Department of Computer Science & IT

Course Scheme & Syllabus

For

Master of Computer Applications
(MCA)
With multi entry/exit option as per NEP-2020

For the year

2022-2023.

UNIVERSITY OF LADAKH

UT LADAKH

Website: www.universityofladakh.org.in

Proposed Syllabi Structure for MCA (2 Years) Program

Semester-I

Course Type	Course Title	Course Code	Credits	Credits (1 Credit =25 Marks)
Foundation Course (Mandatory Non-Credit)	Programming in C	MCA-F-101	---	------
	Mathematical Foundation for Computer Science	MCA-F-102	---	
Core	Computer Organization & Architecture	MCA-C-101	4	12
	Data Structure using C	MCA-C-102	4	
	Operating System	MCA-C103	4	
Minor Elective (Choose one)	Discrete Mathematics	MCA-OE-101	2	2
	Numerical Techniques	MCA-OE-102	2	
Lab	Data Structure Using C	MCA-LA-101	4	4
Minor Project-I	Minor Project-I	Minor Project-I	2	2
	Total Credits of the Semester			20

Semester-II

Course Type	Course Title	Course Code	Credits	Credits (1 Credit =25 Marks)
Foundation Course (Mandatory Non-Credit)	Object-Oriented Programming using Java	MCA-F-201	---	-----
Core	Relational Database Management Systems	MCA-C-201	4	12
	Data Communication & Computer Networks	MCA-C-202	4	
	Analysis and Design of Algorithms	MCA-C-203	4	
Minor Elective (Choose one)	Android Application Development	MCA-OE-201	2	2
	Python Programming	MCA-OE-202	2	
Lab	RDBMS and Minor Lab	MCA-LA-201	4	4
Minor Project-II	Minor Project-II	Minor Project-II	2	2
	Total Credits of the Semester			20

Program EXIT-I (PG Diploma in Computer Application)

Additional 10 Credits for Skill Based Internship/Apprenticeship from the Department or from industry.

Program Entry-II

Students with PG Diploma in Computer Application from University of Ladakh, shall also be eligible Admission in 3rd and 4th Semester

Semester-III

Course Type	Course Title	Course Code	Credits	Total Credits (1 Credit =25 Marks)
Core	Theory of Computation	MCA-C-301	4	12
	Artificial Intelligence and Machine Learning	MCA-C-302	4	
	Web Technologies	MCA-C-303	4	
Major Elective (Choose one)	Data Warehousing and Data Mining	MCA-OE-301	4	4
	Big Data Analytics	MCA-OE-302	4	
	Pattern Recognition	MCA-OE-303	4	
Lab	Web Technology Lab	MCA-LA-301	4	4
	Total Credits of the Semester			20

Semester-IV

Course Type	Course Title	Course Code	Credits	Total Credits
Major Elective-I (Choose one)	Neural Networks and Deep Learning	MCA-OE1-401	4	4
	BlockChain Technologies	MCA-OE1-402	4	
	Soft Computing	MCA-OE1-403	4	
Major Elective-II (Choose one)	Internet of Things	MCA-OE2-401	4	4
	Cryptography and Network Security	MCA-OE2-402	4	
	Virtualization and Cloud Computing	MCA-OE2-403	4	
Project Work	Major Project Work	MCA-LA-401	12	12
	Total Credits of the Semester			20

Evaluation Breakup of the Major Project Work

S.No	Major Project Work	Internal	External
1	Industry	40% of the Credit to be evaluated by the industry	60% to be evaluated by the External Examiner
2	Department	40% credit as Mid-term evaluation by the Department	60% to be evaluated by the External Examiner

Semester-I

Semester: I

Course Name: Programming in C **Course Code: MCA-F-101**

Credits: 0 (Foundation Mandatory Course) **Max. Marks: 50**

Rationale:

This course is designed to enhance student"s analysing and problem-solving skills and to provide in-depth knowledge of C language. Students will be able to develop logic which will help them to create programs, and applications in C. By learning the basic programming constructs, they can easily switch over to any other language in future.

Unit-I **(15 Lectures)**
Steps for problem solving, Computer as a tool for problem solving. Program Design tools: Algorithm, Pseudocode and Flowchart Designing. History of C, Characteristics of C, Introduction to GCC, compiling, linking and running a C–program, Using MAKE Utility. C Program Structure, Data Types, Variables and Constants, Printing Out and Inputting Variables, Constants, Type-Casting, Operators and Expressions, Order of Precedence Conditional Statements, Program Loops and Iteration, Library functions. Syntax, semantic, linker, logical and runtime errors. Single and Multi-dimensional Arrays, Strings, Basic String Handling Functions
Unit-II **(15 Lectures)**
Functions, Passing Parameters, Recursion, Storage classes. Standard C Preprocessor Directives. Standard Formatted & unformatted I/O Functions Defining New Data Types, Structures, Unions, Enumerated Types, Bitwise Operators, Bit Fields. Pointers: Pointers arithmetic, constant void pointers. Dynamic Memory Allocation, Pointers to Pointers, Pointer to array, Array of pointers, Command line input, Pointers to a Function File Accessibility and Directories (access, stat, chmod, chown, chdir, chroot), ProcessControl: (Running Linux Commands from C, fork(), the exec family, wait(), exit()). Graphics Programming: OpenGL Basics, OpenGL Utility Toolkit (GLUT), Defining window, Display mode, OpenGL Functions, Primitives (Points, Lines, Polygons) and Attributes, Simple graphics programs

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Design algorithms for the given problem specifications
2. Write C programs for the designed algorithm specification
3. Write C programs to implement Arrays (Linear & Multi-dimensional), Strings, Functions, Pointers, Recursive Functions
4. Write C programs to implement using Functions, User defined data types like Structures and Union, Pointers, Array of pointers, Call by Value and Call by Reference

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 5 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with two sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt both sub-parts.
4) **Section B** will comprise of two long answer type questions (question number 2 to 3); each question will have an option. Thus, there will be two questions from each unit. In total, there will be four questions in the section; two from each unit and a candidate will be asked to attempt two questions.
5) All short answer type questions will carry 5 marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 3 will carry equal marks of 12.5 marks

Text Books

1. **Balagurusamy. E (2019)** , , "Programming in ANSI C,Eight Edition", **TMH, New Delhi**.
2. **Kanetkar Y (2021)**,"Let Us C, 18thEdition ", **BPB, New Delhi** .

Reference Books

1. **Keringhan, B. W & Ritche, D.M**, "C Programming language", **PHI New Delhi**
2. **Schildt,H** , "A Complete Reference in C, Fourth Edition", **TMH, New Delhi**
3. **Shrivastav,S.K & Shrivastav, D,** "C in Depth", **BPB, New Delhi**.

Semester: I

Course Name: Mathematical Foundation for Computer Science **Course Code: MCA-F-102**

Credits: 0 (Foundation Mandatory Course) **Max. Marks:50**

Rationale:

The objective of the course is to acquaint the students with the concept of mathematical foundation of computer science. The course shall also make the learner understand the primary concepts of mathematics in computer science like lattice theory, Boolean algebra, counting techniques etc.

Unit-I **(15 Lectures)**
Lattices theory: Introduction, Partially Ordered sets, total ordered sets, Hasse diagrams, well ordered sets, Lattices, Duality, Lattices as poset, Sublattices, types of Lattices: bounded lattices, distributive lattices, compliments, complemented lattices. **Boolean algebra and applications:** Introduction, basic definitions, duality, basic theorems, Boolean algebra as lattices, sum-of-product forms of sets, sum-of-product forms for Boolean algebra, logic gates and circuits, truth tables
Unit-II **(15 Lectures)**
Counting Techniques: Introduction- basic counting principles, permutations and combinations, the pigeonhole principle. **Coordinate Systems and vectors:** Rectangular Coordinates in a plane, polar coordinates rectangular Coordinates in a space, Cylindrical polar coordinates, the concept of vectors addition and subtraction of vectors, resolution of vectors, scalar and dot product of two vectors, vector and cross product of two vectors.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Understand the concept of partially ordered sets, well ordered sets, lattices, duality, sub latices and types of lattices.
2. Understand the concept of Boolean algebra, basic theorems, sum of products forms of sets and Boolean algebra, logic Sets.
3. Understand the concept of basic counting techniques, permutations and combinations and also rectangle coordinates in Plane, space, cylindrical coordinates, concept of Vector addition, subtraction, scalar and dot product of two vectors

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

6) There will be two sections A and B.
7) There will be 5 questions in all.
8) **Section A** will carry one compulsory question (question no 1) with two sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt both sub-parts.
9) **Section B** will comprise of two long answer type questions (question number 2 to 3); each question will have an option. Thus, there will be two questions from each unit. In total, there will be four questions in the section; two from each unit and a candidate will be asked to attempt two questions.
10) All short answer type questions will carry 5 marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 3 will carry equal marks of 12.5 marks

Text Books

1. **Seymour Liptschutz**, "Discrete Mathematics", 2nd Ed. **Tata McGraw Hill, New Delhi.**
2. **Sastry S. S**., "Engineering Mathematics", Third edition, PHI.

Reference Books

1. **K. H. Rosen,** Discrete Mathematics & its applications, 5th Ed. 2004, **Tata McGraw Hill.**
2. **Deo NarSingh**, "Graph Theory with applications to Engineering and computer Sciences", **Eastern economic edition, PHI.**

Semester: I

Course Name: Computer Organization & Architecture **Course Code: MCA-C-101**

Credits: 4 **Max. Marks:100**

Rationale:

The course is designed to get the students acquainted with digital electronics and basic number crunching concepts of digital machines. Students might be able to understand the Boolean algebra and circuit theory such counter, register etc and to perform the analysis and design of various digital electronic circuits.

Unit-I **(15 Lectures)**
Number Systems: Binary, Octal, Decimal, Hexadecimal, Number Based Conversions, Binary Arithmetic, 1‟s and 2‟s compliment of binary numbers. **Logic Gates:** NOT, OR, AND, Exclusive-OR, X-NOR, Universal Gates (NAND, NOR). **Boolean Algebra:** Logic Simplification, Laws and rules of Boolean Algebra, De-Morgan‟s Theorems, Sum of Product and Product of Sum form, Standard SOP and POS forms. **Karnaugh Map and Tabular Simplification:** Karnaugh Map, Plotting a Karnaugh Map, Representing standard SOP and POS on K-Map, Simplification of SOP expressions, Don‟t care Condition, Simplification of POS expressions.
Unit-II **(15 Lectures)**
Combinational Circuits: Half Adder, Full Adder, Basic Binary Decoder,4-bit Decoder, BCD to Decimal Decoder, Decimal to BCD Encoder. **Sequential Circuits:** Introduction, Latches: SR Latch, D Latch, Flip Flops: RS Flip flop, T Flip flop, D Flip flop, JK Flip flop. Conversion of SR Flip-Flop to JK Flip-Flop, Application of Flip- Flops. **Counters:** Asynchronous and Synchronous Counters
Unit-III **(15 Lectures)**
Registers: Introduction, Basic Shift Register functions, Serial IN/ Serial OUT Registers, Parallel IN/ Serial OUT Registers, Parallel IN/ Serial OUT Shift Registers. Parallel IN/ Parallel OUT Shift Registers **Basic architecture of computer**: Functional units, Operational concepts, Bus structures, Von Neumann Concept. **Basic Processing**: Instruction code, Instruction set, Instruction sequencing, Instruction cycle, Addressing modes
Unit-IV **(15 Lectures)**
Design of ALU: Binary Arithmetic: Addition, Subtraction, Multiplication, Division of

signed numbers, Floating point number representation

Input-Output Interface: Device Driver, Device Controller and I/O bus.

Address Specifications: Isolated versus Memory-Mapped I/O.

Data Transfer: Synchronous and Asynchronous (Strobe Control, Handshaking). Modes of transfer: Programmed I/O, Interrupt-Driven I/O, and Direct Memory Access (DMA).

Learning Outcomes:

On the successful completion of the course, students will

1. be able to understand Number Systems, Computer arithmetic, basics of Logic gates and Boolean algebra.
2. be familiarized with the combinational circuits, get to know about the basic building block of memory and the working of different types of Flip Flops.
3. get to understand the Counters (Synchronous and Asynchronous) and registers
4. be able to explain architecture of computer and the working of ALU
5. be able to explain the input-output interface and issues related with data transfer between I/O device and memory

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books

1. **Floyd and Jain (2006)**, "Digital Fundamentals", First impression, **Pearson Education.**

2. **M. Mano**, Computer System Architecture, 3rd Ed., **PHI**

Reference Books

1. **Kumar A.Anand**, **"**Fundamentals of Digital circuits", **PHI.**
2. **Tocci J. Ronald**, "Digital Systems Principles & Applications", **Pearson Education.**
3. **M. Morris Mano**, "Digital Logic & Computer Design", **PHI.**
4. **M. Morris Mano**, "Digital Design", 3rd Edition, **PHI.**
5. **W. Stallings,** Computer Organization and Architecture, 7th Edition.

Semester: I

Course Name: Data Structure using C **Course Code: MCA-C-102**

Credits: 4 **Max. Marks:100**

Rationale:

The objective of the course is to introduce the fundamental concepts of Data structures so as to implement, evaluate and analyse the same. The papers also acquaint the students to design and develop the programs for a problem and apply the various data structures like Stacks, Queue, Trees, Graphs, etc.

Unit-I **(15 Lectures)**
Introduction to Data Structure: Concept, Basic Terminology, Elementary Data Structures, Abstract Data Type, Arrays& its representation, Operations on Arrays, Sparse Arrays, Pointers, Linked List (Singly, Double & Circular), Operations on Linked List (Traversing, Insertion, Deletion etc.), Introduction to Garbage Collection. **Stacks and Queues:** Basic Concept, implementation, Applications: Recursion (Fibonacci Series, Factorial & Tower of Hanoi problem), Polish Expressions and their Compilations (Infix, Prefix, Postfix), Queues and their implementation, De-Queues, Priority Queues
Unit-II **(15 Lectures)**
Trees: Concept, Binary Trees, Tree Traversal Techniques (Preorder, Post order, In order), Complete Binary Trees, Binary Search Tree & Operations on Binary Search Tree (Searching, Insertion & Deletion), Height Balance and Concept of AVL Trees and purpose of B-Tree
Unit-III **(15 Lectures)**
Graphs: Concept, Directed Graphs, Graph Representation (Adjacency Matrix and Linked Representation), Dijkstra‟s shortest Path Algorithm, Graph Traversal Techniques (Breadth First Search & Depth First Search). **Searching and Sorting:** Linear & Binary Search, Merge Sort, Heap Sort, Quick sort.
Unit-IV **(15 Lectures)**
Files: Basic terminology Attributes of a File, Classification of Files. File Organizations: Sequential File Organization, Relative File Organization, Indexed Sequential File Organization (Primary, Clustering and Secondary). Hashing: Basic concept, Hash Table, Hash Function

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Understand the concept of Data Structure, Abstract Data Type, Arrays& its representation, Operations on Arrays, Sparse Arrays, Pointers, Linked List (Singly, Double & Circular), Operations on Linked List (Traversing, Insertion, Deletion etc.).
2. Understand the concept and applications of Stacks and Queues and their implementation.
3. Understand the concept and applications of Trees, traversal techniques and various operations and their implementation
4. Understand the concept and applications of Graphs, their representation, traversal techniques and various searching and sorting techniques
5. Understand different types of Files and their implementation

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books

1. **R. Kruse,** "Data Structures & Program Design in C", **Pearson Education**
2. **Seymour Lipschutz(SCHAUM'S ouTlines),** "DATA STRUCTURES"**, Tata McGraw Hill.**

Reference Books

1. **Baluja G. S., "Data Structures Through C++", Dhanpat Rai & Co.**
2. **Dr. PrabhakarGupta,VineetAgarwal, Manish Varshney,** " Data Structure Using „C"**, FIREWALL MEDIA.**
3. **Tanenbaum,** "Data Structures Using "'C" & "C++", **PHI Publication.**

Semester: I

Course Name: Operating Systems **Course Code: MCA-C-103**

Credits: 4 **Max. Marks:100**

Rationale:

The course aims at introducing students to the fundamental concepts of operating systems. The emphasis is on making students familiar with the principles and processes of operating systems, in context of process management, input/output, memory management and file systems.

Unit-I **(15 Lectures)**
Operating System: Introduction, Evolution (Serial processing, Batch Processing, Multiprogramming), Types of OS (Multi-Programming, Time-Sharing, Distributed, and Real-Time Systems), Operating System Structure (Monolithic, Layered, Kernel, Virtual Machine, Client Server Model). **Process Management:** Process Concept, Process states, Implementation of process, PCB, Threads, CPU Scheduling, Types of Schedulers, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, Priority Based, Round Robin, Multilevel Queue).
Unit-II **(15 Lectures)**
Inter-process Communication & Synchronization: Race condition, Critical Section Problem, Mutual Exclusion, Synchronization Hardware, Peterson‟s Solution, Producer - Consumer Problem, Semaphores. **Deadlocks:** Model, Prevention, Avoidance, Detection and Recovery.
Unit-III **(15 Lectures)**
Memory Management-I: Basic Hardware, Address binding, Concept of Logical and Physical Addresses, Dynamic loading, Swapping, Single Process Monitor, Multiprogramming with Fixed Partition and Dynamic Partition, Paging (Basic method, Hardware support (TLB)), Segmentation (Basic method, Hardware support).
Unit-IV **(15 Lectures)**
Memory Management-II: Virtual Memory and its Advantages, Demand Paging (Basic concept), Page Replacement algorithms (FIFO, Optimal Page Replacement, Least Recently Used). **Disk management:** Concept of Files and Directories, Disk allocation methods (Contiguous, Non-contiguous, Indexed), Disk Scheduling Methods (FCFS, Shortest seek Time first, Scan Scheduling).

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the concepts of Evolution, types and structure of Operating System.
2. understand the concepts of Process management in Operating System.
3. understand Inter-Process Communication & Synchronization& Deadlocks in Operating System
4. understand the memory management concepts like Multiprogramming, Paging, TLB, and Segmentation.
5. understand the memory management concepts like Virtual Memory Demand Paging, Page Replacement algorithms and Disk management concepts

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books:

1. **Siberscatz A & Galvin, P (2004)**, "Operating System Concepts", **Willey Pub.**

References:

2. Milankovic. **M (2004)**, "Operating System Concepts & Designs", **TMH.**
3. Tanenbaum, A. S (2000), "Modern Operating System", **PHI.**

Semester: I

Course Name: Discrete Mathematics **Course Code: MCA-OE-101**

Credits: 2 **Max. Marks: 50**

Rationale:

The objective of the course is to introduce fundamentals of discrete mathematics to students for application in Computer Science & Engineering. Through examples and exercises, it will raise the students general mathematical sophistication, i.e., the ability to deal with and create complex structures and convincing arguments.

Unit-I **(15 Lectures)**
Logic and Propositional Calculus: Proposition, Basic Logical Operations, Tautologies and Contradictions, Algebra of Proposition, Logical Implications and Equivalence, Propositional Functions, Quantifiers, Normal Forms, Rules of Inference. **Sets and Functions:** The concept of set, union, intersection and symmetric difference of sets, compliment of a set, Cartesian product of sets, countable and uncountable sets The concept of a function, one-to-one and onto functions, invertible function, Constant function, Identity function, Polynomial function, Rational function, Modulus function, floor and ceiling function
Unit-II **(15 Lectures)**
Matrices and determinants: The concept of a Matrix, Sum, difference and product of matrices, transpose of a matrix, elementary row / column operations on matrices, determinant of a matrix of order up to 3, inverse of a matrix of order up to 3, symmetric and skew symmetric matrices, Matrix method to solve a system of n(=2 or 3) linear equations in (n =2 or 3) variables, Boolean matrix. **Graph Theory-I**: Introduction, Graphs, Pseudographs, Subgraphs, Connected Graphs, Disconnected Graphs, Euler Graphs, Operations on Graphs, Hamiltonian Paths and Circuits, Applications of Graph theory: Konigsberg bridge problem, the Traveling Salesman Problem Trees, Spanning Trees, Fundamental Circuit, Planer Graphs, Kurtowski‟s Two graphs, Euler‟s Formula, Matrix Representation of Graphs: Incidence matrix and adjacency matrix, Coloring of Graphs

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Able to explain the concept of proposition, logical connectives and their various properties.
2. Able to explain the concept of sets and its types and also know the concept of functions and various types.
3. Able to explain the concept of matrix, its types and various operations.
4. Able to explain the concept of graph, its types Hamiltonian paths and circuits and some application of graphs
5. Able to explain the concept of trees, Kurtowski"s two graphs, coloring of graphs

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 5 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with two sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt both sub-parts.
4) **Section B** will comprise of two long answer type questions (question number 2 to 3); each question will have an option. Thus, there will be two questions from each unit. In total, there will be four questions in the section; two from each unit and a candidate will be asked to attempt two questions.
5) All short answer type questions will carry 5 marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 3 will carry equal marks of 12.5 marks

Text Books

1. **Seymour, L (2001)**, "Discrete Mathematics", 2nd Ed**. Tata McGraw Hill, New Delhi.**
2. **Tremblay, J. P & Manhor, R (2004)**, "Discrete Mathematical Structure with Application to Computer Science", 21st edition. **Tata McGraw Hill. New Delhi**

Reference Books

1. **Deo**, **N (2005)** ,"Graph Theory with applications to Engineering and Computer Science", **PHI.**
2. **Liu**,**C. L (2004)**,"Elements of Discrete Mathematics", 2nd Ed. **TMH, New Delhi**
3. **Rosen**,**K. H (2004)**, "Discrete Mathematics & its Applications", 5th Ed**. Tata McGraw Hill**

Semester: I

Course Name: Numerical Techniques **Course Code: MCA-OE-102**

Credits: 2 **Max. Marks: 50**

Rationale:

The main aim of this course is to provide the learners the concept of basic numerical techniques in computer science. The course aims to provide the learner the idea of the theoretical workings of numerical techniques and consequence associated with representation of real numbers and handling of errors, significant digits and precision. The course also highlights techniques for solving non-linear equations and simultaneous algebraic equations.

Unit-I **(15 Lectures)**
Computer Arithmetic: Introduction, Floating Point Representation and Arithmetic, Normalized Floating Point Representation of Numbers. (2L) **Approximations & Errors** – Types of Programming Errors, Data Errors, Computer & Arithmetic Errors, Round off and Truncation Errors, Accuracy and Precision, Measures of Accuracy, Error Propagation (3L) **Iterative Methods -** Non-Linear Equations, Types of Methods to find solutions to nonlinear equations, Algorithms to Compute Roots of Equation – Methods of Tabulation or Brute Force Method, Method of Bisection, Secant Method, Newton-Raphson Method, Method for False Position (5L) Derivation of mathematical formulas and implementation of these methods
Unit-II **(15 Lectures)**
Solution of Simultaneous Algebraic Equations: Linear Equations, Types of Methods to find solutions to linear equations. Algorithms to Solve Linear Algebraic Equations: Gauss Elimination, Gauss Jordan, Gauss Seidel, L.U. Decomposition, Pivoting (10L) Derivation of mathematical formulas and implementation of these methods **Interpolation:** Lagrange Interpolated Polynomial, Newton‟s Methods of Interpolation – Forward difference, Backward difference (4L)

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Understand how numbers are represented in a computer system.
2. Understand the concepts of representation of real numbers, error handling significant digits and precision.

3. Understand how to obtain approximate solutions to intractable mathematical complex problems using various numerical techniques.
4. Know how iterative methods are applied for finding roots of non-linear equations.
5. Understand the concept of finding solutions for simultaneous algebraic equations.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 5 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with two sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt both sub-parts.
4) **Section B** will comprise of two long answer type questions (question number 2 to 3); each question will have an option. Thus, there will be two questions from each unit. In total, there will be four questions in the section; two from each unit and a candidate will be asked to attempt two questions.
5) All short answer type questions will carry 5 marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 3 will carry equal marks of 12.5 marks

Text Books

1. **S.S Sastry (2012)** , "Introductory methods of Numerical analysis", **5th Edition, PHI**
2. **R. S Salaria (2012)** "Computer oriented Numerical Methods"**, 5th Edition, Khanna Book**

Reference Books

1. **Jain, M. K., Iyengar, S. R. K. and Jain, R. K. (2019)**, "Numerical Methods (Problems and Solution)", **New Age Int Publisher**
2. **Rajaraman V, (2005)** "Computer Oriented Numerical Methods", **Prentice Hall India**
3. **Balagurusamy E**, "Numerical Methods", **Tata McGraw-Hill Publishing**

Semester: I

Course Name: Data Structure Using C (Lab) **Course Code: MCA-LA-101**

Credits: 2 **Max. Marks:50**

Lab Sheet

UNIT I

Lab_Activity_1 Write a program in C to insert, delete and update the contents of an array.

Lab_Activity_2 Write a program in C to perform various operations on matrices.

Lab_Activity_3 Write a program to multiply two sparse matrices?

Lab_Activity_4 Write a program to implement singly linked list?

Lab_Activity_5 Write a program to implement different operations like adding a node at beginning, end, center, after a certain element, after a certain count of nodes in a linked list.

Lab_Activity_6 Write a program to implement different operations like deleting a node at beginning, end, center, after a certain element, after a certain count of nodes in a linked list.

Lab_Activity_7 Write a program in C to reverse a linked list by changing the link in the nodes?

Lab_Activity_8 Write a program to add two polynomials represented as linked list?

Lab_Activity_9 Write a program in C to multiply two polynomials represented as linked lists?

Lab_Activity_10 Write a program in C to implement a doubly linked list?

Lab_Activity_11 Write a program to implement different operations like adding a node at beginning, end, center, after a certain element, after a certain count of nodes in a doubly linked List.

Lab_Activity_12 Write a program to implement different operations like deleting a node at beginning, end, center, after a certain element, after a certain count of nodes in a doubly linked List.

Lab_Activity_13 Write a program to implement different operations of a circular linked list

Lab_Activity_14 Write a program to implement various operations on an array-based stack?

Lab_Activity_15 Write a program to implement various operations on a stack represented using linked list.

Lab_Activity_16	Write a program to demonstrate the use of stack in checking whether the arithmetic expression is properly parenthesized?
Lab_Activity_17	Write a program to demonstrate the use of stack in converting an arithmetic expression from infix to postfix?
Lab_Activity_18	Write a program to demonstrate the use of stack in evaluating an arithmetic expression in postfix notation?
Lab_Activity_19	Write a program to demonstrate the use of stack in implementing quicksort algorithm to sort an array of integers in ascending order?
Lab_Activity_20	Write a program to demonstrate the implementation of various operations on a linear queue represented using a linear array.
Lab_Activity_21	Write a program to demonstrate the implementation of various operations on a Circular queue represented using a linear array. Write a program to demonstrate the implementation of various operations on a queue represented using a linked list
Lab_Activity_22	Write a program to demonstrate the use of multiple stacks?

UNIT II

Lab_Activity_23	Write a program in C to create a binary tree
Lab_Activity_24	Write a program to implement the traversal techniques of a binary tree
Lab_Activity_25	Write a program to delete a node in a binary search tree?
Lab_Activity_26	Write a program to implement the different operations of an AVL tree?
Lab_Activity_27	Write a program to implement the different operations of a threaded binary tree.
Lab_Activity_28	Write a program to implement the different operations of a M-way search tree
Lab_Activity_29	Write a program to implement the different operations of a B- tree

UNIT-III

Lab_Activity_30	Write a program in C to implement the graph using different representations
Lab_Activity_31	Write a C program to illustrate the traversal of a graph using Breadth FirstSearch
Lab_Activity_32	Write a C program to illustrate the traversal of a graph using Depth FirstSearch

Lab_Activity_33 Write a C program to in C to find the shortest path in a graph using Dijkstra‟s Algorithm.

Lab_Activity_34 Write a C program in C to implement Euler Graphs

Lab_Activity_35 Write a program in C to implement Hamilton Graphs

Lab_Activity_36 Write a program in C to implement Planner Graphs?

Lab_Activity_37 Write a C program to create Max and Min heaps?

Lab_Activity_38 Write a C program to implement the following sorting algorithms

A. Merge Sort
B. Quick Sort
C. Heap Sort

Lab_Activity_39 Write a C program to implement the following search algorithms

A. Linear Search
B. Binary Search

UNIT-IV

Lab_Activity_40 Write a C program to implement various hashing techniques

Lab_Activity_41 Write a C program to demonstrate the concept of rehashing

Lab_Activity_42 Write a C program to demonstrate the concept of file organization including indexed and sequential file organization

SEMESTER-II

Semester: II

Course Name: Object oriented Programming using Java **Course Code: MCA-F-201**

Credits: (Foundation Mandatory Course) **Max. Marks:100**

Rationale:

This course acquaints students with object-oriented programming concepts and other advanced features and their implementation in Java language. The students shall learn to identify Java language components and know how they work together in real time applications.

Unit-I **(15 Lectures)**
Data types: Integers, Floating point, Character type and Boolean. **Variables:** Assignment, Initialization, type conversion & Casting. **Operators:** Arithmetic, Assignment, Modulus, Relational, Boolean and Bitwise
Unit-II **(15 Lectures)**
Arrays: Single and Multidimensional arrays. **Control statements:** Conditional statements, Iteration Statements and Jump Statements. **Classes & Methods:** Declaring Objects, Creating Methods, Constructors, Command Line Arguments & Argument Passing. Static variables and methods **Inheritance:** Super Class, Member Access, Creating a Multilevel Hierarchy, Method
Unit-III **(15 Lectures)**
Overriding, Dynamic Method Dispatch & Abstract Class. **Packages & Interfaces:** Defining and Importing Packages, Understanding Classpath, Access Protection, Defining and Implementing Interfaces. **Exception Handling:** Exception Types, Using Try and Catch, Throwing Exceptions, Built-In Exceptions in Java, User Defined Exceptions.
Unit-IV **(15 Lectures)**
Multithreaded Programming: Creating & Working with Threads, Thread priorities, Synchronization and Dead Locks. **String Handling:** String Constructor, String Operations, Character Extraction, String Searching & Comparison, String Buffer Class, String Buffer V/s String Class, Lang Package. **I/O Streams:** Stream Classes, Reading & Writing to Console, Accessing files & Directories, File Input and Output Stream, Byte Array Input & Output Stream. **Applets:** HTML tag for applet, Parameter Passing.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the basic concept of object-oriented programming concepts and basics of java programming.
2. develop the Application Software.
3. work with pure object-oriented programming environment.
4. develop multi-threaded Application Programs.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books:

1. **Schildt, H (2004),** "The Complete Reference Java-2 ", Sixth Edition, **TMH.**
2. **E. Balagurusamy (2010)**, "Programming with Java: A Primer", 4th Edition, **Tata Mcgraw Hill**

References:

1. **Dietel & Dietel (2006),** "Java: How to Program Java 2", Sixth Edition, **Pearson Education.**
2. **Horstmann & Cornell (2006),** "Java2 Vol-1 & Vol-2", Seven Indian Reprint, **Pearson Education.**
3. **K. Sierra (2006)**, "Sun Certified Programmer For Java 5"**, Wiley India**

Semester: II

Course Name: Relational Database Management System Course Code: MCA-C-201

Credits: 4 **Max. Marks:100**

Rationale:

The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve information efficiently and effectively from a DBMS. The course also acquaints students to the fundamental concepts necessary for designing, and implementing database systems. It emphasizes on relational database design and the languages and corresponding facilities provided by the relational database management systems.

Unit-I **(15 Lectures)**
Database System Concepts & Architecture: Concept, Characteristics of database, Database system Vs file system, Introduction to DBMS, Advantages, Disadvantages of DBMS, Database users. Concept of Database system architectures, schemas and instances, DBMS architecture & data independence, Components of DBMS, Database Languages & Interfaces, Centralized & Client/Server Architectures of DBMSs
Unit-II **(15 Lectures)**
Data models: Data modeling using ER-Approach (Concept, ER-Notations, Entities, Entity types, Attributes, Attribute types, Relationships Keys concept). Conventional Data Models & Systems: Network data model concept, Hierarchical model concept. Relational Data Model: Concept, Relational model Constraints (Entity Integrity, Referential Integrity, Key Constraints, Domain Constraints), Codd‟s Rules, Relational Algebra (Fundamental Operations).
Unit-III **(15 Lectures)**
Relational Database Design & Normalization: Concept of Functional dependencies (Fully, partial, Transitive), Normalization of relational database, Closure of Attribute Set, Canonical Cover, Norm forms (1NF, 2NF, 3NF, BCNF, 4NF), Join dependencies. **Concurrency:** Concept, Transaction states, Transaction properties (ACID Test), Serializability, Recoverability. Concurrency Control & Recovery Techniques: Concurrency control concept, Concurrency control techniques, Locking (concept, types), Time stamp ordering, Granularity of data items, Dead lock & its Resolution

Unit-IV	**(15 Lectures)**
PL/SQL: Introduction, Concept, Characteristics of SQL, Advantages of SQL, Data definition in SQL, literals, Operators, Specifying Constraints in SQL, Data manipulation in SQL, Views & Queries, Insert, Update & Delete Operations, Creating users, Grant and revoke object privileges. Introduction to PL/SQL: variable, constants, data types, Pl/SQL block structure, Condition and iterative control statements, Concept of cursors & trigger	

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the concept database system and its architectures.
2. design the database and might be aware about some familiar database models.
3. understand functional dependencies and be able to normalize the relational database.
4. understand the transaction management in relational database management system and related security issues.
5. work with PL/SQL (A database designing and development language).

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books:

1. **Elmarsi, Navathe, S B (2004)**,"Fundamentals of database Systems", **Pearson Education**.
2. **Silbebschatz, A. Korth, H,F. Sudarshan ,S (2006)** ,"Database System Concepts", **TMH**

References:

1. **Date, C J (2005)**, "An Introduction to Database Systems", **Addison Wesley**.
2. **Desai, B C (2002)**, "An introduction to database Systems", **Galgotia Publications**.
3. **Leon (2004)**, "Database Management Systems", **Vikas Publications.**
4. **Bayross I.**,"Commercial Application Development using Oracle Developer 2000*",**BPB.***

Semester: II

Course Name: Data Communication & Computer Networks **Course Code: MCA-C-202**

Credits: 4 **Max. Marks:100**

Rationale:

The aim of this course is to acquaint the students the basics of Data communication and computer networks and concentrates on building a firm foundation for understanding the subject. The paper is based around the OSI Reference Model that deals with the major issues in the bottom three (Physical, Data Link and Network) layers of the model, also highlights fundamental knowledge of the various aspects of computer networking and enables students to appreciate recent developments in the area.

Unit-I **(15 Lectures)**
Signals: Concept of Analog and Digital signals. **Digital-to-Digital Encoding,** Line Coding, unipolar, polar (NRZ-L, NRZ-I, Manchester & Differential Manchester encoding) & bipolar **Analog to Digital encoding:** Pulse Amplitude Modulation, Pulse code Modulation, Delta Modulation. **Digital to Analog Modulation**/ encoding: frequency shift keying, amplitude shift keying, phase shift keying, Quadrature amplitude modulation, **Analog-to-Analog Conversion**: Amplitude Modulation, Frequency Modulation, Phase Modulation. **Multiplexing**: frequency division, wavelength division, time division
Unit-II **(15 Lectures)**
Data Link Layer: Pure Aloha, Throughput of pure Aloha, Slotted Aloha, CSMA/CD, Media Access Control in CSMA/CD, MAC Frame Format (IEEE 802.3), Format of Ethernet (DIX) Frame, The Binary Exponential Backoff Algorithm, **Error detection**: types of errors, **detection methods**: parity check, cyclic redundancy check, checksum **Error correction**: forward error correction, hamming code
Unit-III **(15 Lectures)**
Introduction: Computer network, LAN, MAN, WAN, Simplex, Half duplex, Full duplex. **Transmission media**: Twisted Pair cable, Coaxial cable, Fiber optics: Multi mode & single mode (overview). **Network topologies**: Star topology, ring topology, bus topology, mesh topology, Client server n/w, Peer to peer n/w, Distributed n/w, **Wireless n/w**: Bluetooth, 802.11a, b, c, n, ac series, comparison of 802.11ac & n. **Models**: OSI Model, TCP/IP reference Model, Comparison of TCP/IP & OSI model
Unit-IV **(15 Lectures)**
Network layer: Virtual circuits, Shortest path routing, Overview of (Flooding, Broadcast, Multicast IP addresses), IPv4 addresses, IPv4 subnetting, overview of IPv6 addresses, Overview of (Tunneling, Firewalls) **Transport layer**: Quality of service, Elements of transport protocol, and Performance problems in computer networks, **Application layer**: Basic overview of (FTP, Telnet, HTTP, Email, DNS, World Wide Web, Virtual terminal).

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the Concept of analog and digital signals including encoding techniques.
2. understand the Concept of conversion techniques line, Digital to Analog, and Analog to Digital, digital to digital, analog to analog.
3. understand the Concept of techniques involved in Data Link Layer like CSMA/CD, Error detection & error correction.
4. understand the Concept of Computer Networks like transmission media, Network topologies, Wireless and Network Models like OSI and TCP-IP.
5. understand the Concept of Network, Transport and Application Layer.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books

1. **Tannenbaum (2013),**"Computer Networks", Fourth Edition **PHI.**
2. **Stallings.W, (2016),** "Data and Computer Communication", 7th edition, **Pearson Education Asia.**

Reference Books

1. **Behrouz A. Forouzan (2006)**, "Data communication & Networks", Fourth Edition, **TMH.**
2. **Uyless D.Black (2004)**, "Data Communication & Distributed Networks", 3rd Edition, **PHI**
3. **Prakash C. Gupta**, "Data Communications and Computer Networks", **PHI**

Semester: II

Course Name: Analysis and Design of Algorithms **Course Code: MCA-C-203**

Credits: 4 **Max. Marks: 100**

Rationale:

The objective of the course is to teach techniques for effective problem solving in computing. The use of different paradigms of problem solving will be used to illustrate clever and efficient ways to solve a given problem. In each case emphasis will be placed on rigorously proving correctness of the algorithm.

Unit-I **(15 Lectures)**
Introduction to Algorithms, the running times of a program. Use of the Big-Oh, Small-o, Big Omega and small Omega notations, Efficiency of algorithm. Sorting Algorithms (Radix sort and Bucket sort). Introduction to algorithm design techniques. **Algorithm Analysis and Design Technique:** Analysis framework, recursive & non-recursive algorithm (Overview). Analysis of recursive and non- recursive algorithm, Strassen‟s Matrix multiplication, Divide and Conquer (General methods, Merge sort, Quick Sort)
Unit-II **(15 Lectures)**
Greedy Techniques: Knapsack Problems, Prim‟s algorithm, Krushkal‟s algorithm, Dijkstra‟s method, Huffman trees **Transform & Conquer:** Horner‟s rule & Binary Exponentiation, Problem Reduction. **Decrease & Conquer:** Depth-First Search and Breadth-First Seach, Topological sorting
Unit-III **(15 Lectures)**
Advanced Data Structures: Hashing & its terminology, Hash Table and Hash function, Hashing techniques, collision resolution techniques. **Dynamic programming:** General methods, 0/1 knapsack problem, Travelling salesman problem, Warshal‟s and Floyd‟s Algorithm, Optional Binary Search trees.
Unit-IV **(15 Lectures)**
Design Technique: Back-tracking (8- Queen‟s Problem, Hamiltonian Cycles) **P, NP and NP-Complete problems:** Graph Coloring, Branch and Bound, Approximation Algorithms for NP hard problems. Limitation of Algorithm-power: Lower Bound Arguments, Decision Trees.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. analyse the algorithms to determine the computational complexity and justify the correctness.
2. understand sorting techniques (Count, Radix, Bucket, Merge, Quick) student will able to write algorithm and calculate time complexity.
3. solve different kind problems using Divide and Conquer algorithm, Greedy approaches and Dynamic programming.
4. understand Advance Data Structures such as Hashing and different Hashing techniques.
5. understand, distinguish and solve P, NP and NP-complete problems

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Textbooks:

1. **Anany,Levitin**, "Introduction to the Design & Analysis of Algorithm",**Pearson Education.**
2. **Horowitz, Ellis**, "Fundamentals of Computer Algorithms", **Galgotia Publications**

References:

1. **Leiserso, Cormen, Rivert**, "Introduction to Algorithms, **PHI Publication**
2. **Brately Brassard** , "Fundamentals of Algorithms", **PHI Publication**
3. **Michael T. Goodrich, Roberto Tamassia**, "Algorithm Design", **Wiley Publication**

Semester: II

Course Name: Android Application Development **Course Code: MCA-OE-201**

Credits: 2 **Max. Marks:50**

Rationale:

The aim of this course is to acquaint the students about the Android OS architecture, applications development lifecycle and its connectivity with databases. The students shall also be able to get familiarize with Android's APIs for data storage, retrieval, user preferences, files and content providers.

Unit-I **(15 Lectures)**
Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features **Android application components:** Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc **Android User Interface and its components**: Measurements – Device and pixel density independent measuring units. user interface components (text box, button, check box etc) **Event Handling** – Handling clicks or changes of various UI components
Unit-II **(15 Lectures)**
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. **Notifications** – Creating and Displaying notifications, Displaying Toasts **Persistent Storage:** Files – Using application specific folders and files, creating files, reading data from files, **Database** – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, registering content providers, using content providers (insert, delete, retrieve and update), NOSQL and Firebase Database

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Understand the basic concepts of Android operating systems and its components.
2. Understand user interface and event handling.
3. Understand intents and broadcasts: receiver and notification.
4. Understand File storage in android environment.
5. Understand the connectivity and designing of database with android applications.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 5 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with two sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt both sub-parts.
4) **Section B** will comprise of two long answer type questions (question number 2 to 3); each question will have an option. Thus, there will be two questions from each unit. In total, there will be four questions in the section; two from each unit and a candidate will be asked to attempt two questions.
5) All short answer type questions will carry 5 marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 3 will carry equal marks of 12.5 marks

TEXT BOOKS:

1. Meier. R (2012), "Professional Android 4 Application Development:", **Wiley India**

2. Sheusi. J. C (2013), "Android Application Development for Java Programmers", **Cengage Learning.**

REFERENCE:

1. Wei-Meng Lee (2013), "Beginning Android 4 Application Development", **Wiley India (Wrox).**

Semester: II

Course Name: Python Programming **Course Code: MCA-OE-202**

Credits: 2 **Max. Marks:50**

Rationale:

This course acquaints students to understand Python as a scripting language for developers and learn the advanced features of it and their implementation. The students shall learn to identify language components and know how they work together in real time applications.

Unit-I **(15 Lectures)**
Basic Concepts: Comments in Python, Statements, Keywords, Identifiers, Variables, Executing python programs(interactively, from a file, other methods),Overview of IPython, Anaconda, Conda and Jupyter Notebook. **Data types:** Numbers(integers, floating point, complex and bool), Type casting (Implicit Explicit), **Strings basics:** (creating, initializing, accessing elements of string), Operators(Arithmetic, Logical, Bitwise, Boolean, Identity, Special) **Flow control statements**, if –elif-else…, while loop, For loop, Range function. Python Exceptions, Built in exception, User defined exception, Single line comments and multiline comments. **Functions:** Built- in Functions, Calling a function, passing variables in a function call, Function Arguments.
Unit-II **(15 Lectures)**
Python Modules, Basics of NumPy and SciPy: N dimensional array in Numpy, methods and properties of Numpy, array indexing in Numpy. **Lists:** Accessing list, Operations ,Working with lists , Function and Methods Tuple: Accessing tuples, Operations, Working Functions and Methods Dictionaries: Accessing values in dictionaries, Working with dictionaries, Function and Methods **Pandas:** Pandas to open csv files, Reading HTML Files, Reading and Writing to JSONfiles. Overview of SymPy and Matplotlib.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Understand basic concepts of python, writing and Executing python programs
2. Understanding use of Data types, Type casting (Implicit Explicit), String basics, Operators (Arithmetic, Logical, Bitwise, Boolean, Identity, Special) and Functions
3. Understand and implement Flow control statements, Python Exceptions and Python Modules
4. Implementing Lists, tuples and Dictionaries and various operations on them
5. Understand Pandas, using Pandas to open csv files, Reading HTML Files, Reading and Writing to JSON files

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 5 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with two sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt both sub-parts.
4) **Section B** will comprise of two long answer type questions (question number 2 to 3); each question will have an option. Thus, there will be two questions from each unit. In total, there will be four questions in the section; two from each unit and a candidate will be asked to attempt two questions.
5) All short answer type questions will carry 5 marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 3 will carry equal marks of 12.5 marks

TEXT BOOKS:

1. Jesus Caspagnetto, "Professional PHP Programming", **Wrox Publication**

2. Harwani, "Developing Web Applications in PHP and AJAX", **McGraw Hill**

REFERENCE:

1. P.J. Deitel & H.M. Deitel, "Internet and World Wide Web How to program"**, Pearson**

Semester: II

Course Name: **Relational Database Management Systems (Lab)** **Course Code: MCA-LA-201**

Credits: 4 **Max. Marks:100**

Lab Sheet

Lab_Activity_1: List various users, functions and constraints of the database system for Library Management.

Lab_Activity_2: List various users, functions and constraints of the database system for Banking System.

Lab_Activity_3: Identify the various tables and draw a diagrammatic schema to represent the database of Library management system.

Lab_Activity_4: Identify the various tables and draw a diagrammatic schema to represent the database of University system.

Lab_Activity_5: Draw ER Model for the database of Library management system.

Lab_Activity_6: Draw ER Model for the database of University management system.

Lab_Activity_7: Consider the following schema:

Suppliers (sid, sname, address) Parts (pid, pname, color) Catalog (sid, pid, cost)

Write relational algebra queries to

I. Find the name of suppliers who supply some red parts.
II. Find the sids of suppliers who supply some red or green parts.
III. Find the sids of suppliers who supply some red part or are at Srinagar.
IV. Find the sids of suppliers who supply some red and some green part.
V. Find the sids of suppliers who supply every part.
VI. Find the sids of suppliers who supply every red part.
VII. Find the sids of suppliers who supply every red or green part.

Lab_Activity_8: Consider a schema R(A,B,C,D) and functional dependencies A->B and C->D. Check the decomposition of R into R1(AB) and R2(CD) for lossless join and dependency preservation

Lab_Activity_9: R(A,B,C,D) is a relation. Which of the following does not have a lossless join, dependency preserving BCNF decomposition?

1. A->B, B->CD 2. A->B, B->C, C->D
3. AB->C, C->AD 4. A ->BCD

Lab_Activity_10: Using a sample schema and data, demonstrate the use of 1NF, 2NF, 3NF

and BCNF

Lab_Activity_11: Create table Student with following attributes and perform the following operations?

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRESS	ST_TELNO
Date Type	Number	Varchar	Char	Varchar2
Size	6	30	35	15

I. Add new attributes City, Street, Country with Datatype Varchar and length30
II. Modify field ST_ROLLNO and change the size to 5
III. Remove column ST_ADDRESS?
IV. Describe the Table Student
V. Drop Table Student
VI. Copy Structure of one table to another

Lab_Activity_12: CreateUsersuser1, user2, user3 and perform the following operations

I. Grant Session Privilege to the newly created users?
II. Grant privileges for creating and manipulation tables?
III. Grant data manipulation privileges to various users on tables?
IV. Grant privileges with grant option.
V. Revoke privileges.

Lab_Activity_13: Create Object ADDRESS and use the object in a Table DDL

Lab_Activity_14: Create table Student with following attributes and perform the following operations

Attribute Name	ST_ROLLNO	ST_NAME	ST_STREET	ST_CITY	ST_State	ST_Country	DTE_REG
Date Type	Number	Varchar	Char	Char	Varchar2	Varchar2	Date
Size	6	30	35	30	30	30	

I. Insert 10 records in the table.
II. Perform various Project Operations using Select Query.
III. Perform various restrict operations using Select Query.
IV. Update records in the table.
V. Delete records in the table.
VI. Create another table with same structure as existing table without copying the data.

VII. Create another table along with the structure and data from existing table.

VIII. Create another table along with the structure and data from existing table

Lab_Activity_15: Create table Student with ST_ADDRESS as Object Type with following attributes and perform the following operations

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRESS				DTE_REG
			ST_STREET	ST_CITY	ST_State	ST_Country	
Data Type	Number	Varchar	Char	Char	Varchar 2	Varchar2	Date
Size	6	30	35	30	30	30	

I. Insert 10records.

II. Perform various Project Operations using Select Query

III. Perform various restrict operations using Select Query.

IV. Update records in the table

V. Delete records in the table

Lab_Activity_16: Create table STUDENT with following attributes and perform the following operations

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRESS				DTE_REG
			ST_STREET	ST_CITY	ST_State	ST_Country	
Data Type	Number	Varchar	Char	Char	Varchar 2	Varchar2	Date
Size	6	30	35	30	30	30	

I. Insert 10 records in the table.

II. Perform various Project Operations using Select Query.

III. Perform various restrict operations using Select Query using various arithmetic and Logical Operators like

a) Less Than

b) Greater Than

c) Less Than or Equal to

d) Greater Than or Equal To

e) Equal to

f) Not Equal To

IV. Perform restrict operations shown to (iii)using various datatypes like numeric, Characters, Date.

V. Perform Update operations using various Arithmetic and Logical Operators on

Table STUDENT

VI. Perform Delete operations using various Arithmetic and Logical Operators on Table STUDENT

VII. Use Insert and Select Commands together with Arithmetic and Logical Operators

Lab_Activity_17: Perform following Transaction Control Operations on the above table

I. Perform various data manipulation operations the table.

II. Create Five Save points from S1 to S5.

III. Rollback to Various save points and observe the changes in the table.

IV. Perform various DDL operations the table and observe its effect on Save point and Rollback on the table.

V. Try to abnormally terminate the application to observe whether data is saved or not.

VI. Use Commit and Commit Work commands to save the data permanently

Lab_Activity_18: Create table STUDENT with following attributes and perform various DML operations to verify domain constraint

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRESS
Date Type	Number	Varchar2	Varchar
Size	6	30	35
Constraint	NOT Null	Not NULL	NOTNULL

Lab_Activity_19: Create table STUDENT with following attributes and perform various DML operations to verify Validity Integrity

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRESS
Date Type	Number	Varchar2	Varchar
Size	6	30	35
Constraint	CHECK (ROLLNO >20001 and ROLLNO<30001	Not NULL	NOTNULL

Lab_Activity_20: Create table STUDENT with following attributes and perform various DML operations to verify Entity Integrity using Primary and Unique Keys

Attribute Name	ST_ROLLNO	ST_NAME	ST_ADDRSS
Date Type	Number	Varchar2	Varchar
Size	6	30	35
Constraint	Primary/Unique Keys	Not NULL	NOTNULL

Lab_Activity_21: Create table STUDENT with following attributes and perform various DML operations to verify Referential Integrity using given tables (employee and department)

Attribute Name	EMP_ID	EMP_NAME	ST_ADDRESS	DEPT_ID
Date Type	Number	Varchar2	Varchar	Number
Size	6	30	35	4
Constraint	Primary Key	Not NULL	NOT NULL	Foreign Key

Attribute Name	DID	NAME	Address
Date Type	Number	Varchar2	Varchar
Size	4	30	100
Constraint	Primary Key	Not NULL	NOTNULL

Lab_Activity_22: Write SQL queries to demonstrate use of Join and various SQL functions

Lab Sheet for Minor Elective

Lab_Activity_1: Compare various operating systems with Android OS.

Lab_Activity_2: Install and configure java development kit (JDK), android studio and android SDK

Lab_Activity_3: Configure android development tools (ADT)plug-in and create android virtual device

Lab_Activity_4: Develop a program to display Hello World on screen

Lab_Activity_5: Develop a program to implement linear layout and absolute layout.

Lab_Activity_6: Develop a program to implement frame layout, table layout and relative layout.

Lab_Activity_7: Develop a program to implement Text View and Edit Text

Lab_Activity_8: Develop a program to implement AutoComplete Text View.

Lab_Activity_9: Develop a program to implement Button, Image Button and Toggle Button

Lab_Activity_10: Develop a program to implement login window using above UI controls

Lab_Activity_11: Develop a program to implement Checkbox.

Lab_Activity_12: Develop a program to implement Radio Button and Radio Group

Lab_Activity_13: Develop a program to implement Progress Bar.

Lab_Activity_14: Develop a program to implement List View, Grid View, Image View and Scroll View

Lab_Activity_15: Develop a program to implement Custom Toast Alert.

Lab_Activity_16: Develop a program to implement Date and Time Picker.

Lab_Activity_17: Develop a program to create an activity.

Lab_Activity_18: Develop a program to implement new activity using explicit intent and implicit intent.

Lab_Activity_19: Develop a program to implement content provider.

Lab_Activity_20: Develop a program to implement service

Lab_Activity_21: Develop a program to implement broadcast receiver

Lab_Activity_22: Develop a program to implement sensors.

Lab_Activity_23: Develop a program to build Camera.

Lab_Activity_24: Create sample application with login module. (Check username and password) On successful login, Change Text View “Login Successful” and on login fail, alert user using Toast “Login fail”.

Lab_Activity_25: Create login application where you will have to validate username and password till the username and password is not validated, login button should remain disabled.

Lab_Activity_26: Develop a program to a) Send SMS b) Receive SMS

Lab_Activity_27: Develop a program to send and receive e-mail.

Lab_Activity_28: Deploy map-based application.

Semester-III

Semester: III

Course Name: Theory of Computation **Course Code: MCA-C-301**

Credits: 4 **Max. Marks: 100**

Rationale:

The Theory of Computation is a scientific discipline concerned with the study of general properties of computation be it natural, man-made, or imaginary. The objective of the course is to understand the nature of efficient computation. The students shall also get acquainted with the relationship among formal languages along with notion of computability and common paradigms of computing.

Unit-I **(15 Lectures)**
Introduction: Finite Automata, Strings, Alphabets and Languages, state tables & diagram. Acceptability of a String by a Finite Automaton (FA). Regular Expressions (RE), Identities for Regular expressions, Conversion of FA to RE and vice versa **Non-Deterministic Machines:** Nondeterministic Finite State Machines, Conversion of NFA to DFA , The Equivalence of DFA and NDFA, Minimization of Finite Automata.
Unit-II **(15 Lectures)**
Transducers: Mealy & Moore machines, Conversion: Mealy to Moore, Moore to Mealy. Pumping Lemma for Regular sets. **Grammars:** Context free Grammar, Right-Linear Grammar, Left-Linear Grammar, Derivation Trees, Parsing and Ambiguity, Top-down Parsing, Bottom-up Parsing, Chomsky Normal form and Greibach Normal form.
Unit-III **(15 Lectures)**
Context Free languages: Properties of Context free languages. Chomsky Classification of languages. **Push Down Automaton:** Introduction, Deterministic and Non-Deterministic PDA, Relationship between PDA and CFL, Conversion from PDA to CFG.
Unit-IV **(15 Lectures)**
Turing Machines: Computing with Turing Machines, Nondeterministic Turing Machines, Unrestricted Grammars, Context Sensitive languages, Church's Thesis, Types of Turing Machine (Multi-tape TM, Multi-Dimensional and Multi-Head TM), Universal Turing Machines, Concept of Halting problem

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the concepts of Automaton Theory and Formal Languages such as Alphabets, Strings and Regular Expressions.
2. understand the working of different types of Finite Automaton and these models such as Mealy and Moore Machine.
3. understand Grammars of Automaton and its normal forms.
4. understand the concept of Context Free Language and Pushdown Automaton.
5. understand the concepts of Turing Machines and its various types and applications.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Textbook:

1. **Eugene Xavier, S.P**, "Theory of Automata and Formal Languages and Computation", **New Age International Publishers, New Delhi.**
2. **Mishra, K.L.P., and Chandrasekaran, N. (2010),** "Theory of Computer Science: Automata, Languages and Computation"**, PHI Learning Private Limited, New Delhi.**

References:

1. **Hopcroft, J., and Ullman, J. (1979)**, "Introduction to Automata Theory, Languages and Computation", **Addison-Wesley**.
2. **H. R. Lewis and C. H. Papadimitriou**, "Elements of the Theory of Computation", **Prentice Hall of India**
3. **Michael Sipser,** "Introduction to the Theory of Computation, Thompson", _____

Semester: III

Course Name: Artificial Intelligence & Machine Learning Course Code: MCA-C-302

Credits: 4 **Max. Marks:100**

Rationale:

The objective of the course is to acquaint the students to know how to design and develop the intelligent systems. Students might be able to get the knowledge of intelligent agent, knowledge base reasoning, searching and problem-solving techniques, working with fuzzy values and multi agents- based environment and knowledge acquisition of machine learning techniques.

Unit-I **(15 Lectures)**
Introduction to Artificial Intelligence: Foundation and History of Artificial Intelligence, Agents, types of Agents, Intelligent Agents, Structure of Intelligence Agents; Knowledge Based Agent, Environments and its types, Relationship between Environment and Agent. Introduction to Knowledge representation, Hypothesis, Knowledge Levels, Knowledge Classification, Knowledge Representation Schemas; Logic Based, Procedural, Network and Structural Representations
Unit-II **(15 Lectures)**
Searching and Problem Solving: Searching, Problem-Solving Agents; Uninformed Search Strategies, Breadth First Search, Iterative Deepening Search, Bidirectional Search, Informed Search Strategies; Action and Path Costs, Heuristic Functions, Greedy Best First Search, A* Search, IDA* Search.
Unit-III **(15 Lectures)**
Multi Agent Systems and Fuzzy Sets: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools. Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification; Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.
Unit-IV **(15 Lectures)**
Introduction to Machine Learning: Overview of Machine learning (ML), Components of a learning problem, Applications, Choosing a Model Representation, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Semi-supervised Learning, Reinforcement learning, Inductive Learning, Perspectives and issues in Machine learning, Concept of Clustering and Classification

Neural Network: Neuron, Artificial Neural Networks (ANNs), Perceptrons, Gradient Descent, Backpropagation, Deep learning, Deep Neural Network, Hierarchical Representation, Unsupervised pre training, Activation Functions

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand basic concepts of Artificial intelligence, early developments in this field, basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.
2. understand the applicability, strengths, and weaknesses of the basic knowledge representation
3. implement a search problem as a state space, and how different types of search algorithms work like state space search, heuristic search, Greedy Best First Search, A* Search, IDA* Search.
4. understand basic concepts of Multi Agent Systems and Fuzzy Sets
5. understand the basics of Machine Learning and its various techniques including the concept of Artificial Neural Networks, types and its various techniques

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books:

1. **Russel,S and Norvig, P**, "Artificial Intelligence, A Modern Approach", **PHI**.
2. **Alpaydin. E, (2014), "**Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", **Third Edition, MIT Press**.
3. **Kirthi Raman, Phuong Vo.T.H, Et al (2017)**, "Python: Data Analytics and Visualization", **Packt Publishing**

References:

1. **Night, R**, "Introduction to Artificial Intelligence", **TMH.**
2. **Patterson, D W**, "Introduction to Artificial Intelligence and Expert Systems",
3. Indian Reprint, **PHI**.
4. **Martin T. Hagan, Howard B. Demuth, Mark Beale, Orlando De Jesús,** "Neural Network design", **China Machine Press.**
5. **Tom Mitchell, "**Machine Learning", 1st Edition, **McGraw- Hill**.

Semester: III

Course Name: Web Technologies **Course Code: MCA-C-303**

Credits: 4 **Max. Marks:100**

Rationale:

The course is designed to acquaint the students with the techniques to design and develop the web based applications. Students might be able to work on the Dot Net Framework Environment (ASP Dot Net) using Database connectivity for developing dynamic applications.

Unit-I **(15 Lectures)**
Introduction to HTML and CSS: Introduction, HTML tags: types, Formatting text, Controlling fonts, Tables, Adding pictures, adding links, creating forms working with text boxes, radio buttons, check boxes, dropdown menu, submit button setting up frames, creating web pages, Page Navigation in HTML, Introduction to CSS and its types, CSS properties. **Introduction to IIS:** Introduction, configuring IIS. Deploying a web Application.
Unit-II **(15 Lectures)**
.Net Framework and IDE: Introduction, .Net Architecture, CLR, MSIL And JIT, Class Library. **Introduction to ASP.NET:** Architecture, Application Domain, Life cycle of a Web Form. Standard Controls in ASP.NET :(Text Box, Button, Label, Image Control, Drop Down List, Check Box Control), Navigation control (Tree view Control, Menu Control), Validation Controls, Login Controls, HTML controls in ASP.NET, Master Page
Unit-III **(15 Lectures)**
OOPS Concepts using C#: Introduction to Classes, Objects and Constructors, Argument Passing, Passing Objects and Lists. Polymorphism, Inheritance (Single and multiple), Interfaces and Inheritance, Abstract Class and Interfaces. Strings & Mutable Strings. **Delegates and Events**: Introduction, Delegate: Declaration, Methods, Instantiation, Invocation. Error & Exception Handling. Working with Date and Time. **ASP.Net Objects**: Request Object, Response Object, State Management in Asp.NET (Hidden Field ,View State, Cookies, Query Strings, Session Application).
Unit-IV **(15 Lectures)**
Data Base Connectivity: Architecture of ADO .Net, Server Explorer, Connecting with databases using OLEDB and SQL server, working with dbConnection Class, dbCommand Class, dbDataReader Class, dbTransaction Class, dbDataAdapter Class, Data Set Class. **Working with Data and Data Controls:** Data Bound Controls (List Control, Iterative Controls, View Controls, GridView Control). Creating New Data Connection in Code and perform data Manipulations in Code. Reporting in ASP.NET.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the basic principles of web designing and design web pages using HTML and Cascading Style sheets.
2. understand ASP.NET architecture. Student will be able to work with ASP.NET standard controls and develop interactive web applications. Student will also implement validation and authentication in web application.
3. understand the basic concepts of C# language.
4. understand the concept of Request and Response objects in ASP.NET. Student will able to implement state management in web applications. Student will able to work with different databases, retrieve and manipulate data using ADO.NET.
5. make use of databound controls and create reports in ASP.NET.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books:

1. **Platt ,D S (2005),** "Introducing Microsoft .Net", **Microsoft Press,PHI.**
2. **Simon et. al(2005),** " C# for Begineers", **Wrox Publications.**
3. **Simon et. al(2005),** "Professional C#", **Wrox Publications.**

References:

1. **Schildt, H(2005),** "The Complete Reference C #",**TMH.**
2. **Kogent Learning Solutions Inc (2009), "**Black Book ASP.NET 3.5", Beginners Edition, **Dreamtech Press.**
3. **Imar Spaanjaars, "**Beginning ASP.NET 4: in C# and VB", **WROX publication.**
4. **Deitel & Deitel,** "Internet & WWW HOW to Program," 3rd Edition, 2005, **PHI**.
5. **Dino Esposito, "**Programming Microsoft ASP.NET 4", 1st Edition,2011, **Dreamtech Press.**

Semester: III

Course Name: Data Warehousing and Data Mining **Course Code: MCA-OE-301**

Credits: 4 **Max. Marks:100**

Rationale:

The main aim of the course is that to acquaint the students about architecture and models of data warehousing to store the data. It also makes students understand about the various data mining techniques such as data clustering and classifications of data. The soft computing and its techniques are also introduced

Unit-I **(15 Lectures)**
Data Warehousing: Introduction to Data Warehousing: Definition, Data warehouse vs Operational data base systems, Multi-tiered architecture of data warehouse, Data warehouse models: Enterprise, Data mart and Virtual Warehouse, Metadata repository, Data warehouse modeling: Introduction to Data Cube, OLAP and OLTP.
Unit-II **(15 Lectures)**
Data mining Basics: Introduction to Data Mining: Definition, Data mining vs Traditional data analysis, Data mining process, Data mining techniques, Data mining tasks, Data mining applications, Challenges and Issues in data Mining, Future of data mining.
Unit-III **(15 Lectures)**
Association Rule Mining and Classification: Association Rule mining: Introduction and Importance, Basic association rule mining Algorithms: Apriori, Sampling and Partitioning. Classification: Introduction and Importance, Different Classification Algorithms: Distance based (k-nearest neighbor) Decision trees (ID3).
Unit-IV **(15 Lectures)**
Cluster Analysis: Cluster Analysis: Introduction and Importance, Similarity and Dissimilarity measures, Different Clustering Techniques: Hierarchical Technique (Divisive and Agglomerative), Partitioning (k-means, k-mediods), Density based (OPTICS, DenClue, DBSCAN), Grid based (Sting, CLIQUE). **Soft Computing:** Introduction to Soft Computing, Soft Computing vs Hard Computing Introduction to different soft computing techniques (Neural Networks, Fuzzy Sets, Rough Sets and Genetic Algorithms) and their utility in data mining.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the concepts of Data Warehousing and its various models.
2. understand the concepts of Data Mining basics such as Data Mining Processes, Techniques, Tasks, Applications and Issues.
3. understand and use the various Data Mining Algorithms related to Association Rule Mining and Clustering such as Apriori, Decision Tree and Sampling and Classifications.
4. understand and work with Clustering Techniques such as Partitioning, Hierarchical, Density Based and Grid Based.

5. learn about the concepts of Soft Computing and various techniques such as Neural Network, Fuzzy Sets, Rough Sets and Genetic Algorithm.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books:

1. **Dunham, H,M**, "Data Mining: Introduction and Advanced Topics", **Pearson Education**.
2. **Pang Ning tan, Michael S,B and Kumar V**, "Introduction to data Mining", **Pearson Education.**
3. **Arun K Pujari**, "Data Mining Techniques", **University Press**.

References:

1. **J. Han, M Kamber (2001),** "Data Mining Concepts and Techniques", **Morgan Kufman Publishers.**

Semester: III

Course Name: Big Data Analytics **Course Code: MCA-OE-302**

Credits: 4 **Max. Marks:100**

Rationale:

This course provides a basic introduction to big data and corresponding quantitative research methods. The objective of the course is to familiarize students with big data analysis as a tool for addressing substantive research questions.

Unit-I **(15 Lectures)**
Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Statistical concepts: Sampling distributions, resampling, statistical inference, prediction error. Regression modelling, Multivariate analysis, Bayesian modelling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction
Unit-II **(15 Lectures)**
Neural Networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods **Introduction to Streams Concepts –** Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.
Unit-III **(15 Lectures)**
Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – **Clustering Techniques** – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.
Unit-IV **(15 Lectures)**
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Apply the statistical analysis methods
2. Compare and contrast various soft computing frameworks
3. Design distributed file systems

4. Apply Stream data model
5. Use Visualization techniques

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text Books

1. **Michael Berthold, David J. Hand**, "Intelligent Data Analysis", **Springer**.
2. **Anand Rajaraman and Jeffrey David Ullman**, "Mining of Massive Datasets", **Cambridge University Press.**

Reference Books

1. **Bill Franks,** "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics", **John Wiley & sons**.
2. **Glenn J. Myatt**, "Making Sense of Data", **John Wiley & Sons.**
3. **Pete Warden**, "Big Data Glossary", **O"Reilly**.
4. **Jiawei Han, Micheline Kamber** "Data Mining Concepts and Techniques", **Elsevier**

Semester: III

Course Name: Pattern Recognition **Course Code: MCA-OE-303**

Credits: 4 **Max. Marks:100**

Rationale:

This course provides a basic introduction to pattern recognition including basic statistical concepts and image processing techniques. The course also discusses concept of non-parametric pattern recognition techniques. Artificial Neural Networks are also included

Unit-I **(15 Lectures)**
Introduction: application of pattern recognition, statistical decision theory, image processing and analysis. probability: introduction, probability of events, random variables, joint distribution and densities, moments of random variables, estimation of parameters from samples, minimum risk estimations.
Unit-II **(15 Lectures)**
Statistical decision making: introduction, baye‟s theorem, multiple features, conditionally independent features, decision boundaries, estimation of error rates, characteristic centers, estimating the composition of populations
Unit-III **(15 Lectures)**
Non parametric decision making: introduction, histograms, kernel and windows estimators, nearest neighbour classification techniques, adaptive decision boundaries, adaptive discriminant functions, minimum squared**.**
Unit-IV **(15 Lectures)**
Clustering: introduction, hierarchical clustering, partitional clustering. **Artificial neural networks:** introduction, nets without hidden layers, nets with hidden layers, the back – propagation algorithm, hopfied nets – an application: classifying sex from facial images.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Understand concepts related to pattern recognition techniques
2. Apply statistical decision making techniques for different pattern recognition problems
3. Understand well known pattern recognition techniques like clustering algorithms and artificial neural networks.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

6) There will be two sections A and B.
7) There will be 9 questions in all.

8) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
9) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
10) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text and Reference Books:

1. **Earl Gose, Richard Johnsonbaugh and Steve Jost,** "Pattern Recognition And Image Analysis"**, Phi.**
2. **Duda R.O. and Hart P.E.,** "Pattern Classification and Scene Analysis", **John Wiley.**
3. **Fu. K. S.,** "Syntactic Methods In Pattern Recognition"**, Academic Press.**

Semester: III

Course Name: Web Technologies Lab **Course Code: MCA-LA-301**

Credits: **Max. Marks:**

Lab Activities

Note: The list for reference purpose only. Teacher may make modification if required.

Lab_Activity_1 Design a home page which will display your information, i.e. Bio data, using Image Link and File Link to upload images and necessary documents.

Lab_Activity_2 Create a HTML web page with the following:

A. To embed an image map in a webpage
B. To fix the hot spots
C. Show all the related information when the hot spots are clicked.

Lab_Activity_3

A. Create a webpage with HTML describing your department. Use paragraph and list tags.
B. Apply various colors to suitably distinguish key words. Also apply font styling like italics, underline and two other fonts to words you find appropriate. Also use header tags.
C. Create links on the words e.g. "Wi-Fi" and "LAN" to link them to Wikipedia pages.
D. Insert an image and create a link such that clicking on image takes user to other page.
E. Change the background color of the page. At the bottom create a link to take user to the top of the page.

Lab_Activity_4

A. Design a CSS to create menu.
B. Design a webpage i.e. Biodata using CSS.
C. WAP to create table and list using CSS.
D. To create a web page that displays college information using various Style sheets.
E. Write a program to Use different font, styles: In the style definition you define how each selector should work (font, color etc.). Then, in the body of your pages, you refer to these selectors to activate the styles.

Lab_Activity_5 Write a console application that obtains four int values from the user and displays the product.

Lab_Activity_6 If you have two integers stored in variables var1 and var2, what Boolean test can you perform to see if one or the other (but not both) is greater than 10?

Lab_Activity_7 Write an application that includes the logic from Exercise 6, obtains two numbers from the user, and displays them, but rejects any input where both numbers are greater than 10 and asks for two new numbers.

Lab_Activity_8 Write a console application that places double quotation marks around each word in a string.

Lab_Activity_9 Write an application that uses two command-line arguments to place values into a string and an integer variable, respectively. Then display these values.

Lab_Activity_10 Write an application that receives the following information from a set of students:

a. Student Id:
b. Student Name:
c. Course Name:
d. Date of Birth:

The application should also display the information of all the students once the data is entered. Implement this using an Array of Structures.

Lab_Activity_11 Write programs using conditional statements and loops:

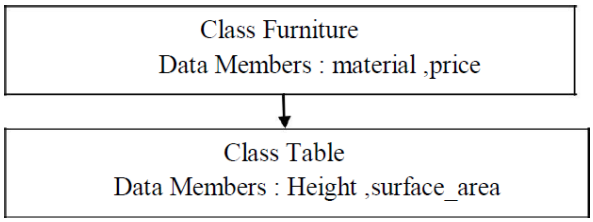
A. Generate Fibonacci series.
B. Generate various patterns (triangles, diamond and other patterns) with numbers.
C. Test for prime numbers.
D. Generate prime numbers.
E. Reverse a number and find sum of digits of a number.
F. Test for vowels.

Lab_Activity_12 Write a program to declare a class "staff" having data members as name and post. Accept this data for five staffs and display names of staff who are HOD.

Lab_Activity_13 Write a program to declare class "Distance" have data members dist1, dist2, dist3. Initialize the two data members using constructor and store their addition in third data member using function and display addition.

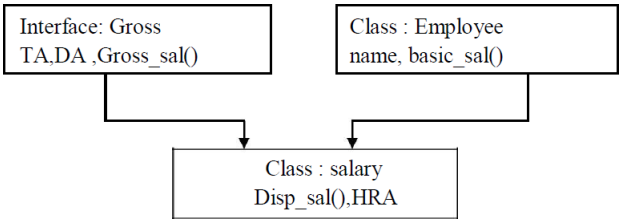
Lab_Activity_14 Write a program using function overloading to swap two integer numbers and swap two float numbers.

Lab_Activity_15 Write a program to implement single inheritance from following figure. Accept and display data for one table.



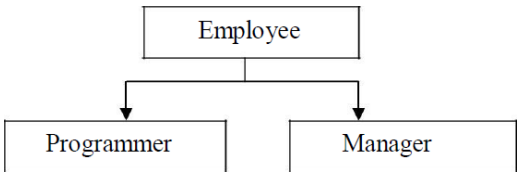
Lab_Activity_16 Define a class "salary" which will contain member variable Basic, TA, DA, HRA. Write a program using Constructor with default values for DA and HRA and calculate the salary of employee.

Lab_Activity_17 Program to implement the following multiple inheritance using

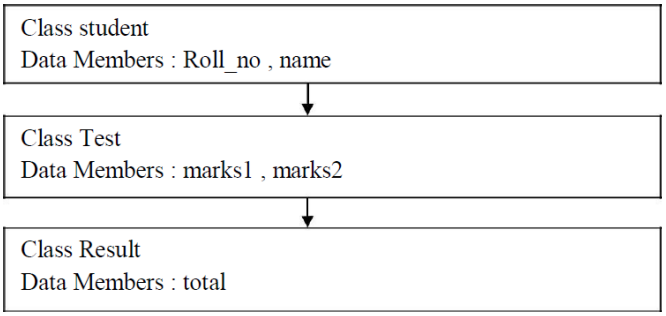


interface.

Lab_Activity_18 Write a program for above class hierarchy for the Employee where the base class is Employee and derived class and Programmer and Manager. Here make display function virtual which is common for all and which will display information of Programmer and Manager interactively.



Lab_Activity_19 Write a program to implement multilevel inheritance from following figure. Accept and display data for one student.



Lab_Activity_20 Write a program to create a delegate called TrafficDel and a class called TrafficSignal with the following delegate methods.

Public static void Yellow() { Console.WriteLine("Yellow Light Signal To Get Ready"); }

Public static void Green() { Console.WriteLine("Green Light Signal To Go"); }

Public static void Red() { Console.WriteLine("Red Light Signal To Stop"); }

Also include a method IdentifySignal() to initialize an array of delegate with the above methods and a method show() to invoke members of the above array.

Lab_Activity_21 Write a program to accept a number from the user and throw an exception if the number is not an even number.

Lab_Activity_22 Create an application that allows the user to enter a number in the textbox named "getnum". Check whether the number in the textbox "getnum" is palindrome or not. Print the message accordingly in the label control named lbldisplay when the user clicks on the button "check".

Lab_Activity_23 Create an application which will ask the user to input his name and a message, display the two items concatenated in a label, and change the format of the label using radio buttons and check boxes for selection, the user can make the label text bold, underlined or italic and change its color. Include buttons to display the message in the label, clear the text boxes and label and exit.

Lab_Activity_24 List of employees is available in listbox. Write an application to add selected or all records from listbox (assume multi-line property of textbox is true).

Lab_Activity_25 Create a project that calculates the total of fat, carbohydrate and protein. Allow the user to enter into text boxes. The grams of fat, grams of carbohydrate and grams of protein. Each gram of fat is 9 calories and protein or carbohydrate is 4 calories. Display the total calories of the current food item in a label. Use to other labels to display and accumulated some of calories and the count of items entered. The form food has 3 text boxes for the user to enter the grams for each category include label next to each text box indicating what the user is enter.

Lab_Activity_26 Create the application that accepts name, password, age, email id, and user id. All the information entry is compulsory. Password should be reconfirmed. Age should be within 21 to 30. Email id should be valid. User id should have at least a capital letter and digit as well as length should be between 7 and 20 characters.

Lab_Activity_27 Create a sample website for a bank and include types of navigation.

Lab_Activity_28 Create a Login Module which adds Username and Password in the database. Username in the database should be a primary key.

Lab_Activity_29 Create a web application to insert 3 records inside the SQL database table having following fields (DeptId, DeptName, EmpName, Salary). Update the salary for any one employee and increment it to 15% of the present salary. Perform delete operation on 1 row of the database table.

Lab_Activity_30 Create a web page to display the cricket score from the table event (id, name, score). Refresh the website automatically after every 30 seconds.

Semester-IV

Semester: IV

Course Name: Neural Networks and Deep Learning **Course Code: MCA-OE1-401**

Credits: 4 **Max. Marks:100**

Rationale:

The objective of the course is to acquaint the students with the general concept of neural networks and Deep Learning. The course shall include all the supervised and unsupervised techniques of neural networks and deep learning.

Unit-I **(15 Lectures)**
Introduction: Neuron as basic unit of neurobiology, McCulloch-Pitts model, Hebbian hypothesis; limitations of single-layered neural networks. Perceptrons, Gradient Descent, Backpropagation Activation functions in Neural Networks
Unit-II **(15 Lectures)**
Supervised Learning: Single-layered neural networks, perceptron rule, gradient descent algorithms; stochastic gradient descent, momentum, and adaptive sub-gradient method. multi-layered neural networks: first order methods, backpropagation algorithm, **Unsupervised Neural Networks techniques and their applications**
Unit-III **(15 Lectures)**
Introduction of Deep Learning: Historical context and motivation for deep learning; basic supervised classification task, regularizing a deep network, model exploration, and hyperparameter tuning, Activation function. **Convolution Neural Networks:** Introduction to convolution neural networks: layers of CNN stacking, striding and pooling, applications of CNN in image, and text classification .
Unit-IV **(15 Lectures)**
Sequence Modeling: Recurrent Nets: recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks **Autoencoders:** Undercomplete autoencoders, regularized autoencoders, sparse autoencoders, denoising autoencoders, representational power, layer, size, and depth of autoencoders, stochastic encoders and decoders.

Learning Outcomes:

On the successful completion of the course, students will

1) Learn about Neural Networks and Deep learning applications
2) Be able to implement and apply neural network algorithms to real-world applications.
3) Be able to identify and apply the appropriate NN and DN technique to classification, pattern recognition, optimization and decision problems.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text and Reference Books:

1. **Ian Goodfellow,** Deep Learning, **MIT Press**, 2016.
2. **Jeff Heaton**, Deep Learning and Neural Networks, **Heaton Research Inc**, 2015.
3. **Mindy L Hall,** Deep Learning, **VDM Verlag, 2011**
4. **Martin T. Hagan, Howard B. Demuth, Mark Beale, Orlando De Jesús,** "Neural Network design", **China Machine Press.**

Semester: III
Course Name: Blockchain Technologies **Course Code: MCA-OE1-402**
Credits: 4 **Max. Marks:100**
Rationale:
This course is intended to study the basics of Blockchain Technology. During this course learner will explore various aspects of Blockchain Technology like application in various domains. By implementing learner will have idea about private and public Blockchain and smart contracts

Unit-I **(15 Lectures)**
Introduction to Cryptography: Structure of cryptosystem – symmetric key cryptography – asymmetric key cryptography – types of attacks – authentication models – SHA-256 Hash algorithm – RSA algorithm – Elliptic Curve cryptography – Digital signature standards.
Unit-II **(15 Lectures)**
Basics of Blockchain concepts: Architecture – Properties of Blockchain – Distributed ledger – Merkle tree – structure of a block – Smart contract – Crowd funding – Transaction – Double spending – Block propagation
Unit-III **(15 Lectures)**
Types of Blockchain: Blockchain Components – Permissioned Blockchain – Permissionless Blockchain – Consortium Blockchain – Consensus – Proof of Work, Proof of Stack, Proof of Burn, Proof of Elapsed Time – Mining –
Unit-IV **(15 Lectures)**
Consensus Algorithms: PAXOS consensus Algorithm – RAFT consensus Algorithm – Byzantine general problem – Practical Byzantine fault tolerance Algorithm – Three phase commit Protocol.

Learning Outcomes:
On the successful completion of the course, students will be able to:

1. understand the technology components of Blockchain and how it works behind the scenes.
2. identify different approaches to developing decentralized applications.
3. understand public key cryptosystems and hashing.
4. explain how cryptocurrency works.
5. track alternative Blockchains and emerging trends in Blockchain

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.
Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 5 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with two sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt both sub-parts.
4) **Section B** will comprise of two long answer type questions (question number 2 to 3); each question will have an option. Thus, there will be two questions from each unit. In total, there will be four

questions in the section; two from each unit and a candidate will be asked to attempt two questions.

5) All short answer type questions will carry 5 marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 3 will carry equal marks of 12.5 marks

Text Books

1. **Chandramouli Subramanian, Asha A George, Abhilash K A, Meena Karthikeyan**, (2021) "Blockchain Technology", **University Press (India) Private Limited**
2. **Imran Bashir,** "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", **Packt Publishing**

Reference Books

1. **Andreas Antonopoulos, Satoshi Nakamoto (2014),** "Mastering Bitcoin", **O"Reilly**.
2. **Arshdeep Bahga, Vijay Madisetti**,(2017) "Blockchain Applications: A Hands-on Approach", **VPT**
3. **Lorne Lantz, Daniel Cawrey (2020)**, "Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications (Grayscale Indian Edition)", **OREILLY**

Semester: IV

Course Name: Computer Vision **Course Code: MCA-OE1-403**

Credits: 4 **Max. Marks:100**

Rationale:

The objective of the course is to acquaint the students with the general concept of Computer Vision like image formation, image model, imaging geometry etc. The course shall discuss image processing techniques including representation of two dimensional and three dimensional geometric structures.

Unit-I **(15 Lectures)**
Computer vision issues: Achieving simple vision goals, high-level and low-level capabilities, arrange of representations, the role of computers, computer vision research and applications, image formation, image model , image functions, imaging geometry, reflectance, spatial properties, color digital images , imaging devices for computer vision ,photographic imaging, sensing range ,reconstruction imaging
Unit-II **(15 Lectures)**
Early Processing : Recovering Intrinsic Structure, Filtering the Image, Finding Local Edges, Range Information from Geometry, Surface Orientation from Reflectance Models, Optical Flow , Resolution Pyramids , Boundary Detection, On Associating Edge Elements, Approximate Location, The Hough Method for Curve Detection, Edge Following as Graph Searching - Edge Following as Dynamic Programming ,Contour Following
Unit-III **(15 Lectures)**
Region Growing, Regions, a local technique: blob coloring, global techniques: region growing via thresholding, splitting and merging, texture, structural models of texel placement, texture as a pattern recognition problem, the texture gradient**.** Motion, Motion Understanding , Understanding Optical Flow , Understanding Image Sequences, Representation of Two-Dimensional Geometric Structures, Two-Dimensional Geometric Structures , Boundary Representations ,Region Representations, Simple Shape Properties
Unit-IV **(15 Lectures)**
Representations of Three-Dimensional Structures: Solids and their Representation, Surface Representations, Generalized Cylinder Representations, Volumetric Representations, Understanding Line Drawings, Knowledge Representation and Use, Representations, Semantic Nets, Semantic Net Examples, Control Issues in Complex Vision Systems

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the role of computers in computer vision research and applications
2. understand the basic concept of image formation, image model, image functions, imaging geometry etc.
3. apply basic image processing techniques like filtering, local edge finding, boundary detection etc.
4. understand the region growing techniques
5. understand the idea of two dimensional three dimensional representation

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

6) There will be two sections A and B.
7) There will be 9 questions in all.
8) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
9) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
10) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Text and Reference Books:

5. **Dana Harry Ballard, Christopher M. Brown,** "Computer vision"**, Prentice-Hall**
6. **Richard Szeliski,** "Computer Vision: Algorithms and Applications", **Springer, 2011**
7. **Pedram Azad, Tilo Gockel, R. Dillmann,** "Computer Vision: Principles and Practice", **Elektor Electronics Publishing**

Semester: IV

Course Name: Internet of Things **Course Code: MCA-OE2-401**

Credits: 4 **Max. Marks:100**

Rationale:

The main objective of this course is to make student familiar with the concepts of Internet of Things and existing technologies based on it. It will provide the way to identify the problems which might be solved by IoT with feasible solution.

Unit-I **(15 Lectures)**
Introduction and Concepts: Components of Internet of Things (IoT), Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates. **IoT Architecture:** Reference Model, SOA-Based, API-Based **IoT Devices & Objects:** Transducers, Actuators, Sensors, Smart Objects, Embedded Devices, Arduino, Raspberry Pi, RFID.
Unit-II **(15 Lectures)**
Introduction Communication Technologies: M2M, D2D, D2Gateway, Difference between IoT &M2M. **Introduction to Computing Technologies:** Edge Computing, Fog Computing, Cloud Computing with respect to IoT **Introduction to Protocols:** IoT Protocol Stack, IPv6. **Application Layer Protocols:** CoAP, MQTT, XMPP, AMQP. **Data Link Protocols:** IEEE 802.15.4e, IEEE 802.11 ah, Bluetooth Low Energy, Zigbee, LoRaWAN.
Unit-III **(15 Lectures)**
Network Layer Routing/Encapsulation Protocols: RPL, CORPL, CARP, 6LoWPAN. **Session Layer Protocols:** MQTT, SMQTT, AMQP, CoAP, XMPP **Introduction of IoT Privacy and Security:** Concept, Threats & Attacks on Different Layers, Security Models, Privacy Preserving Techniques used in IoT **Security in IoT Protocols:** MAC 802.15.4: 6LoWPAN, RPL, Application Layer
Unit-IV **(15 Lectures)**
Data Analytics in IoT: Data Acquiring, Organizing, Processing & Analytics, Concept of Apache Hadoop, Apache Spark, Apache Oozie, Apache Storm **Applications of IoT:** Smart Cities, Home Automation, Health, Industry, Energy, Environment, Retail, Logistics, Agriculture, Life Style

Learning Outcomes:

On the successful completion of the course, students will be able to

1. understand the concept of basic concepts of Internet of Things.
2. grasp the knowledge on enabling technologies of IoT.
3. understand machine to machine communication systems.
4. analyse the real life problems for providing technology based solution.
5. identify the problems for providing technology based solutions and have skills on the Design of IoT based Applications.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Textbooks:

1. **Bahga, A ,Madisetti, V (2015)**, "Internet of Things-A Hands-on Approach", **Universities Press (India).**
2. **Buyyaand, R, Dastjerdi,A.V(2016) ,** "Internet of Things: Principles and Pradigms", **Cloud Computing and Distributed Systems (Clouds)** Laboratory, ManjaSoft Pvt Ltd., Australia.
3. **FeiHu**,"Security and Privacy in Internet of Things (IoTs) Models, Algorithms and Implementations", **CRC Press.**

References:

1. **Kellmereit. D, Obodovski. D (2013)** ," The Silent Intelligent-The Internet of Things", Published by **DND Ventures LLC, 1st Edition**.
2. **Hersent. O, Boswarthick . D, Elloumi . O (2017),"**The Internet of Things Key Applications and Protocols", Published by **Wiley, Reprint**

Semester: IV

Course Name: Cryptography & Network Security Course Code: MCA-OE2-402

Credits: 4 Max. Marks:100

Rationale:

The course is designed to acquaint the students about security of computer networks when data is transmitting from source to destination and vice versa. Students might be able to apply the cryptographic techniques (protocols) to ensure the network security.

Unit-I **(15 Lectures)**
Introduction to concept of security: Need for security, Security approaches (security models, security management practices), Principles of security. **Cryptographic Techniques-I**: Introduction, Plain text, Cipher text, Substitution techniques, Transposition techniques, Encryption, Decryption, Symmetric Key Cryptography (overview of DES), Steganography, Key range, Key size, Possible types of attacks.
Unit-II **(15 Lectures)**
Cryptographic Techniques-II: Asymmetric key Cryptography (Overview), RSA algorithm, Digital signatures, Overview of Knapsack algorithm, Public Key Infrastructure (PKI), Digital Certificates, Private Key Management, PKIX Model.
Unit-III **(15 Lectures)**
Internet Security Protocols: Basic Concepts, Secure Socket Layer(SSL), Secure Hyper Text Transfer Protocol (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), Electronic Money, Email Security, Wireless Application Protocol (WAP) Security
Unit-IV **(15 Lectures)**
Network Security & Authentication: User Authentication Mechanism & Network Security, Authentication Basics, Passwords, Authentication Tokens, Certificate based Authentication, Biometric Authentication, Kerberos, Firewalls, IP Security, Virtual Private Networks.

Learning Outcomes:

On the successful completion of the course, students will be able to

1. get an insight about the various security principles and issues in the computer networks. The students will get the knowledge about various types of attacks that are possible in the world of Internet.
2. learn various encryption and decryption techniques for ensuring the data security.

3. learn about various Asymmetric key cryptographic techniques, knapsack algorithms and various strategies to manage the public and private keys.
4. get familiar with basic concepts about incorporating Internet Security via various mechanisms and protocols like SSL, TLS, etc. The students will learn how to ensure email security by PGP and various other similar protocols.
5. understand various user authentication mechanisms (biometric, certificate-based, etc) and will be able to learn about various other Network security mechanisms.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Textbooks:

1. **Atul Kahate,** "Cryptography and Network Security", **TMH**.

References:

1. **William Stallings**, "Cryptography and Network Security: Principles and Practices," **PHI**.
2. **Bragg, R and Rhodes, M (2004)**,"Network Security: The Complete Reference", **TMH.**
3. **Maiwald, E (2004)**, "Fundamentals of Network Security", **Dreamtech Press.**

Semester: IV

Course Name: Virtualization and Cloud Computing Course Code: MCA-OE2-403

Credits: 4 Max. Marks:100

Rationale:

The course is designed to acquaint the students about the basic concept of virtualization technology and cloud computing. A detailed overview of cloud computing is included beginning from the basic concepts of cloud computing, cloud service models, cloud computing services and cloud security management issues.

Unit-I **(15 Lectures)**
Overview of Virtualization: Basics of Virtualization, Virtualization and Cloud Computing, Need of Virtualization, Virtualization Types Application Virtualization Desktop Virtualization, Network Virtualization, Storage Virtualization, System-level or Operating System Virtualization, Server Virtualization: Understanding Server Virtualization, Types of Server Virtualization - Virtualization Advantages.
Unit-II **(15 Lectures)**
Virtual Machine Basics - Types of Virtual Machines, Resource Virtualization: Processor Memory Input/Output Hypervisor Concepts and Types Case Study: VMWare Xen - KVM. **Understanding Cloud Computing:** Cloud Computing - Definition and Characteristics - History of Cloud Computing - Cloud Architecture - Benefits and Challenges of Cloud Computing - Cloud Deployment models: private cloud - public cloud - hybrid cloud
Unit-III **(15 Lectures)**
Cloud Service Models: Software-as-a-Service, Understanding SaaS , Architecture of SaaS Platform-as-a-Service, Understanding PaaS, Architecture of PaaS, Infrastructure-as-a-Service, Understanding IaaS, Architecture of IaaS, Developing and Deploying applications using Google App Engine, Creating instances in Amazon EC2, Deploying and Accessing Applications in Amazon EC2.
Unit-IV **(15 Lectures)**
Cloud Security and Trust Management: Privacy and Security in Cloud, Security Service Boundary, Securing Data, Encryption, Data Integrity and Auditing, Identity Management and Access Control, Trusted Computing, Cloud Storage Services: Create and manage Amazon S3 instances, Upload files to S3 after applying proper security mechanisms to ensure data confidentiality and integrity

Learning Outcomes:

On the successful completion of the course, students will be able to

1. Analyse the trade-offs between deploying applications in the cloud and over the local infrastructure
2. Describe various service delivery models of cloud computing architecture
3. Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services and Google AppEngine.
4. Describe the virtualization technology behind the working of cloud computing.
5. Identify security and privacy issues in cloud computing and devise appropriate security solutions for protecting cloud resources.

Note for Paper Setting:

There will be internal examinations (Assignments, Tests and Presentations) of 30% marks in each semester. End-semester examination will be of the rest 70% marks in each semester.

Question paper pattern for external exam

1) There will be two sections A and B.
2) There will be 9 questions in all.
3) **Section A** will carry one compulsory question (question no 1) with four sub-parts (consisting of short answer type questions). Each sub-part (short answer type question) will be from each unit and a student will have to attempt all the four sub-parts.
4) **Section B** will comprise of four long answer type questions (question number 2 to 5); each question will have an option. Thus, there will be two questions from each unit. In total, there will be eight questions in the section; two from each unit and a candidate will be asked to attempt four questions.
5) All short answer type questions will carry 3½ marks each. Thus, question No 1 will carry weightage of 10 marks. Whereas, each question from no 2 to 5 will carry equal marks of 14 marks

Textbooks:

1. **George Reese (2019),** "Cloud Application Architectures", **1st Edition, O'Reilly**

2. **James E. Smith and Ravi Nair (2017)**, "Virtual Machines: Versatile Platforms for Systems and Processes", **1st Edition, Elsevier**.

References:

2. **Barrie Sosinsky (2012)**, "Cloud Computing Bible", **Wiley India Pvt. Ltd**., 2012
3. **William von Hagen (2008)**, "Professional Xen Virtualization", **Wrox Publications**
4. **Danielle Ruest and Nelson Ruest (2009)**, "Virtualization: A Beginner's Guide", **Tata McGraw Hill**, 2009
5. **Tim Mather, Subra Kumaraswamy, Shahed Latif (2009)**, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", **O'Reilly Media**

Semester: IV

Course Name: Major Project **Course Code: MCA-LA-401**

Credits: 12 **Max. Marks: 300**

Major Project Work	**12 Credits**

Evaluation Breakup of Major Project Work

S.No	Major project in	Internal	External
1	Industry	40% of the Credit to be evaluated by the industry	60% to be evaluated by the External Examiner
2	Department	40% credit as Mid-term evaluation by the Department	60% to be evaluated by the External Examiner