Structure and Operating System)	6	4
Total			**20**

Part-I: Semester-II

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

Part-II: Semester-III

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

Part-II: Semester-IV

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

***Non-Divisional Credits**

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

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 20,End Sem 80).
- Lab Exam will be of 100 marks.

Semester-I

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

Paper-MCA101

Programming and Data Structure

UNIT-I: **10hrs**

Review of C programming, Control structures: conditional and looping statements, Arrays. Multi-dimensional arrays, Structures, Functions, Recursive functions, use of pointers, Dynamic memory allocation using malloc( ) and calloc( )

UNIT-II: **10hrs**

Linear data structures and their sequential storage representation, Stack, Queues, Circular Queues and Dequeues, Operations on these data structures, Applications of Stack and Queue, Priority Queue.

Linear data structures and their linked representation: Singly linked, Circularly linked and doubly linked lists, insertion and deletion operations on these data structures, Representation of sparse matrix using linked list

UNIT-III: **10hrs**

Non-linear data structures: Binary tree representation, Tree traversal: Inorder, Preorder, Postorder (recursive and non-recursive algorithms), Conversion of general tree to Binary tree, Binary search tree, Representations of graph: adjacency matrix, adjacency list, multi list, Graph traversal: Depth first and Breadth first

UNIT-IV: **10hrs**

Performance analysis of Searching techniques such as Sequential and Binary search.

Performance analysis of Sorting techniques such as Insertion, Selection, Bubble, Quick, Radix, Merge, and Heap sort.

Representation of B-tree and AVL tree, creation, insertion and deletion operations on these trees,

Text Books:

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

Reference Books:

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

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	3	3	2		1	1		
CO2	1	2	3	3	2		1	2	1	1
CO3	1	2	3	2	2		1	1	1	1
CO4	1	3	3	3	2		2	3	2	1
CO5	2	2	3	3	2		2	2	1	1

Course Code	**MCA102**
Course Name	**DATA COMMUNICATION AND NETWORKS**
Category	Programme Core Course
Prerequisite	Basics of Computer

Paper-MCA102

Data Communication and Networks

UNIT :I **12hrs**

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

UNIT:II **14hrs**

Data Link Layer: 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.

UNIT:III **10hrs**

Network Layer: 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.

UNIT: IV **04hrs**

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

Text Book:

1. B.A. Forouzan, Data Communication And Networking, 4th Edition, Tata McGraw Hill, 2007.
2. Peter Lars Dordal, An Introduction to Computer Networks**,** 2nd Edition, Loyola University of Chicago, 2014.

Reference Books:

1. A. S. Tenenbaum, Computer Network, 5thEdition, PHI, 2011.

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

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	3	2	1	2	2	1	3	1
CO2	1	3	3	3	1	2	1	2	2	1
CO3	1	2	3	2	1	2	2	1	2	1
CO4	1	2	3	3	1	1	2	1	2	1
CO5	1	2	3	2	1	1	2	2	1	1

Course Code	**MCA103**
Course Name	**OPERATING SYSTEMS**
Category	Programme Core Course
Prerequisite	Computer Programming and Data Structures

Paper-MCA103

Operating Systems

UNIT-I: 10 hrs

Operating System Overview: -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.
Process Management – Process concepts, Life cycle, PCB, Schedulers, Process Scheduling, Threads, Scheduling Levels, CPU Scheduling: Scheduling-Criteria, Algorithms, Algorithm Evaluation.

UNIT-II: 10hrs

Concurrency:-Process synchronization, The Critical- Section Problem, Peterson's Solution, synchronization Hardware, Semaphores, Classic problems of synchronization, Monitors.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock detection, deadlock prevention, deadlock avoidance, Recovery from deadlock.

UNIT-III: 10hrs

Memory Management: Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual Memory: Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files

UNIT-IV: 10hrs

Mass-Storage Structure: Overview, Disk Structure, Disk scheduling, disk management, Swap-space management, RAID structure.
File Systems: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, Protection. File- System Structure and Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Text Book:

1.A. Silberchatz, P. B. Galvin, G. Gagne, Operating System Concepts, 8th Edition, Wiley India, 2010.

Reference Books:

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

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1			1	1		1	1		
CO2	2	2	3	3	1		2	2	2	1
CO3	1	2	3	2	2		1	2	1	1
CO4	1	2	3	3			2	1		1
CO5	1	3	3	3	1		1	2	2	1

Course Code	**MCA104**
Course Name	**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**
Category	Programme Core Course
Prerequisite	Basics of set theory and combinatory

Paper-MCA104

Mathematical Foundations of Computer Science

UNIT-I: 14hrs

Fundamentals of Logic: Propositional Logic, Propositional Equivalences, Predicate and Quantifiers, nested Quantifiers, Rules of Inference.

Set Theory: Sets, Set Operations.

Introduction to proofs: proof by Induction, proof by contradiction, proof by cases with examples.

Mathematical Induction: Introduction to Induction, strong Induction, Recursion.

Relations: 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.

Functions: Types of Functions, Composition of Functions, Invertible Functions, Recursive Functions, Pigeon-hole principle.

UNIT-II: 06hrs

Discrete Numeric functions and Generating Functions: Discrete Numeric Functions, Generating Functions, Recurrence relations and recursive algorithms, Linear recurrence relations, Solving Recurrence Relations by Generating Functions.

UNIT-III: 10hrs

Graphs: Graphs, Graph models, special types of graphs, Representing graphs, Graph Isomorphism, connectivity, Euler and Hamilton paths, Planar graphs, Graph Coloring, Matching problem.

Trees: Introduction to Trees, Applications of Trees, Binary Trees, n-ary Trees, Tree Traversal, Spanning Trees

UNIT-IV: 10hrs

Algebraic Structures: 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,

Text Books:

1. C.L.Liu, D. P. Mohapatra, Elements of Discrete Mathematics: A Computer Oriented Approach, 4th Edition, McGraw-Hill, 2016.

2. K. H. Rosen, Discrete Mathematics & Its Applications (with Combinatorics and Graph Theory), 6th Edition, McGraw-Hill, 2007.

Reference Books:

1. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill, 1997.
2. R. L. Graham, D. E. Knuth, O. Patashnik, Concrete Mathematics: A Foundation for Computer Science, 2nd Edition, Pearson Education, 2007.
3. D. B. West, Introduction to Graph Theory, 2nd Edition, PHI Learning, 2009.
4. A. Brualdi, Introductory Combinatorics, 4th Edition, Pearson, 2004.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1		1	1		2
CO2	1	2	1	1	1		1	1		1
CO3	1	2	1	1	1		1	2	1	1
CO4	2	3	1	2	2		2	2	1	1
CO5	2	2	1	2	1		1	2	1	1

Paper-MCA105

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 anode, 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 usingPrim'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)

Paper-MCA201

Object Oriented Programming using JAVA

UNIT-I: 08hrs

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

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

UNIT-II: 12 hrs

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

UNIT-III: 10 hrs

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

UNIT-IV: 10 hrs

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, 11th Edition, Tata McGraw Hill, 2019.
Reference Books:
1. Y. Daniel Liang, An Introduction to JAVA Programming, 10th Edition, Pearson. 2. K. Sierra, Head First Java, 2nd Edition, O'Reilly Media, Inc, , 2003. 3. E. Balaguruswamy, Programming with JAVA, 6th Edition, Tata McGraw Hill, 2014.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2		3	2	3		3	2	1	1
CO2	3	1	3	3		1	2	2	2	3
CO3	3	3	3	3	2	2	3	3	3	3
CO4	2	2	3	3	2	2	3	3	3	3
CO5	3	2	3	3	2	1	2	3	3	3

Course Code	**MCA202**
Course Name	**COMPUTER ORGANIZATION AND ARCHITECTURE**
Category	Programme Core Course
Prerequisite	Digital Logic

Paper-MCA202

Computer Organization and Architecture

UNIT :I **10hrs**

Introduction: 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.

Computer Arithmetic: Data Representation: Fixed Point Representation, Floating Point Representation. Addition and Subtraction, Multiplication (Booth Algorithm), Division Algorithm, Floating Point Arithmetic Operation, Decimal Arithmetic Operation

UNIT:II **10hrs**

Instruction Set Architecture: 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 & Manipulation: Data transfer, Data Manipulation, Arithmetic, Logical & Bit Manipulation Instruction, Program Control: Conditional Branch Instruction.

CPU Organization: Fundamental Concepts: Instruction-cycle, Fetching and storing a word in Memory, Register Transfer, Performing an Arithmetic & Logic Operation, Branching. Control word, Stack Organisation, Register Stack, Memory Stack, RPN, Evaluation of Arithmetic Expression using RPN, Subroutine, Control Unit Operation: Hardware Control & Micro Programmed Control.

UNIT:III **10hrs**

Memory Organization:

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.

UNIT: IV **10hrs**

Input/Output Organization: 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 & Processor.

Interrupt: Class of interrupt, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt.

Program Interrupt, Types of Interrupt, RISC & CISC Characteristic. Parallel Processing: Flynn's Classification, Introduction to Pipelining and hazards, Speedup, Efficiency, Throughput
Text Book:
1. William Stalling, Computer Organization and Architecture, 8th Edition, PHI, 2010.
Reference Books:
1. Rajiv Chopra, Computer Architecture and Organization, 1st Edition, S. Chand Publication, 2013.
2. Carl Hamacher, Zvonkoranesic, and SafwatZaky**,** Computer Organization, 5th Edition, McGraw-Hill Education India, 2002.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Analyze the designing process of combinational and sequential circuits.
CO2	Identify the addressing modes used in macro instructions.
CO3	Describe the memory organization with the virtual memory concept along with the mapping and replacement technique.
CO4	Describe the input / output organization technique with its implementation.
CO5	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**
CO1	2	2	1	3	1		1	1	1	1
CO2	2	1	1	2	1		2	2	2	2
CO3	3	2	2	2	1		1	1	1	1
CO4	3	2	3	3	1		1	1	1	1
CO5	3	2	3	2	1		1	1	1	1

Course Code	**MCA203**
Course Name	**DATA BASE MANAGEMENT SYSTEMS**
Category	Programme Core Course
Prerequisite	Basic Understanding of Algorithms and Data Structures

Paper-MCA203

Database Management Systems

UNIT-I: 10hrs

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

UNIT-II: 12hrs

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

UNIT-III: 8hrs

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

UNIT-IV: 10hrs

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

Text Book:

1.A. Silberschatz, F. H. Korth, Database System Concepts, 6thEdition, Mc Graw Hill, 2010.

Reference Books:

1.R. Elmasri, Fundamental of Database Systems, 7thEdition, Pearson Education, 2016.
2.B. Desai, An Introduction to Database System, 2ndEdition, Galgotia publication, 2012.
3.C.J. Date, An Introduction to Database Systems, 8thEdition, Pearson Education, 2004.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to
CO1	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.
CO2	Construct formal queries using relational algebra and relational calculus and structured query languages to perform database operations.
CO3	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.
CO4	Describe various indexing techniques and explain the basics of query evaluation mechanisms.
CO5	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)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	3	1	2	2		2	1	2	1
CO2	2	3	1	2	2		1	2	3	1
CO3	1	2	1	2	3		2	1	3	1
CO4	1	2	1	1	1		1	1	3	1
CO5	2	3	1	2	1		1	2	2	2

Course Code	**MCA204**
Course Name:	**FORMAL LANGUAGE AND AUTOMATA THEORY**
Category:	Programme Core Course
Prerequisite:	Basics of computer programming

Paper-MCA204

Formal Language and Automata Theory

UNIT-I: **10hrs**

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 "-transitions from NFA, Conversion from Epsilon-NFA to DFA, Minimization of DFA.

UNIT-II: **10hrs**

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.

UNIT-III: **10hrs**

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 Greibachnormal forms, Converting CFG to CNF & GNF, Closure properties of context free languages (CFL).

UNIT-IV: **10hrs**

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 andNP Hard problems.

Text Books:

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.

Reference Books:

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.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Develop and implement mathematical models with DFA, NFA for regular languages.
CO2	Design regular expression for regular sets.
CO3	Design and implement grammar and PDA for context free languages and demonstrate their properties. Construct Turing machines for context sensitive and un-restricted languages.
CO4	Describe the Chomsky hierarchy of Formal Languages and Grammar.
CO5	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)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	3	1		2	2	3	2
CO2	3	2	1	2	2			2	3	2
CO3	3	3	2	2	2			2	3	2
CO4	2	2	2	3	1		1		2	
CO5	2	3	2	3	3		2	1	3	3

Paper -MCA205

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

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

DSE Paper – MCA206A

Data Warehousing and Mining

UNIT-I: **10hrs**

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.

UNIT-II: **10hrs**

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

UNIT-III: **10hrs**

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.

UNIT-IV: **10hrs**

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, 3rd Edition, Morgan Kaufmann Publishers, 2011.
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, 10th Edition, TataMcGraw Hill, 2007.
3. G. K. Gupta, Introduction to Data Mining with Case Studies, 3rd Edition, Easter EconomyEdition, Prentice Hall of India, 2006.

Reference Books:

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

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Describe the requirement of a data warehouse and its components.
CO2	Explain the data warehouse life cycle.
CO3	Explain the concepts of data mining and data pre-processing.
CO4	Analyze different classification algorithms and apply the same to real life problems.
CO5	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**
CO1		2		3	2			1	2	1
CO2	1	2		2	2	2		1	2	1
CO3	1	2		3	2	2	1	2	2	
CO4	1	1	2	3	3	3	2	2	2	2
CO5	1	2	2	3	3	3	3	2	2	2

Course Code	**MCA206B**
Course Name	**ECOMMERCE**
Category	Programme Elective Course
Prerequisite	Basic Business Knowledge

DSE Paper – MCA206B

E Commerce

UNIT-I: **8hrs**

Computer Systems in Electronic Business: Motivation, brief history of e-commerce, Advantages and Disadvantages, Benefits to Organization, Benefits to society, Forces behind E commerce industry framework, Architectural framework.

Traditional Commerce v/s E- Commerce: Traditional business commerce, Rules for traditional commerce, Main difference between e-commerce and traditional commerce, Technical & non-technical limitations, Enterprise Data Interchange.

UNIT-II: **10hrs**

E- Commerce Models: 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.

Network infrastructure for ecommerce: 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.

UNIT-III: **10hrs**

Mobile Commerce: 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.

Electronic Payment System: 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.

UNIT-IV: **12hrs**

Security in E-Commerce: 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.

Legal Issues related to E-commerce in India: 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.

Text Book:

1. P.T. Joseph, S.J., E-commerce & Managerial Perspective, 3rd Edition, PHI, 2008.
Reference Books:
1. Janice Raynolds, The Complete E-commerce Book, 2nd Edition, Taylor & Francis Group, 2017.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1		2	3	2		3				
CO2		2	3	2		3				
CO3		2	2							
CO4	2	2		3			2		3	
CO5		3		3		3	2	2	2	2

Course Code	**MCA206C**
Course Name	**INTERNET OF THINGS**
Category	Programme Elective Course
Prerequisite	Basic Idea of Computer Networks

DSE Paper –MCA206C

Internet of Things

UNIT-I: 10hrs

Introduction to IoT, Basic requirements for building an IoT system, IoT reference framework, IoT network level – performance criteria.

IoT devices: Sensors, Types of sensors and their functions: temperature, pressure, air pollution, proximity, infrared, moisture & humidity, flow, level, noise, and speed sensors. Characteristics of sensors. Use of RFID

Actuators, Types of actuators and their functions: electrical, mechanical, and hydraulic actuators, controlling IoT devices

UNIT-II: 10hrs

IoT requirements for networking protocols, device addressing, credential management, wireless spectrum, determinism, security and privacy, application interoperability, semantic interoperability. IoT Protocol Stack: layered view.

Link layer: IEEE 802.15.4 technology, LoRaWAN end-to-end architecture, Time-Sensitive Networking

Internet Layer: Routing Protocol for Low-Power and Lossy Networks.

UNIT-III: 10hrs

Application Protocols Layer: Data Serialization Formats, Communication Paradigms: Request/Response Versus Publish/Subscribe, Blocking Versus Non-blocking, QoS: Resource Utilization, Data Timeliness, Data Availability, Data Delivery

IoT Application Protocols: CoAP, XMPP, MQTT, AMQP, SIP, IEEE 1888, and DDS RTPS.

Application Services Layer: ETSI M2M network architecture, oneM2M standards.

IoT Services Platform: Functions and Requirements, IoT Platform Manager, Discovery, Communication Manager, Data Management, Management of IoT Devices, Configuration and Fault Management, Performance Management and measures

UNIT-IV: 10hrs

IoT security and Privacy: challenges, requirements, IoT Three-Domain Architecture, Attacks and Countermeasures for each domain.

Applications of IoT in areas like Smart home, Agriculture, Healthcare, Industry, Transportation, Retail, Oil and Gas, Energy etc. IoT Service Model: Anything as a Service, IoT Connected Ecosystems Models

Text Book:

1. A. Rayes and S. Salam, Internet of Things from Hype to Reality: The Road to Digitization, 2nd Edition, Springer,2019.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	3	2	1	2	3	2	1
CO2	1	2	1	2	3	1		3	2	
CO3	2	2		1	2	1	1	2	1	1
CO4	2	1		1	1	1	2	2	2	
CO5	2	2	1	3	2	1	2		1	1

Course Code	**MCA206D**
Course Name	**MOBILE APPLICATION DEVELOPMENT**
Category	Programme Elective Course
Prerequisite	Data Communication and Computer Networks

DSE Paper-MCA206D

Mobile Application Development

UNIT-I: 10hrs

Introduction to Android Operating System:

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

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

UNIT-II: 10hrs

Android User Interfaces:

Measurements – Device and pixel density independent measuring UNIT - s Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components – Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

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

UNIT-III: 10hrs

Intents and Broadcasts:

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

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding

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, 1st Edition, Wiley, 2014
4. https://www.gitbook.com/book/google-developer-training/android-developerfundamentals-course-concepts/details.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1		2	2	1	1	2	3
CO2	1	1	1	1	2		2	2	2	3
CO3		1				2	2	1	2	3
CO4	1		1		2	1	1	1	2	3
CO5			1	3		2	3	2	3	3

Course Code	**MCA206E**
Course Name	**MACHINE LEARNING**
Category	Programme Elective Course
Prerequisite	Basic knowledge of Mathematics

DSE Paper-MCA206E

Machine Learning

UNIT-I: **10hrs**

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.

UNIT-II: **10hrs**

Conditional Probability, Bayes' Theorem, Naïve Bayes Classifier, K-nearest neighbour, Multiple linear regression, Shrinkage method, Ridge regression, Logistic regression, Linear Discriminant Analysis

UNIT-III: **10hrs**

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

UNIT-IV: **10hrs**

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).

Text Books:

1. T. Hastie, R.Tibshirani, and J.Friedman , The Elements of Statistical Learning-Data Mining, In-ference, and Prediction, 2nd Edition, Springer Verlag, 2009.
2. S.Haykin, Neural Networks and Learning Machines, 3rdEdition,Pearson Education, 2009.

Reference Books:

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.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1		1	1			2	3	1
CO2	3	1		1	1			2	3	1
CO3	3	2		1	2			3	3	2
CO4	3	2		1	2			3	3	2
CO5	3	1	1		1			1	3	3

Semester-III

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

Paper-MCA301

Software Engineering and OOAD

UNIT-I: **10 hrs**

Introduction to Software and Software Engineering: 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.
Models: Waterfall, Prototype, Evolutionary, Incremental, Spiral, Agile, V-model

UNIT-II: **08hrs**

Requirement Analysis: 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.

UNIT-III: **10hrs**

Introduction to Object Oriented Technology: Development and OO Modelling History, Modelling Concepts.
Object Oriented Analysis: Identifying Use-Cases, Complexity in Object Oriented Analysis, Business Process Modelling and Business Object Analysis, Use-Case Driven Object Oriented Analysis, Use-Case Model.
Class Modelling: 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.

UNIT-IV: **12hrs**

Software Project Management: 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.
Software Testing: 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 Test-

ing(Need of Regression Testing, How to perform Regression Testing, Testing Tools).
Text Books:
1.R. Mall, Fundamentals of Software Engineering, 5th Edition, PHI, 2019. 2.R.S. Pressman, Software Engineering, A Practitioner's Approach, 7th Edition, McGraw-Hill, 2009 3.Timothy C. Lethbridge, Robert Laganière, Object-Oriented Software Engineering Practical Software development using UML and Java,2nd Edition, McGraw-Hill.
Reference Books:
1.Sommerville, Software Engineering, 9th Edition, Addison Wesley.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to-
CO1	Describe fundamentals of software engineering and SDLC phases.
CO2	Prepare requirements analysis report, estimation, planning, scheduling, and perform other software project management activities.
CO3	Apply object oriented analysis and design to build a software system.
CO4	Explain project management tasks, design artifacts, testing strategies and implement them appropriately.
CO5	Discuss maintenance, quality standards and reliability issues of softwares.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	1	2		1	1	2	2
CO2	1	1	1	2	2	2	1	2	1	1
CO3	2	1	1	1	1		1	1	1	1
CO4	1	1	2	1	1	1	2	1	1	1
CO5	1	1	1	1	1	1	1	1	2	1

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

Paper-MCA302

Web Technology

UNIT-I: 8hrs

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols - The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. **Markup Languages: XHTML**. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-XML Creating HTML Documents-Case Study.

UNIT-II: 8hrs

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.

UNIT-III: 12hrs

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

UNIT-IV: 12hrs

PHP MySQL: 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. **Introducing Databases and SQL**–Deciding How to Store Data, Understanding Relational Databases, Setting Up MySQL, A Quick Play with MySQL, Connecting MySQL from PHP. **Retrieving Data from MySQL with PHP**–Setting Up the Book Club Database, Retrieving Data with SELECT, Creating a Member Record Viewer. Manipulating MySQL Data with PHP–Inserting, Updating, and Deleting Records.
Text Books:
1. M. Doyle, Beginning PHP 5.3, 1st Edition, John Wiley & Sons,2011. 2. J. Duckett, Beginning HTML, XTML, CSS and JavaScript, 1st Edition, John Wiley & Sons,2011.
Reference Book:
1. L. Welling, L. Thomson, PHP and My-SQL Web Development, 1st Edition, Sams Publishing,2003.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	3	1	1			1	1	1	1
CO2	2	3	2	2	1				1	1
CO3	2	3	1	2	1		1	1	2	2
CO4	2	3	2	3	2		1	1	2	2
CO5	2	3	2	3	2		1	1	1	2

Course Code	**MCA303**
Course Name	**DESIGN AND ANALYSIS OF ALGORITHMS**
Category	Programme Core Course
Prerequisite	Data Structure

Paper-MCA303

Design and Analysis of Algorithms

UNIT-I: **10hrs**

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

UNIT-II: **10hrs**

Divide and Conquer: Merge sort, Quick sort, Time complexity analysis for Merge and Quick sort.

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

UNIT-III: **10hrs**

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, Bellmen Ford Algorithm, Dijkstra's Algorithm.

UNIT-IV: **10hrs**

String matching, Rabin-Karp Algorithm, KMP Algorithms. Theory of NP-completeness: Complexity classes of P, NP, NP-Hard, NP complete. Polynomial reduction, Cook's theorem, discussion on SAT, CNF-SAT, Min vertex cover, max clique, Graph coloring.

Text Book:

1. T.H.Coreman et.al, Introduction to Algorithms, 3rd Edition, MIT press Cambridge,2010.

Reference Books:

1. M. R. Kabat, Design and Analysis of Algorithms, 1st Edition, PHI,2013.
2. S. Sridhar, Design and Analysis of Algorithms, 1st Edition, Oxford University Press,2015.
3. E. Horowitz, S. Sahni, Fundamentals of Computer Algorithms, 2nd Edition, Computer Science press,2010.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2		2	3	2	1	3	3	3
CO2	2	2	3	2	3	2	1	2	2	2
CO3	2	2	3	3	2	1	2	3	3	3
CO4	2	3	3	3	2	3	2	2	2	3
CO5	2	3	2	3	2	3	2	3	3	3

Course Code	**MCA304A**
Course Name	**Data Science**
Category	Programme Elective Course
Prerequisite	Statistics, Mathematics, Programming Knowledge

Paper-MCA304A

Data Science

UNIT-I: **8hrs**

Brief Introduction to Data Science. Descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, hypothesis testing

UNIT-II: **8hrs**

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.

UNIT-III: **12hrs**

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.

UNIT-IV: **12hrs**

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

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.

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.

3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson.

4. Laura Igual and Santi Seguí, Introduction to Data Science, Springer.

Reference Books:

1.Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.
2. “Practical Data Science with R”. Nina Zumel, John Mount. Manning, 2014.
3. Davy Cielin, Arno Meysman, Mohamed Ali, Introducing Data Science, Manning
4. Andreas, Practical Data Science, Apress

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	1	1			1	1	3
CO2	3	1	1	1	1			1	1	3
CO3	3	1	2	1	1			1	1	3
CO4	1	3	1	2	1			1	1	3
CO5	1	3	3	3	1			1	1	3

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

Paper-MCA304B

Compiler Construction

UNIT-I: 12 hrs

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.

UNIT-II: 14 hrs

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 or 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.

UNIT-III: 08 hrs

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.

UNIT-IV: 06 hrs

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.

Text Book:

1. A. V. Aho, M. S. Lam, R. Sethi and J. D. Ullman, Compilers: Principles, Techniques &Tools , 2nd Edition, Pearson Education, 2007.

Reference Book:

1. K. D. Cooper and L. Tarezon T. Munakata, Engineering a Compiler, 2nd Edition, Elsevier, 2011.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	1			2	3	1
CO2	3	3	2	1	1			2	3	1
CO3	3	3	2	1	2			3	3	2
CO4	3	2	2	1	2			3	3	2
CO5	3	3	1		1			1	3	3

Course Code	**MCA304C**
Course Name	**INFORMATION SECURITY**
Category	Programme Elective Course
Prerequisite	Computer Network

Paper-MCA304C

Information Security

UNIT-I: 8hrs

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

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

UNIT-II: 12hrs

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

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

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

UNIT-III: 10hrs

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

UNIT-IV: 10hrs

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

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security,

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

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	1	1			2	3	3
CO2	2	3	2	1	1			2	3	3
CO3	2	2	2		3			2	1	2
CO4	2	3	1	1	1			2	2	3
CO5	2	2	1		1			2	2	3

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

Paper-MCA304D

Digital Image Processing

UNIT-I: **08hrs**

Digital Image Fundamentals and Transforms: 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

UNIT-II: **08hrs**

Image Enhancement Techniques: 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.

UNIT-III: **16hrs**

Image Restoration and Image Compression: 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

UNIT-IV: **08hrs**

Image Segmentation and Representation: Edge detection: Thresholding, Region Based segmentation, Boundary representation: chair codes, Polygonal approximation, Boundary segments: boundary descriptors: Simple descriptors, Fourier descriptors, Regional descriptors, Simple descriptors, Texture.

Text Books:

1. Rafael C Gonzalez and Richard E Woods, Digital Image Processing, 4th 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, 4th Edition, CRC Press,2001. 3. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing Analysis and Machine Vision, 4th Edition. 4. B. Chanda, D. DuttaMagundar ,Digital Image Processing and Analysis, 2nd Edition, Prentice Hall of India, 2000.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2			1	1		2	3	3	3
CO2	3	3	2	2	2	1	3	2		
CO3	2	3	1	3	2	1	2		2	3
CO4	2			3	3	1	3		2	3
CO5	2	1	3	3	3	3	3	2	3	3

Course Code	**MCA304E**
Course Name	**SOFT COMPUTING**
Category	Programme Elective Course
Prerequisite	Basic Mathematics

Paper-MCA304E

Soft Computing

UNIT-I: **8hrs**

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.

UNIT-II: **8hrs**

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.

UNIT-III: **12hrs**

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.

UNIT-IV: **12hrs**

Simulated Annealing, Ant-Colony Optimization, Particle Swarm Optimization, Multi-objective optimization techniques and evolutionary computing.

Text Books:

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.
2. D. K. Pratihar, Soft Computing, 2nd Edition, Narosa Publishing House, 2009.
3. S. Haykin, Neural Network - A Comprehensive Foundation, 2nd Edition, Pearson Education, 2006.

Reference Books:

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.

	COURSE OUTCOMES: After completion of this course successfully, the students will be able to
CO1	Apply fuzzy logic and fuzzy inference system concept to design automation system for real life problems
CO2	Apply the concepts of genetic algorithm to solve engineering optimization problems.
CO3	Train the Artificial Neural Network for decision making in real life environment.
CO4	Use the concepts of Artificial Neural Network (ANN) to solve real life engineering and societal problems.
CO5	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)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1			2	2	2	2		1	3	
CO2			2	3	2	2	1	2	3	2
CO3			3	1		2	3		3	3
CO4	2		3	3	2	3	3	2	3	2
CO5	2		3	3	2	2	3	2	3	2

Paper-MCA305

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. Sore the required data in a database (create it using MySQL) using PHP and also display message regarding status of registration (Success or Unsuccess).
8. Create a database through PHP and MySQL, and create, delete and modify data on database.
9. Store the data from a HTML form designed for registering a webinar and using PHP and MySQL, store, and update the data. Display the database data in HTML form.
10. Create anapplication using HTML, PHP. Create login form using HTML and checkusername and password using PHP, if login successful it will go on next HTML page and if failure again goesback to login page

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:

Course Code	**MCA306A**
Course Name	**NETWORK AND INTERNET TECHNOLOGIES**
Category	IDSE course
Prerequisite	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, 1st Edition, BPB Publications, 2007.

Reference Books:

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

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	3	2	2	2		1			1
CO2	1	2	1			1		1	1	1
CO3	1	2	1			1		1	1	1
CO4	1	3	1	3	3	3	1	1	2	1
CO5	2	3	2	3	3	3	1		2	1

Course Code	**MCA306B**
Course Name	**FUNDAMENTALS OF COMPUTER**
Category	IDSE course
Prerequisite	Basic Mathematics

IDSEPaper-MCA306B

FUNDAMENTALS OF COMPUTER

UNIT-I: **10hrs**

Computer Basics: Simple model of computer, Problem solving using computer (flowchart, program, working of a computer, hardware and software). **Data Representation**: Character representation, representation of integers and fractions, Decimal to Binary conversion. Input / Output Units.

UNIT-II: **10hrs**

Memory System: 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.

UNIT-III: **10hrs**

Binary Arithmetic: Addition, Subtraction, Signed numbers, Two's complement representation of numbers, Addition/ Subtraction of numbers in 2's complement notation, binary multiplication, binary division, floating point representation of numbers, arithmetic operation with normalized floating point numbers.

UNIT-IV: **10hrs**

Logic circuit: Switching circuits, AND, OR, NOT operation, Boolean functions, canonical forms of Boolean function, Logic circuits, **Computer Architecture**: Interconnection of Units, Processor to Memory communication, I/O devices to processor communication, Bus Architecture of personal Computers. Introduction to Programming Language, Operating System.

Text Books:

1. V. Rajaraman and N. Adabala, **Fundamental of Computers**, 6th Edition, PHI.
2. A. Goel, **Computer Fundamentals**, 1st Edition, Pearson Education.

Reference Books:

1. P.Aksoy, L.DeNardis, **Introduction to Information Technology**, 2nd Edition, Cengage Learning.

2. P.K.Sinha, P.Sinha, **Fundamental of Computers**, 8th Edition, BPB Publishers, 2007.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1		1			1	1	1	1
CO2	1	1	2	2	1	1			1	1
CO3	1	1		1				1	1	1
CO4										
CO5	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.

IDSE Paper-MCA306C

INTRODUCTION TO PROGRAMMING USING PYTHON

UNIT-I: **10hrs**

Introduction: Installation, First python Program: Interactive Mode Programming, Script Mode Programming, Identifiers, Reserved words, Lines and Indentation, Multi-Line Statements, Quotation &Comments,; Assigning values to Variables, Multiple Assignment.

UNIT-II: **10hrs**

Standard Data Types: Numbers, Strings, Lists, Tuples, Dictionary; Data type conversion; **Basic Operators:** Arithmetic, Comparison, Assignment, Bitwise; Operators: Logical, Membership, Identity; Operators Precedence; Python Numbers & Mathematical functions. **Data type conversion:** Basic operators: Arithmetic, Comparison, Assignment, Bitwise; Basic Operators, Python Numbers & Mathematical functions, Python Strings.

UNIT-III: **12hrs**

Python Statement and Loops: if, if-else, while, for loop, break, continue, pass, python function; Files I/O.

Functions: Definition, call, positional and keyword parameter, Default parameters, variable number of arguments, Modules – import mechanisms, Functional programming – map, filter, reduce, max, min, lambda function – list comprehension.

UNIT-IV: **08hrs**

Object Oriented Programming : classes and objects, Inheritance –Polymorphism overloading, Error handling and Exceptions – try, except and raise- exception propagation

File Processing: reading and writing files.

Text Book:

1. Nischay Kumar Hegde, **Python Programming Fundamentals - A Beginner's Handbook**, 1st Edition, Educreation Publishing.

Reference Books:

1. Martin C. Brown, **Python: The Complete Reference**, 2nd Edition, Mc-Graw Hill.

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

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1		1		2	3		1	2		
CO2		2	1	2	3		1	2	1	
CO3	2	2	1	2	3		1	2	1	
CO4	1	2	2	2	2		1	2		
CO5		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.An Introduction to Coding Theory	2.Big Data Computing
3.Cloud Computing	4.Computer Graphics
5.Data Science for Engineers	6.Google Cloud Computing Foundations
7. Introduction to Cyber Security	8. Linux Operating System
9.Applied Natural Language Processing	10. Web Based Technologies and Multimedia Applications
11.Peer to Peer Networks	12.Animations
13. Parallel Algorithms	14. Distributed Computing systems

15.Pattern Recognition	16.Real Time Systems
17.Microprocessors and Microcontroller	18.Computational Complexity Theory
19.Deep learning	20.Data Analytics with Python
21.Embedded System Design	22.Android app using Kotlin
23.Introduction to Haskell programming	24. Human-Computer Interaction
25.Arduino	26.Software Project Management
27.Computer Application in Business	28.Computer Vision
29.R	30.Virtual Reality

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