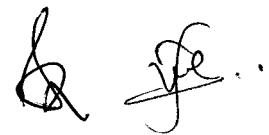# MASTER OF COMPUTER APPLICATIONS (2 Years) 2022-2024

SCHEME OF TEACHING AND EXAMINATIONS

FIRST SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA101	Object Oriented Programming With 'C++'	3	2	-	4	100	25	-	125	40	15	-	55
MCA102	Relational Database Management Systems	3	2	-	4	100	25	-	125	40	15	-	55
MCA103	Operating System with Case Study of Linux	3	2	-	4	100	25	-	125	40	15	-	55
MCA104	Computer System Architecture	3	2	-	4	100	25	-	125	40	15	-	55
MCA105	Software Engineering	3	2	-	4	100	25	-	125	40	15	-	55
MCA106	Lab-1 : Programming in C++	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA107	Lab-II : Programming in SQL/PL-SQL	-	-	2	1	-	50	50	100	-	30	25	55
MCA108	Lab-III : Programming in Linux	-	-	2	1	-	50	50	100	-	30	25	55
MCA109	Personality Development / Mock Interviews	-	-	2	1	-	25	-	25	-	15	-	15
	TOTAL	15	10	12	26	500	300	200	**1000**	200	180	100	**480**

FIRST SEMESTER
Object Oriented Programming with 'C++ '
Subject Code - MCA101

Max Marks : 100   **Min Marks : 40**

Course Outcomes

- Student will understand the basic terminology used in computer programming and will be able to design programs involving decision structures, loops and functions.
- Student will understand the dynamics of memory by the use of pointers, understand different data structures and create/update basic data files.
- Skills - At the end of the course, a student will be able to :
  a) Analyse a simple programming problem specification.
  b) Design a high-level (programming language independent) solution to the problem using functional abstraction and general imperative programming language constructs. Write, compile, execute and debug a C++ program which maps the high-level design onto concrete C++ programming constructs

Syllabus

UNIT - I: Language Fundamental
Overview of OOP: The Object Oriented paradigm, Basic concepts of OOP, Benefits of OOP, Object oriented languages, Application of OOP **Overview of C++:** History of C++, **Data Types:** Built-in data types, User-defined data types, Derived data types. **Constants and Variables:** symbolic constants, Dynamic initialization of variable, Reference variable. Operators in C++.**Control Structures:** if-else, nested if-else, while, do-while, for, break, continue, switch, goto statement.

UNIT - II: Structure & Function
Structures: A Simple structure, defining a structure variable, Accessing structures member, Enumeration data type. **Function:** Function Declaration, Calling Function, Function Definition, **Passing Arguments to function:** Passing Constant, Passing Value, Reference Argument, Structure as argument, Default Argument. **Returning values from function:** return statement, Returning structure variable, Return by reference. Overloaded Functions, Inline Functions and Templates.

UNIT - III: Object Classes and Inheritance
Object and Class, Defining the class and its member, Making an outside function inline, nesting of member function, array as class member, structure and classes. **Memory allocation:** memory allocation for objects, new and delete operator, static datamember, static member functions, object as function argument. **Constructor & Destructor:** Null and default constructor. Parameterized constructor, Constructor with default argument, copy constructor, class destructors, **Inheritance:** Introduction to inheritance, Types of inheritance, function overriding, Constructor in Derived class. **Access specifiers:** public, private, protected.

UNIT - IV: Pointers, Virtual Function and Operator Overloading
Pointers: Introduction, & and * operator, pointer to object, this pointer, pointer to derived class. **Dynamic polymorphism:** Virtual function, Pure Virtual Function, Abstract class. **Static Polymorphism:** Operator keyword, overloading unary operator (++ (pre increment and post increment),--) using operator function, overloading binary operators (+,-,==,>=,<=, +=,<,>,[]), Friend function, Friend class, overloading binary operators using friend function.

UNIT - V: File & Stream
File and Stream: C++ Stream class, unformatted I/O operations, formatted console I/O, manipulators, opening and closing a file, detecting eof, file modes, get(), put(),reading and writing a class object, Updating a file random access.

RECOMMENDED BOOKS:
1. **C++: The Complete Reference,** *Herbert Schildt,* Tata McGraw-Hill
2. **Object Oriented Programming with C++,** *E. Balagurusamy,* Tata McGraw-Hill
3. **The C++ Programming Language,** *BjarneStroustrup,* Addison-Wesley.
4. **Object Oriented Programming in C++,***RobertLafore,* Galgotia Publications.
5. **Introduction to Object Oriented Programming,** *K V Witt,* Galgotia Publications.
6. **Object Oriented Programming,** *G Blaschek,* Springer Verlag
7. **Object Data Management ,***RCattel,* Addison Wesley.

Relational Database Management Systems
Subject Code - MCA102

Max Marks : 100   **Min Marks : 40**

- Students will be able to design a database based on the given requirements.
- Students will be able to make Database oriented application with knowledge of subject provided to them.
- Students get the knowledge about Standard Query Language statements, PL/SQL, Query processing and optimization.
- Students are expected to apply normalization techniques on given database.
- RDBMS are the basic building blocks of data warehousing, mining, Big Data Analytics, cloud computing etc.

Syllabus

UNIT - I: Overview of Database Management
Data, Information and knowledge, Importance of database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases, Client/Server databases, Object-oriented databases, Object-relational databases, Introduction to ODBC concept.

UNIT - II: ER Model & Relational Algebra
Entity - Relationship model as a tool for conceptual design- entities, attributes and relationships. ER diagrams; Concept of keys; Case studies of ER modeling Generalization; specialization and aggregation. Converting an ER model into relational Schema. Extended ER features.
Relational Algebra: select, project, cross product, different types of joins (inner join, outer joins, self-join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra, stand alone and embedded query languages.

UNIT - III: Normalization
Introduction, Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce-Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF.Issues in physical design; Concepts of indexes, Denormalization. Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Security & Authorization in SQL.

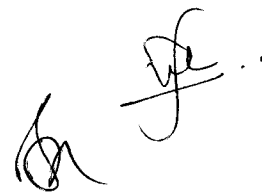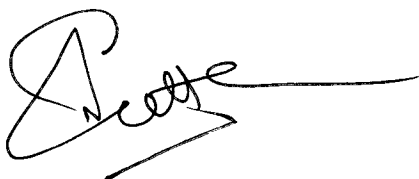### UNIT - IV: SQL and Relational Database Design
Introduction to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING...
ORDERBY....), CREATE, INSERT, DELETE, UPDATE, ALTER, LIKE, DROP, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references. Transaction control commands –grant, privileges, commit, Rollback, Savepoint.

UNIT - V: PL/SQL
Introduction to PL/SQL variables – literals – data types – advantages of PL/SQL; Control statements : if ; iterative control – loop, while, for, goto ; exit when; Cursors : Types –implicit, explicit – parameterized cursors – cursor attributes; Exceptions: Types – internal , user-defined , handling exceptions – raise statement; Triggers; PL/SQL tables and records: Declaring PL/SQL tables - referring PL/SQL tables, inserting and fetching rows using PL/SQL table, deleting rows; records - declaration of records - deleting records; Sub programs: Functions -procedures - in, out, inout parameters; purity functions - packages - package specification -advantages of packages - private and public items - cursors in packages.

BOOKS RECOMMENDED:
1. **Database System Concept:** *A. Silberschatz , H.F. Korth and S. Sudarshan*, TMH
2. **Fundamentals of Database Systems:** *Elmasri&Nawathe*, Pearson Education
3. **An Introduction to Database Systems:** *C. J. Date*, AWL Publishing Company
4. **SQL, PL/SQL:** *Ivan Bayross*, BPB Publication
5. **An Introduction to database systems:** *Bipin Desai*, Galgotia Publication.
6. **Database Management System:** *A. K. Majumdar&P.Bhattacharya*, TMH

Operating System with Case Study of Linux
Subject Code – MCA103

Max. Marks: 100   Min Marks : 40

Course Outcomes

- Student will come to know the basics of how does operating system work.
- They will inculcate knowledge of basic functions of operating system like memory management, disk scheduling etc.
- They develop critical thinking to manage processes and learn managing hardware and software both.
- As Linux is open source software student can make their own experimental process and add functionality in it. It enhances the understanding of coding and implementation of any software.

Syllabus

UNIT - I: Introduction
Defining operating system, History and Evolution of operating system, Dual mode operation in operating system . **Basic Concepts**: batch processing, spooling, multiprogramming, multiprocessor system, time sharing, real time systems, Functions and Goals of operating system, Operating system as resource manager, Operating system as an abstract machine.

UNIT - II: Process Management
Process concept, Process Control Block, **Process State**: State Transition Diagram, **Scheduling Queues**: Queuing Diagram, Types of schedulers-context switching and dispatcher, various types of CPU scheduling algorithms and their evaluation, multilevel queues and multilevel feedback queues, Thread life cycle, multithreading.

UNIT - III: IPC and Dead Locks
Inter Process Communication: competing and co-operating processes, Introduction to concurrent processing, Precedence graphs, Critical section problem, Semaphore concept, Study of classical process synchronization problems: Producer–Consumer, Dining Philosophers. **Deadlocks**: The dead lock problem, dead lock definition, **Deadlock Characterization**: necessary condition, resource allocation graph, **Deadlocks handling**: Deadlock prevention, Deadlock avoidance, Banker's algorithm, Deadlock detection, Recovery from Deadlock.
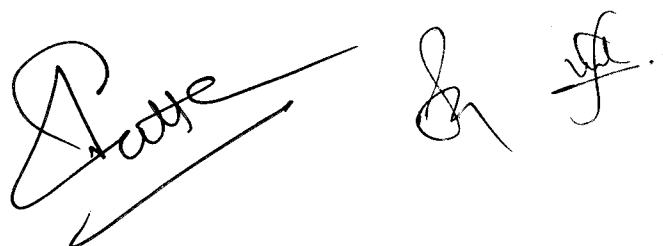
UNIT - IV: Memory Management
Preliminaries of memory management, Contiguous memory allocation, partitioned allocation MFT, fragmentation, MVT, partition allocation policies, compaction, Non-Contiguous memory allocation, Paging, Structure of page table, Segmentation, **Virtual Memory**: Concepts, demand paging, Swapping, **Page replacement policies**: FIFO, Optimal, LRU, MRU, Thrashing. **Secondary Storage**: Hierarchy, physical characteristics, evaluation of disk access time and data transfer rate, **Scheduling algorithms**: FCFS, SCAN etc.

UNIT – V: File and Device Management
File concept: file types, file directory maintenance, File sharing, Basic file system structure, access methods-sequential and direct access, free space management contiguous, linked allocation and indexed allocation and their performances. **Protection and Security**: principle of protection, domain structure, access matrix, access control, the security problems. **Distributed systems:** Introduction& Features, Types of distributed OS.

BOOKS RECOMMENDED:
1. **Operating System Concepts**, *Abraham Silberschatz, Peter B. Galvin and Greg Gagne,* Wiley India
2. **Modern Operating System**, *Andrew .S. Tanenbaum,* PHI
3. **Operating System Concepts**, *James L. Peterson and Abraham Silberschatz,* Addison-Wesley
4. **Operating System Concepts & Design**, *Milan Milenkovic,* MGH
5. **An Introduction to Operating Systems**, *Harvey M. Dietel,* Addison Wesley

Computer System Architecture
Subject Code - MCA104

Max Marks : 100   **Min Marks : 40**

Course Outcomes

- Student develops an intuitive knowledge of circuitry design of electronic components.
- Students will be able to understand the overall internal architecture of computer in detail and also the digital representation of data in a computer system
- Understand the general concepts in digital logic design, including logic elements and their use in combinational and sequential logic circuit design.
- Understand computer arithmetic formulate and solve problems, understand the performance requirements of systems.

Syllabus

UNIT – I Representation of Information and H/w component:
Number system (decimal, BCD, octal, hexadecimal) and conversions, r and r-1's complement, Fixed and Floating point representation, Binary codes: Excess-3, ASCII, EBCDIC, Error detection codes. Boolean Algebra, Map simplification K-Map, Logic Gates, **Combinational Circuit:** Half and Full Adder, Decoder and Multiplexer; **Sequential Circuit:** Flip-Flop (SR, D, JK, Master-Slave, T), 4 bit Register, Register with parallel load, Shift register, Binary ripple Counter, Binary synchronous counter.

UNIT – II Register transfer language and micro operations
Register Transfer Language (RTL), Concepts of bus, Bus and Memory transfers, **Micro-operation:** Arithmetic, Logic and Shift micro operation, Instruction code, Computer registers, Computer instructions, Timing and control, Instruction Cycle and Interrupt Cycle, Memory reference instructions, Input-output and interrupt, Design of basic computer.

UNIT – III Programming Computers and CPU
Machine Language, Assembly Language, Assembler, Program Loops, Input /Output, Programming, General register organization, Stack organization, Instruction format, Addressing modes, Data transfer and manipulation language, Micro-programmed and Hardwired control, RISC Vs. CISC, **Pipelining in CPU design:**, Parallel Processing ,Arithmetic and RISC pipelining.
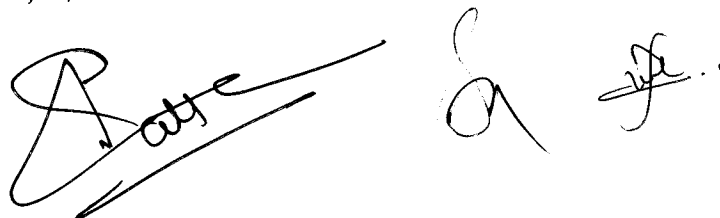
UNIT – IV Computer Arithmetic and I/O Techniques: Addition, Subtraction, Division and Multiplication Algorithm, Input-Output Interface, asynchronous data transfer; **Modes of transfer:** Programmed I/O, Interrupt Mechanism, Direct Memory Access (DMA), I/O Processor.

UNIT – V Memory Organization
Memory hierarchy: Static and Dynamic RAM, ROM; Building large memory using chips, Associative memory: associative mapping, direct mapping, set associative mapping; cache memory organization, virtual memory.

BOOKS RECOMMENDED:

1. **Computer System Architecture,***Morris Mano*, PHI
2. **Computer Organization and Architecture,** *William Stalling,* PHI
3. **Computer organization and Architecture,** *J.P.Hayes*, TMH
4. **Digital Computer Logic Design,** *Morris Mano,* PHI
5. **Fundamentals of Microprocessors,***B. Ram*
6. **Computer System Architecture and organization,***Dr.M. Usha,T. S. Shrikant,*Wiley publication.
7. **Digital Computer Electronics,***Malvino.*
8. **Structured Computer Organization,***Andrew M. Tanenbanm,* PHI
9. **Modern Digital Electronics,***R.P.Jain,* Tata McGrawHill

Software Engineering
Subject Code - MCA105

Max Marks : 100   **Min Marks : 40**

Course Outcomes

- The student will have a fair idea about the importance of using software engineering principles in real life projects and also be able to pick an appropriate software development model for developing systems
- The student will be able to prepare software requirement sheet for a real life project, keeping in mind the properties of an SRS document
- The student will be able to use mathematical models for calculating the size, cost and duration of real life projects
- The student will be able to test the developed system using different testing techniques.
- Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.

Syllabus

UNIT – I Software Engineering Fundamentals:
Introduction to Software Engineering; Software Engineering Principles(Layers); Software Process – Process Framework, Umbrella Activities, Process Adaptation; Software Crisis; Process Models-Waterfall Model, Prototype Model, Incremental Model, Spiral Model, RAD Model; Agile Process.

UNIT – II Software Analysis and Design:
Requirement Engineering; Analysis Model-Data Flow Diagram, Data Dictionary, E-R Diagram, Decision Table; Software Requirements Specification(SRS), Structure of SRS; Pseudo code; Software Design; Design Process; Design Concepts-Abstraction, Partitioning, Modularity, Information Hiding, Refinement, Refactoring; Function Oriented Design; Object Oriented Design; Cohesion and Coupling.

UNIT – IIISoftware Quality and Case Tools:
Software Metrics, Categories of Metrics, Function Point Metric; Software Quality; McCall's Quality Factors; Software Maturity Model-CMM,CMMI; Software Quality Assurance; ISO Standards-9000, 9001 and 9126; Software Reliability; Case Tools and its Scope; Case Objectives; Architecture of Case Tools; Case Classification.
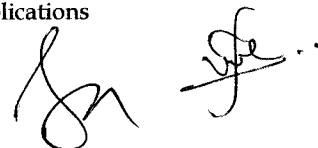
UNIT – IVCoding and Testing:
Programming Style; Structured Programming; Coding Standard; Internal Documentation; Software Testing-Verification and Validation; Alpha and Beta Testing; Levels of Testing-Unit, Integration and System Testing; Testing Techniques- White Box, Black Box; Cyclomatic Complexity; Test Plan; Debugging-Debugging Process, Debugging Strategies(Approaches).

UNIT – VSoftware Maintenance and Project Management:
Risk Management – Software Risk, Risk Identification; Introduction to Software Maintenance, Categories of Maintenance; Belady and Lehman Model; Boehm Model; Project Management Concept – People, Product, Process, Project; Software Team; Software Project Planning; Software Project Estimation; Cost Estimation Model(COCOMO, COCOMO II, Putnam-SLIM, Walston and Felix); Software Reengineering.

RECOMENDED BOOKS:

1. **Software Engineering: A Practitioner's Approach**, *Roger S. Pressman*, TMH
2. **An Integrated approach to Software Engineering**, *PankajJalote*, Narosa Publications
3. **Software Engineering**, *Bharat Bhushan Agarwal.*

MASTER OF COMPUTER APPLICATIONS (2 Years) 2022-2024

SCHEME OF TEACHING AND EXAMINATIONS

SECOND SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA201	Programming in Python	3	2	-	4	100	25	-	125	40	15	-	55
MCA202	JAVA Programming	3	2	-	4	100	25	-	125	40	15	-	55
MCA203	Data Structure and Algorithms	3	2	-	4	100	25	-	125	40	15	-	55
MCA204	Elective – I	3	2	-	4	100	25	-	125	40	15	-	55
MCA205	Elective – II	3	2	-	4	100	25	-	125	40	15	-	55
MCA206	Lab-IV : Programming in Python	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA207	Lab-V : Programming in JAVA	-	-	2	1	-	50	50	100	-	30	25	55
MCA208	Lab-VI : Programming Based on MCA203	-	-	2	1	-	50	50	100	-	30	25	55
MCA209	Group Discussion	-	-	2	1	-	25	-	25	-	15	-	15
	TOTAL	15	10	12	26	500	300	200	**1000**	200	180	100	**480**

S.No	Elective -I	Elective -II
1.	Theory of Computations	Data Ware Housing And Mining
2.	Advanced Computer Architecture	Internet of Things
3.	Computer Graphics	Mobile Computing

Programming in Python
Subject Code - MCA201

Max. Marks: 100   **Min Marks : 40**

At the end of course student will understand
- To understand why Python is a useful scripting language for developers and learn how to design and program Python applications.
- To learn how to use lists, tuples, dictionaries, indexing and slicing to access data in Python programs.
- To define the structure and components, how to write loops, decision statements, functions and pass arguments of a Python program.
- To learn how to build and package Python modules for reusability.

Syllabus

UNIT – I
Introduction to Python Programming: What is a Program, Formal and Natural Languages, Why use Python, Uses of python, Strengths & Drawbacks, The Python Interpreter, Running Python, The IDLE User Interface, The Interactive Prompt, Script Mode, Dynamic Typing , Debugging. Types, Operators, Expressions & Statements: Values and Types, Assignment Statement, Variable Names, Expressions & Statements, Order of Operations, String Operations, Comments.

UNIT – II
Conditionals: Boolean Expressions, Logical operators, Conditional & Alternative Execution, Chained and Nested Conditions. Iterations: Reassignment, Updating Variables, The "for" and "while" statements, break. Strings: String is a sequence, len, Traversal with a for loop, String Slices, Searching, Looping and Counting, String Methods, the "in" operator, String Comparison.

UNIT – III
Lists: List is a Sequence, Traversing and other Operations, List Slices, List Methods, Map Filter and Reduce, Deleting Elements, Lists and Strings, Objects and Values, Aliasing, List Arguments. Dictionaries: A Mapping and as a Collection of Counters, Looping and Dictionaries, Reverse Lookup, Dictionaries and Lists, Memos, Global Variables. Tuples: Tuple Assignments, Tuples as Return Values, Variable Length Argument Tuples, Lists and Tuples, Dictionaries and Tuples, Sequence of Sequences.
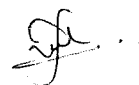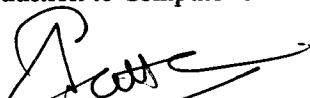
UNIT – IV
Functions: Function Calls, Math Functions, Composition, Adding New Functions, Definitions & Uses, Flow of Execution, Parameters and Arguments, Why Functions, Stack Diagrams, Void and Fruitful Functions, Return Values, Incremental Development, Composition, Boolean Functions, Checking Types. Recursion: Stack Diagram for Recursive Functions, Infinite Recursion, Taking Input from Keyboard, More Recursion. Catching Exceptions

UNIT – V
Files: Files & Persistence, Reading and Writing, Filenames and Paths. Object-Oriented Programming: Programmer defined Types, Attributes, Instances as Return Values, Classes and Functions, Classes and Methods, Inheritance and Polymorphism. **Graphics programming**: Drawing with turtle graphics, using turtle module, moving the turtle with any direction, moving turtle to any location, the color, bgcolor, circle and speed method of turtle, drawing with colors, drawing basic shapes using iterations.

BOOKS RECOMMENDED:

1. **Learning Python** 5th Edition, *Mark Lutz*, O'Reilly Publications
2. **Core Python Programming**, *R. NageshwaraRao*, Dreamtech Publications
3. **Think Python** 2nd Edition, *Allen B. Downey*, O'Reilly Publications
4. **Beginning Python: Using Python 2.6 and Python 3.1**, *James Payne*, Wiley
5. **Python Essentials Reference**, 4th Edition, *David M. Beazley*, Addison – Wesley
6. **Practical Programming: An Introduction to Computer Science Using Python 3**, *Paul Gries et al.*, Pragmatic Programmers

JAVA Programming
Subject Code – MCA202

Max. Marks: 100   **Min Marks : 40**

Course Outcomes

- Use an appropriate programming environment to design, code, compile, run and debug computer programs.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Understand the basic principles of creating Java applications with graphical user interface (GUI).
- Student will be able to write a computer program to solve specified problems as well as make Business and research applications.
- Students will be able to write and test applets for potential inclusion in web pages and also will be able to understand the use of APIs in robust, enterprise three level application developments.
- Students will be able to understand the Java features for secure communications over the internet.

Syllabus

UNIT - I: Introduction to Java Programming
An overview of Java: Object Oriented Programming, Features of Java, Java Virtual Machine, Java Environment: Java Development Kit, Java Standard Library, Data Types, **Variables:** Declaring a variable, Dynamic Initialization, The scope and life time of variable, Type conversion and Casting: Narrowing and Widening Conversions, Numeric Promotions, Type Conversion Contexts; **Operators:** Arithmetic Operators, Relational Operators, Logical Operators, Bit wise Operators, Conditional Operators, new operator, [ ] and instance of operator. **Control Statements:** Java's Selection statement, Iteration Statement, Jump Statement. **Arrays:** Declaring Array variables, constructing an Array, Initializing an Array, Multidimensional Arrays, Anonymous Arrays.

UNIT - II: Define the Class and interface
Introducing Classes: Class Fundamentals, Declaring Object, Assigning Object Reference Variables, Defining **Methods:** method overloading and overriding, Using objects as parameter, Constructors, Garbage collection, finalize () method. **Inheritance:** Inheritance basic, method overloading, object reference this and super, Chaining constructor using this () and super (), Member accessibility modifier: public, protected, default accessibility of member, private protected, private, **Package:** Define package, CLASSPATH, importing package, Interface: Define an interface, implementing interface, extending interface, variable in interface, **Overview of nested class:** Top level nested class and interface, Non static inner class, Local class, Anonymous class.

UNIT - III: Exception handling and Multithreading
Exception Handling: Exception types, Uncaught Exception, Using try and catch, multiple catch, nested try block, throw, throws, and finally. **Multithreading:** Creating Thread, Thread Priority, Synchronization, Thread Scheduler, Running & Yielding, Sleeping & Waking Up, Waiting & Notifying, Suspending & Resuming; miscellaneous methods in thread class.
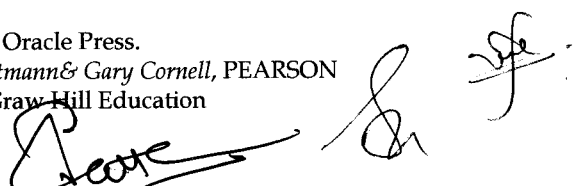
UNIT - IV: Fundamental Library Classes of Java and Input/Output
Object class, String class, String Buffer class, Wrapper class, Math class, Collection: Collection interface, List interface, Set interface sorted interface, Array List class, Liked List class, Tree Set, Comparator, Vector, Stack. **I/O Classes and Interfaces:** File, Buffer Stream, Character Stream, and Random Access for files, Object Sterilization.

UNIT - V: Event Handling: Overview of Event Handling, Event Hierarchy, The Delegation Event Model, Event Classes, KeyEventClass, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Event Adapters. **GUI Programming:** Introduction to Swing, History, Features, Components and Containers, Swing Packages, Painting, Swing Component Classes: JLabel, JTextField, Swing Buttons, JTabbedPane, JScrollBar,JList, JComboBox, Trees, JTable, Swing Menus:< Main Menu, PopUp Menu, ToolBar. **JDBC:** Introduction to JDBC, JDBC Drivers Type, Connection, JDBC URLs, Driver Manager, Statement – Creating, Executing, Closing, Result Set – Data Types and Conversions. Prepared Statement, Callable Statement, Mapping SQL and Java Types.

BOOKS RECOMMENDED:
1. **Java: The Complete Reference,***HerbertSchildt*, Oracle Press.
2. **Core Java: Volume-I & Volume 2,***Cay S. Horstmann& Gary Cornell*, PEARSON
3. **Programming with Java,***E. Balagurusamy,*McGraw-Hill Education
4. **Core Java**, *R.NageshwaraRao*, Dreamtech Press

Data Structure and Algorithms
Subject Code - MCA203

Max. Marks: 100   **Min Marks : 40**

Course Outcomes

- Students will be able to design the appropriate data structures and algorithms for solving real world problems and enables them to gain knowledge in practical applications of data structures.
- Choose efficient data structures and apply them to solve problems and analyze the efficiency of programs based on time complexity.
- Student gets analytical ability to create better design of computer applications.
- There is number of technique such as Searching, Sorting, Tree and Graph so that student gain the reasoning ability to implement these concept in development of live commercial applications

Syllabus

UNIT – I Array and Linked Lists
Algorithm: Concept of Algorithm, definition, characteristics of algorithm, algorithmic notation, analysis of algorithm, rate of growth, time, Basic time and space analysis of an algorithm, Asymtotic notation. **DataStructure:** Definition, Types of Data Structure, Data Structure operation. **Array:** Linear Array, Representations of Array in Memory, Traversing, Insertion and Deletion in Linear Array, Multidimensional Array.
Linked list: Representation of linked lists in memory, Traversing a linked list, Searching a linked list, Memory Allocation, Insertion into a linked List, Deletion from a Linked List, Header Linked List, Two- Way Linked Lists, Circular Linked List.

UNIT – II Stack and Queues
Stacks Definition, concepts, operation and application of Stacks, Recursion and Polish notations, Quick sort, tower of Hanoi, Queue, Priority Queue: definition concepts, operation and application of Queue, circular queue and Dequeue.Linked representation of stack and queue.

UNIT – III Trees and their Representations:
Terminologies related to trees, Binary Tree, complete binary tree, almost complete binary tree; Tree Traversals-preorder, in order and post order traversals, their recursive and non-recursive implementations, Expression tree-evaluation, Linked representations of binary tree, operations. Header nodes; threads, Binary Search Tree: searching, Inserting and deleting in BST, Heap; Path Lengths; Huffman's Algorithms. Basic idea of AVL Tree.
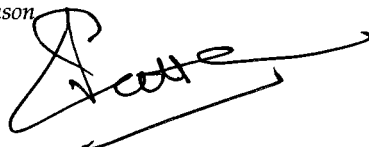
UNIT – IV Graphs:
Related definitions; Graph representations- adjacency matrix, adjacency list, adjacency multi-list; Traversal schemes - depth first search, breadth first search; Minimum spanning tree; Shortest path algorithm; Kruskal and Dijkstra's algorithms.

UNIT – V Searching, Hashing and Sorting:
Searching : Linear Search, Binary Search, Searching and data modification Hashing- Basics, methods, collision, resolution of collision, chaining; Internal Sorting, External sorting - Bubble Sort, Insertion Sort, Selection Sort, Merge sort, Radix sort, heap sort.

BOOKS RECOMMENDED:

1. **Data Structures and Program Design in C**, *Kruse R.L*, PHI.
2. **Data Structures using C and C++,***Tanenbaum*, PHI.
3. **Fundamental of Data Structures**, *Horowitz and Sahani*, Galgotia Publishers.
4. **Data Structures**, Schaum Series.
5. **Data Structures**, *Bhagat Singh*.
6. **Data Structures,***Trembley and Sorenson*

Elective I: 1. Theory of Computation
Subject Code - MCA204

Max. Marks: 100   **Min Marks : 40**

Course Outcomes

At the end of this course students will:
- Be able to construct finite state machines and the equivalent regular expressions. Be able to prove the equivalence of languages described by finite state machines and regular expressions.
- Be able to construct pushdown automata and the equivalent context free grammars.
- Be able to prove the equivalence of languages described by pushdown automata and context free grammars.
- Be able to construct Turing machines and Post machines.

Syllabus

UNIT - I:
Alphabet, String and language, Finite state Machines, finite automata with ϵ-moves, Conversion of NDFA to DFA, Removal of ϵ-transition from NDFA, Two way finite automata, finite automata with output, Mealy & Moore machines, Applications of finite automata, minimization of finite automata.

UNIT - II:
Chomsky classification of Languages , Regular Expression and Language, Properties of Regular languages, Pumping lemma for regular sets, Closure properties of regular sets, Decision algorithms for Regular sets, Myhill-Nerode theorem.

UNIT - III:
Context free grammars and their properties, derivation tree, simplifying CFG, ambiguity in CFG, Chomsky Normal form, Greibach Normal form, Pumping lemma for CFL, Closure properties of CFL.

UNIT - IV:
Pushdown automata: Informal description, Definition, Determinism and Non determinism in PDA, Equivalence of PDA's and CFL's. Two way PDA, Concept of Linear Bounded Automata, context sensitive grammars and their equivalence, Turning machine construction, determinism and non-determinism in TM, Multi tape, multi-track TM.

UNIT - V:
Undecidability, Universal turning machine and an undecidable problem, recursive function theory,Recursively enumerable sets, recursive sets, partial recursive sets, Church's hypothesis, post correspondence problem,Russell's paradox.

RECOMMENDED BOOKS:

1. **Theory of Computer Science, Automata Languages & computation,** *K.L.P. Mishra, N. Chandrashekharan,* PHI.
2. **Introduction to Automata Theory Language and Computation,** *John E. HopcraftandJeffary D. Ullman,* Narosa Publication house.
3. **Introduction to Formal Languages, Automata Theory and Computation,** *Kamala Krithivasan and Rama. R,*Pearson.
4. **Introduction to Automata Theory Languages and Computation,** *John E. Hopcraft, Jeffary, D. Ullman and Rajeev Motwani.*

Elective I: 2. Advanced Computer Architecture
Subject Code – MCA204

Max. Marks: 100   **Min Marks : 40**

Course Outcomes

- To make the students aware about Parallel Computing.
- To apprise the students of the concepts of Multiprocessors, Multicomputer, Pipelining etc.
- To increase the employability.
- To open up new areas in the field of research and development in the area of computer architecture.

Syllabus

UNIT I:
Introduction - Feng's and Flynn's classification scheme – SISD, SIMD, MISD, MIMD, Multiprocessor and Multicomputer, UMA, NUMA, COMA, NORMA, memory models, parallel computer and its type. Applications of Parallel Computers. Cache Coherence Protocols – Snoopy and Directory Protocols.

UNIT II:
System Interconnect Architecture – Static and Dynamic, Hypercube Interconnection network, multistage interconnection networks-architecture and routing, design consideration, throughput delay, bandwidth. Architecture and routing of 3 stage and 4 stage Banyan Network. Routing and Addition in Hypercube Interconnection network. Performance Metrics and Benchmarks.

UNIT III:
Principle of pipelining-overlapped parallelism, Linear and non-linear pipelining, reservation table, calculation of MAL.Types of Instruction Pipeline. Arithmetic pipeline designs example –Floating point adder, pipelined multiplier.
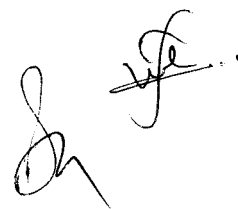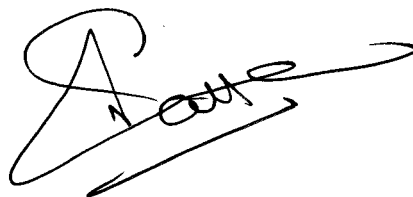
UNIT IV:
Advanced processor Technology – RISC, CISC, VLIW architectures, Hazard detection and resolution, functional organization of instruction in IBM 360/91. Numerical Problems based on CPI, IPC and MIPS.

UNIT V:
Exploring parallelism in program - Parallel Algorithm for Matrix addition and subtraction. Bitonic sort, sorting on linear array processors or odd even sort, PRAM algorithm for addition of numbers or Parallel Reduction. Bernstein's condition, ISO efficiency concept.

BOOKS RECOMMENDED:

1   **Computer Architecture & Parallel Processing,***Kai Hwang and F.A. Briggs*, McGraw Hill.
2   **Advanced Computer Architecture,***Kai Hwang*, McGraw Hill.
3   **Parallel Computing,** *M.R. Bhujade*, New Age Publication.
4   **Parallel Computing Theory and Practice,***Michael J. Quinn*, Tata McGraw Hill

Elective I: 3. Computer Graphics
Subject Code - MCA204

Max Marks : 100   **Min Marks : 40**

Course Outcomes

Upon successful completion of this course, student will be able to

- Understand the core concepts of computer graphics, including viewing, projection, perspective, modelling and transformation in two and three dimensions.
- Apply the concepts of colour models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.
- Interpret the mathematical foundation of the concepts of computer graphics.

Syllabus

UNIT - I: Display Devices
Refresh Cathode-Ray tubes, Random Scan and Raster Scan Display, Color CRT Monitors, Color display techniques: shadow masking and Beam penetration, Direct view storage tubes, Flat Panel display: plasma panel displays, LED & LCD devices. **Interactive Graphics:** Physical Input devices, logical classification, input function, interactive picture construction techniques.

UNIT - II: Output Primitives
Points and Lines, Line drawing Algorithms: DDA Algorithm and Bresenham's Line Algorithm, Antialiasing. Circle generating Algorithms: Bresenham's Circle Algorithms, Midpoint Circle Algorithm, Ellipse Generating Algorithm: Midpoint, Character generation and text display. Output command for various geometrical shapes, Filled Area Primitive: Scan line polygon fill algorithm, Boundary fill algorithm, Flood fill algorithm. Attribute of outputs primitives: line attribute, Area-fill Attribute, Text attribute, Bundled attributes, Area-Fill.

UNIT -III:Two Dimensional Transformation and Viewing
Transformation: Translation, Scaling, Rotation, Reflection, Shearing. Matrix representations of Transformation and Homogenous Coordinates, Composite Transformations and Concatenation of transformation.**Two-Dimensional Viewing Coordinate system:** World/user coordinates, Device coordinate, Normalized device coordinates, Viewing pipeline: windows and viewports, Viewing transformation pipeling, Window-to-Viewport coordinate transformation, Clipping algorithm: point, line clipping algorithm: Cohen-Sutherland, Liang Barsky, Nicholl-Lee-Nicholl, Line Clipping, polygon clipping algorithm : Sutherland-Hodgman, Weiler-Atherton, text clipping.

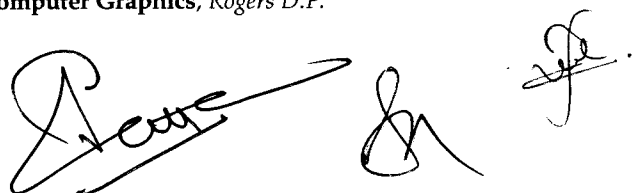**UNIT - IV: 3-D Transformation and Viewing**
3-D Transformation: Translation, Scaling, Rotation about standard and arbitrary axis, Other Transformation: Reflections and shears, Transformation commands. **Viewing:** Viewing Pipeline, Viewing Coordinates: transformation from world to viewing coordinates.

UNIT - V: 3-D Projection
Projection: Parallel Projection, Perspective Projection, Normalized view volume, viewport Clipping, Clipping in Homogeneous Coordinate. **Visible-Surface detection algorithms:** Back-Face removal, Depth Buffer method, Scan line method, Depth sorting method, Area subdivision and Octree method.

RECOMMENDED BOOKS:

1. **Computer Graphics,**Hearn D. & Baker P.M.
2. **Computer Graphics:** A Programming Approach,Harrington S.
3. **Procedural Elements for Computer Graphics,** Rogers D.F.

Elective II: 1. Data Warehousing and Mining
Subject Code - MCA205

Max. Marks: 100   **Min Marks : 40**

Upon Completion of the course, the students will be able to
- Store voluminous data for online processing, Preprocess the data for mining applications
- Apply the association rules for mining the data
- Design and deploy appropriate classification techniques and Cluster the high dimensional data for better organization of the data
- Discover the knowledge imbibed in the high dimensional system and Evolve Multidimensional Intelligent model from typical system
- Evaluate various mining techniques on complex data objects

Syllabus

UNIT – I:Introduction to Data Warehousing and OLAP Technology for Data Mining
What is Data Mining?, Data Mining: On what kind of data?, KDD Process, Data Mining Functionality, Are all the patterns interesting?, Attribute Types,What is Data Warehouse?, Data Cube: A multi-dimensional data model, Data Warehouse Architecture, Data Warehouse Implementation, Data Warehouse Usage(Applications), OLAP Operations, Concept of Transaction, Transactional Database, Distributed Database, Commit Protocols.

UNIT - II:Data Preprocessing, Data Mining Primitive, Languages and SystemArchitecture
Why preprocess the data?, Data Cleaning, Data Integration, Data Transformation, DataReduction, Concept Hierarchy Generation, Data Mining Primitive, Data Mining Query Language, Architecture of Data Mining System.

UNIT - III: Mining Association Rules in Large Databases
Association Rule Mining, Mining Single-dimensional Boolean Association Rules from Transactional Databases(Apiori algorithm, FP-Tree growth algorithm), Mining Multilevel Association Rules from Transactional Databases, Mining Multi-dimensional Association Rules from Transactional Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-based Association Mining.
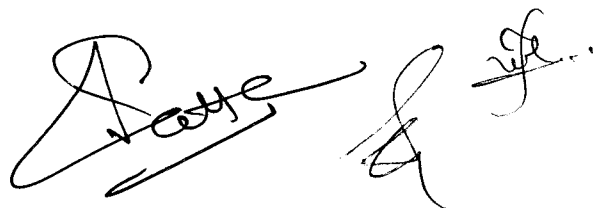
UNIT - IV: Classification, Prediction and Cluster Analysis
What is Classification?, What is Prediction?, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification based on Association, Other Classification Methods, Prediction, Classification Accuracy, What is Cluster Analysis?, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

UNIT - V: Mining Complex Types of Data & Applications and Trends in Data Mining Mining Time-series and Sequence Data, Mining Spatial Databases, Mining Multimedia Databases, Mining Text Databases, Mining World Wide Web, Data Mining Applications, Social Impact of Data Mining, Trends in Data Mining.

RECOMENDED BOOKS:

1. **Data Mining: Concepts and Techniques,** *Jiawei Han and MichelineKamber*
3. **Data Mining Techniques,** *Arun K Pujari,*
4. **Data Mining Introductory and Advanced Topics,***Margaret H Dunham,* Pearson

Elective II:2. Internet of Things
Subject Code - MCA205

Max Marks : 100   **Min Marks : 40**

Course Outcomes

On completion of the course, you should be able to:

- Explain the definition and usage of the term "Internet of Things" in different contexts and Understand the key components that make up an IoT system
- Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
- Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis
- Understand where the IoT concept fits within the broader ICT industry and possible future trends and appreciate the role of big data, cloud computing and data analytics in a typical IoT system

Syllabus

Unit – I OVERVIEW:
IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

Unit – II REFERENCE ARCHITECTURE:
IoT Architecture – State of the Art – Introduction, State of the art, Reference Model and architecture, **IoT reference Model** – IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints** – Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Unit – III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS:
PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

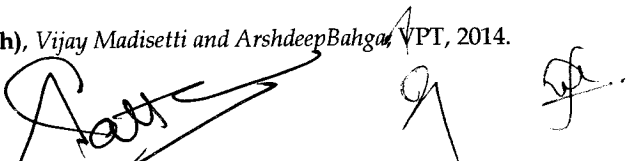**Unit – IV TRANSPORT & SESSION LAYER PROTOCOLS:**
Transport Layer Transmission Control Protocol (TCP), Multipath Transmission Control Protocol (MPTCP), User Datagram Protocol (UDP), Datagram Congestion Control Protocol (DCCP) , Stream Control Transmission Protocol (SCTP),Transport Layer Security (TLS), Datagram Transport Layer Security (DTLS))
Session Layer- Hyper Text Transfer Protocol (HTTP), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP), Message Queue Telemetry Transport (MQTT)

Unit – V SERVICE LAYER PROTOCOLS & SECURITY:
Service Layer – oneM2M, European Telecommunications Standards Institute (ETSI) M2M (Machine-to-Machine), OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, Routing Protocol for Low-Power and Lossy Networks (RPL), Application Layer

RECOMMENDED BOOKS:

1. **From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence,** *Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle,* Academic Press, 2014
2. **Learning Internet of Things,** *Peter Waher,* PACKT publishing
3. **Architecting the Internet of Things,** *Bernd Scholz-Reiter, Florian Michahelles,* Springer
4. **Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications,** *Daniel Minoli,* Willy Publications
5. **Internet of Things (A Hands-onApproach),** *Vijay Madisetti and ArshdeepBahga,* VPT, 2014.

Elective II: 3. Mobile Computing
Subject Code: MCA205

Max. Marks: 100   **Min Marks : 40**

After completion of course student are able to:
- Understand the cellular concepts and infrastructure such as frequency reuse.
- Hand off and how interference between mobiles and base stations affects the capacity of cellular systems.
- Identify the technical aspects of wireless and mobile communications along with the knowledge about the wireless LAN, PAN, MANET and its routing protocol.
- Mobile Computing plays important role in research in wireless communication.

Syllabus

UNIT I: Introduction
Introduction to Mobile Communication, Evolution of modern Mobile wireless communication systems, Applications of mobile communication, Need and Requirements of Mobile communication, satellite systems and Applications, Type of satellite systems, characteristics of satellite systems, Global Positioning system (GPS) and Applications, some open research topics in mobile communication

UNIT II: Mobile Communication Systems
Introduction, Cellular System Infrastructure, Registration, Handoff Parameters and Underlying support, Roaming Support Using System Backbone, to Mobile IP, Functions of Mobile IP, Mobile Node, Corresponding Node, Home Network, Foreign Network, Home Agent , Foreign Agent, Care-of Address, IP Packet Delivery, Agent Discovery, Agent Solicitation , Registration, Tunneling , Dynamic host configuration protocol

UNIT III: Mobility and Frequency Management
Mobility management in wireless Networks, Handoff Techniques, Handoff detection and Assignment, Types of Handoff, channel Reservation for Handoff calls, WLAN transmission technology, Frequency hopping, Direct Sequence Modulation, Frequency division, Orthogonal Frequency Division, Spectrum utilization.
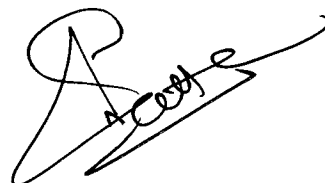
UNIT IV: Wireless LANs and PANs
Introduction to IEEE 802.11, Ricochet, Ricochet Wireless Modem, Services Provided by Ricochet, Home RF, Home RF Technology, Hiper LAN, Bluetooth , Advantages and disadvantages of Wireless LAN, Infra redvs radio transmission , introduction to MAC. Technologies influence WLANs / WPANs in future.

UNIT V: Mobile Adhoc Network
Introduction to Mobile Adhoc Network (MANET), Characteristics of MANET, Applications of MANET, Routing, Need for Routing, Routing Classification, Table-Driven Routing Protocol – Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing, Wireless Routing Protocol. Source initiated On-demand Routing- AdhocOn Demand Distance Vector Routing, Dynamic Source Routing, Temporarily Ordered Routing Algorithms, Hybrib Protocol – Zone Routing Protocol..

RECOMMENDED BOOKS:

1. **Mobile Communication:** *Jochen H. Schiller*, Pearson Education Publication
2. **Introduction to Wireless and Mobile Systems:** *D.P. Agrawal, Qing-An Zing*, Vikas Publishing House.
3. **Wireless Communication and Networks:** *ItiSahaMisra*, McGraw Hill education.
4. **Wireless and mobile Communication:** *T.G. Palanivelu, R. Nakkeeran*, PHI Publication.
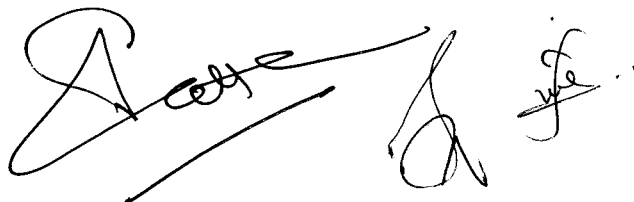5. **Mobile Commerce:** *KarabiBandyopadhyay*, PHI Publication.

MASTER OF COMPUTER APPLICATIONS (2 Years) 2022-2024

SCHEME OF TEACHING AND EXAMINATIONS

THIRD SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA301	.Net Technology	3	2	-	4	100	25	-	125	40	15	-	55
MCA302	Computer Network & Data Communication	3	2	-	4	100	25	-	125	40	15	-	55
MCA303	Artificial Intelligence	3	2	-	4	100	25	-	125	40	15	-	55
MCA304	Elective – III	3	2	-	4	100	25	-	125	40	15	-	55
MCA305	Elective – IV	3	2	-	4	100	25	-	125	40	15	-	55
MCA306	Lab-VII : Programming in .Net Technology	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA307	Lab-V III: Networking	-	-	2	1	-	50	50	100	-	30	25	55
MCA308	Lab-IX : Mini Project	-	-	2	1	-	50	50	100	-	30	25	55
MCA309	Seminar	-	-	2	1	-	25	-	25	-	15	-	15
	TOTAL	15	10	12	26	500	300	200	**1000**	200	180	100	**480**

S.No.	Elective –III	Elective -IV
1.	Compiler Design	Big Data Analytics
2.	Cyber Security	Cloud Computing
3.	Digital Image Processing	Soft Computing

.Net Technology
Subject Code – MCA301

Max. Marks: 100   **Min Marks : 40**

- Students will understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
- Students will describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE).
- Students will create applications using Microsoft Windows Forms and also ADO .NET.
- Students will be able to design web applications using ASP.NET

Syllabus

UNIT – I: Introduction to the .NET framework:

Overview of .net framework, Managed Execution process, CLR, .Net Framework class library, common language specification, Common Type System, JIT Compilation, MSIL, Assemblies, metadata, Garbage collection. Windows form: Working with Visual Studio IDE, creating a .NET solution, MDI application.

UNIT – II: Programming with .NET Framework

Components and controls, Data types, variables, Constant, Enumerations, Declaring Enumeration, Type conversions, Operators, Control Structures: conditional statements, loops, Arrays: creating array in vb.net, Dynamic arrays, Multi-dimensional arrays, Jagged Array, The Array class, Method of Array Class, Functions: defining Function, Function returning a value, Recursive function, Param Arrays, Passing Array as Function Arguments, Defining Sub procedures, Passing Parameters by Value and by reference.

UNIT – III: OOPS and Exception Handling

Types, structures:Declare a structures, structures variable, structures and array, structures and objects, structures and procedures, structures within structures. classes : class Definition,Member fnctions and Encapsulation,Constructor and Destructors, Parameterized Constructor, Shared Members of vb.net Class, Inheritance: Base and Derived Classes, Base Class Initialization, MyBase, Interfaces:creating interfaces, using multiple interfaces, using the MustInherit keyword(creating abstract classes), using MustOverride, MustOverridable, and NotOverridable, Polymorphism, Inheritance based polymorphism, Interface based polymorphism. Exception Handling: Try catch statement, Exception classes in .Net Framework, Handling Exceptions, Creating User define Exceptions.

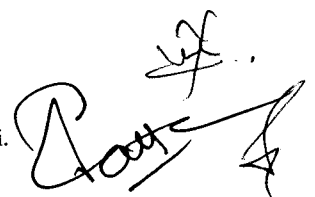### UNIT – IV: Building .NET Framework Applications

Introduction to ASP .NET, Differentiate classic ASP and ASP .NET, Asp.net- Life Cycle, , Asp.net state management, Web application, Web forms, Controls in web forms, Events in Web form, Form validations – Client side, Server side.

UNIT – V: Database Programming in .NET

ADO .NET Architecture, .NET data provider, dataset components, ADO. NET Adapter and Dataset, ADO.Net Dataview and Datagrid view, creating database applications using Window forms and web forms (Database connectivity through ADO .NET), Introduction to web services.

BOOKS RECOMMENDED

1. MSDN online – by Microsoft
2. Visual Basic .NET Complete - By BPB Publications, New Delhi.
3. The Complete Reference VB .NET – By Jeffery R. Shapiro, Tata Mcgraw Hill.
4. Professional VB .NET 2003 – by bill Evjen& others, Wiley Dreamtech India (P) Ltd. New Delhi.

Computer Network & Data Communication
Subject Code - MCA302

Max Marks : 100   Min Marks : 40

- To give the students a basic understanding of computer network.
- To give the students the basic concepts of bandwidth, data communication etc.
- To make the students more employable.
- To open up new areas in the field of research and development in the area of computer networking.

UNIT – I
Introduction to Computer Networking: The Concept of Networking, Data Communication, Required network elements, The role of Standards Organization. Line Configuration, Various Topologies, Transmission Mode, Categories of Networks- LAN, MAN, WAN. The benefits of a Computer Networks. The OSI and TCP/IP Reference Model: The Concept of Layered Architecture, Design Issues for the Layers. Interfaces and services, Detailed Functions of the Layers. Comparison between OSI and TCP/IP Reference model.

UNIT – II
Transmission of Digital Data: Bandwidth, Nyquist and Shannon's theorems for maximum data rate of a channel. Transmission media- Co-axial, UTP, Fiber optic and wireless. Analog and digital data Transmission- Serial and Parallel transmission. Modulation Techniques – AM, FM, PM. ADSL Modem. Multiplexing and Switching: The Concept of Multiplexing- FDM, TDM, WDM, CDM. The Concept of Switching- Circuiting, Message switching, Packet switching. Virtual Circuit and Datagram.

UNIT – III
Data Link Layer : Line Discipline, Flow Control- stop and wait, sliding window, Go back N, Selective Repeat. Error Detection and Correction – Parity, CRC, Hamming Code. ALOHA, Slotted ALOHA, CSMA/CD, HDLC. IEEE standards for LAN's and MAN's – Ethernet, DQDB
The concept of ICMP, ARP, RARP, SNMP, SMTP, MIME, POP3 Protocols.

UNIT – IV
Network Layer and Transport Layer: IP Addressing, Classes of IP Addresses, Subnet Mask. IPv4 and IPv6 Header Formats. Routing algorithms - Distance Vector, Link State. TCP Header Format, UDP Header Format. Congestion Control Algorithms – Leaky Bucket and Token Bucket. Internetwork, Networking Devices – Repeater, Bridge, Router, Gateway, Switch, Hub

UNIT – V
Comparative study of Networking Technologies: X.25, Frame Relay, Cell Relay -ATM, ATM Cell, ATM Switch – Multistage Switch. Banyan Network. DSL, ADSL, SONET, SMDS.
Network Security: The Importance of Security in Networking. Confidentiality, Authentication, Integrity, Non Repudiation. Traditional Cryptography - Data Encryption Standards, RSA algorithm. Deffie Hellman Algorithm. Virus, Worm, Trojan Horse, DoS, Spoofing, Phishing.

BOOKS RECOMMENDED:

- Computer Networks - A. S. Tanenbaum
- Data Communication and Networking - B. A. Forouzan

Artificial Intelligence
Subject Code – MCA303

Max. Marks: 100 **Min Marks : 40**

- Student will have ability to define the heuristics and apply them for solving complex problem with understanding of different heuristic based search techniques.
- Student will have understanding of different knowledge structure and inference mechanism with ability to apply them in intelligent solutions of complex problem.
- Student will understand the existence of uncertainty in problem solving and how mathematical /statistical models are used to overcome these problems.
- Students will understand planning system and different types of planning required for problem solving process

Syllabus

UNIT – I
Introduction to AI: Foundations of AI, Philosophy and History; AI problems, AI technique; The Turing Test. **Intelligent Agents:** Agents and Environments, the Concept of Rationality, the Nature of Environments and the Structure of Agents. **Problem solving & State Space Search:** General problem solving: defining problems as State Space Search, Problem Characteristics; Production Systems & their characteristics.

UNIT – II
Exhaustive Searches: Generate and Test, Breadth First Search, Depth First Search and DFID
Heuristic Search Techniques: Branch and Bound technique; Best first search; A* algorithm; Problem Reduction AND/OR Graphs and AO* algorithm. **Local Searches & Optimizations:** Hill climbing and its variants. **Constraint Satisfaction Problems:** Definition; Constraint Propagation and Backtracking. **Game Playing:** Mini-Max Search Procedure; Alpha-Beta Cutoffs; Additional Refinements.

UNIT – III
Knowledge Representation: Types of Knowledge; Knowledge Representation Issues; **Logic:** First order Predicate Logic; Representation of facts in FOL; Inference in FOL; Resolution Principle, Clausal Form and Unification; **Inference Mechanisms:** Forward and Backward Chaining; **Slot and Filler Structures:** Semantic Networks; Frame Systems and value inheritance; Conceptual Dependency; Scripts;
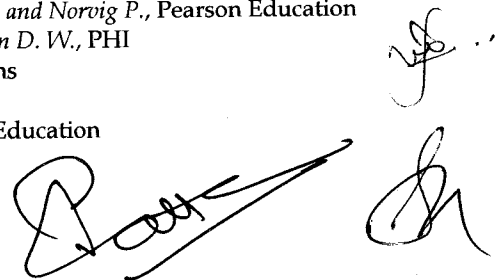
UNIT – IV
Reasoning under Uncertainty: Non-monotonic Reasoning, Logics for Non-monotonic Reasoning, Default Reasoning, Minimalistic Reasoning, Implementation Issues, Truth Maintenance Systems; Probabilistic Reasoning and Uncertainty; Statistical Reasoning; Probability Theory; Bayes Theorem and Bayesian networks; Certainty Factor; Dempster-Shafer Theory. **Planning:** Overview; The Blocks Word; Component of a Planning System: Goal Stack Planning; Nonlinear Planning;

UNIT – V
Expert Systems: Introduction, Characteristics, History and Applications of expert systems; Expert System Shells; Rule Based Systems Architectures, Non Production System Architectures; Knowledge Acquisition and Validation; Case Studies: MYCIN & DENDRAL. **Learning:** Rote learning; Learning by Taking Advise; Induction; Explanation based learning; Discovery; Analogy.

BOOKS RECOMMENDED:
1. **Artificial Intelligence 3rd Edition,** *Rich E., Knight K. and Nair S. B.,* McGraw Hill Education
2. **Artificial Intelligence: A Modern Approach 3rd Edition,** *Russell S. J. and Norvig P.,* Pearson Education
3. **Introduction to Artificial Intelligence and Expert Systems,** *Patterson D. W.,* PHI
4. **Principles Of Artificial Intelligence,** *Nilson N. J.,* Narosa Publications
5. **Artificial Intelligence3rd Edition,** *Winston P. H.,* Pearson Education
6. **A First Course in Artificial Intelligence,** *Khemani D.,* McGraw Hill Education

Elective III: 1. Compiler Design
Subject Code - MCA304

Max. Marks: 100   Min Marks : 40

Course Outcomes

- Students will be able to know about various phases of compiler design.
- Students will be aware of the function and complexity of modern compilers.
- Students will have a concrete view on the theoretical and practical aspects of compiler design
- Students will be able to apply ideas and techniques discussed to various software design.

Syllabus

UNIT - I
Introduction to Compiling and one pass compiler:
Compilers & translators, Phases of compilers, Compiler writing tools, Bootstrapping; overview of one pass compiler.

Finite Automata and Lexical Analysis:

Role of Lexical Analyzer; specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata, DFA and NFA, Implementation of lexical analyzer; tools for lexical analyzer -LEX.

UNIT - II

Syntax analysis & Parsing Technique:
Context free grammars; Bottom up parsing, Shift reduce parsing, Operator Precedence parsing, Top down parsing, elimination of left recursion; recursive descent parsing, Predictive parsing.
Automatic Construction of Efficient parsers:
LR parser, construction of SLR and canonical LR parser table, Using ambiguous grammar, An automatic parser the generator, YACC, Using YACC with ambiguous grammar, creating YACC lexical analyzer with LEX, Error recovery in YACC.

UNIT - III

Syntax Directed Translation:
Syntax directed schema, Construction of syntax tree, Translation with top down parser.

Run Time Environment:
Source Language issues, Storage organization and allocation strategies, Parameter passing, Implementation of block-structured language.

UNIT - IV

Intermediate Code Generation:
Intermediate languages; Postfix notation, Three-address code, Quadruples and triples, Translation of assignment statements, Boolean expression, and Procedure call.

Error Detection & recover:
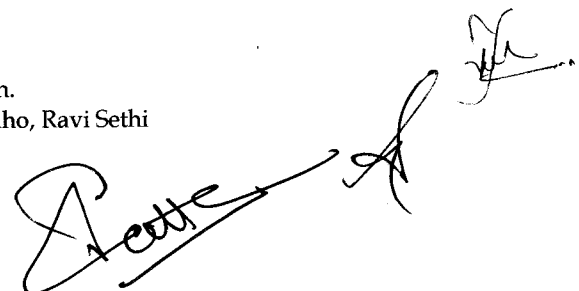Lexical & syntactic phase error, semantics error.

UNIT - V
Code Optimization:
Optimization of basic block, Loop optimization global data flow analysis, Loop in variant computation.
Code Generation: Issue and design of code generator, the target machine, a simple code generator.

BOOKS RECOMMENDED:
- **Principles of Compiler Designing** - Alfred V. Aho and J.D. Ullman.
- **Principles of Compiler-Principles, Technique and Tools** - Alfred V. Aho, Ravi Sethi

Elective III: 2. Cyber Security
Subject Code – MCA304

Max. Marks: 100   **Min Marks : 40**

Course Outcomes

- Students will be able to acknowledge about the cybercrime, cyber criminal, and intellectual property rights. Protection and resilience of Critical Information Infrastructure.
- To enable effective prevention, investigation and prosecution of cybercrime and enhancement of law enforcement capabilities through appropriate legislative intervention.
- Students learn basics about computer, Network and Data Security, threats to any network and data security.
- They also know how to secure any network, computer and data in it, security goals to secure any network
- Students learn internal details of security mechanism so that they could adopt it in their programming.

Syllabus

UNIT – I: INTRODUCTION
Computer Security Concepts, The Challenges of Computer Security, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A model for network Security, **Symmetric Encryption Principal:** Cryptography, Cryptanalysis, Feistel Cipher Structure, DES, Random and Pseudorandom Numbers, Symmetric Block Modes of Operation (ECB, CBC, CFB, CTR).

UNIT – II PUBLIC KEY CRYPTOGRAPHY
Approaches to Message Authentication, **Hash Functions:** Hash Functions Requirement, Security of Hash Functions, The SHA Secure Hash Function, **Public Key Cryptography:** Public –Key Encryption Structure, Applications for Public Key Cryptosystem, RSA, Attacks on RSA, OAEP.

UNIT – III MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION
Message Integrity: Document and Finger Printing, Message and Message Digest, Cryptographic Hash Function Criteria Random Oracle Model, Birthday Problems and Summery of solutions, **Message Authentication:** Modification Detection Code, Message Authentication Code, Introduction of HMAC & CMAC, **Digital Signature:** Comparison, Process, Services, Attacks on Digital Signature.
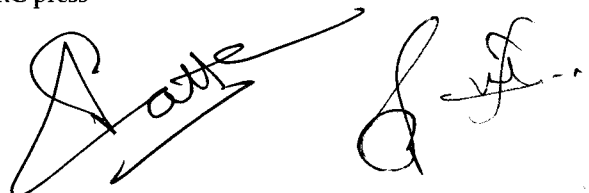
UNIT – IV MALICIOUS SOFTWARE
Intruders: Intruder Behavior Patterns, Intrusion Techniques, Intrusion Detection by Audit Records, Statistical Intrusion Detection, Distributed Intrusion Detection, Honeypot Types of Malicious Software, Nature of Viruses, Virus Classification, Antivirus Approaches, Worms and its Propagation model, DDoS Attack.

UNIT – V FIREWALL & SECURITY TOOLS
Firewall: Need & Characteristics of Firewall, Types of Firewall, Firewall Basing, Firewall Location and Configuration, Introduction to Kali Linux ,Tools Available in Kali Linux and Its Usage. WireShark Packet Analyzer and Its Features. Cyber Security Policy, Domain of Cyber Security Policies.

RECOMMENDED BOOKS:
1. **Network Security Essentials,** *William Stallings*, PEARSON
2. **Cryptography and Network Security,** *William Stallings*, PHI.
3. **Cryptography and Network Security,** *AtulKahate*, Tata McGraw Hill
4. **Cryptography and Network Security,** *B.A. FOROUZAN*, TMH
5. **Cyber Security policy Guidebook,** *Jennifer Jason Paul, Marcus Jeffery Joseph*. Wiley Publication,2012.
6. **Network Security: The Complete Reference**, Robertra Bragg, Tata McGraw Hill.
7. **Cyber Security Essentials,** *James Graham, Richard Ryan*, CRC press

Elective III: 3. Digital Image Processing
Subject Code – MCA304

Max. Marks: 100   **Min Marks : 40**

Course Outcomes

- Review the fundamental concepts of a digital image processing system and analyze images in the frequency domain using various transforms.
- Evaluate the techniques for image enhancement and image restoration and categorize various compression techniques.
- Interpret Image compression standards, image segmentation and representation techniques.
- At the end student will come to know about the application area and use of image processing in different research area mostly in image diagnosis, medical.

Syllabus

Unit – I: Introduction: Digital Image Fundamentals Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sensing and acquisition Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Unit – II: Image Enhancement Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods; **Frequency Domain:** Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

Unit – III: Image Restoration A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

Unit – IV: Image Compression: Fundamentals, Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards. **Morphological Image Processing:** Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformations,Some Morphological Algorithms.

Unit – V: Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. **Representation and Description:** Representation, Boundary Description and Regional Descriptor.

RECOMMENDED BOOKS:

1. **Digital Image Processing,** *Rafel C Gonzalez and Richard E. Woods,* PHI 2nd Edition
2. **Computer Vision and Image Processing,** *Scott.E.Umbaugh,* Prentice Hall

Elective IV: 1. Big Data Analytics
Subject Code – MCA305

Max. Marks: 100

Min Marks : 40

Course Outcomes

After the completion of course, Student must be able
- To understand the building blocks of Big Data.
- To articulate the programming aspects of cloud computing (map Reduce etc). Also get the knowledge about the big data programming languages apache, pig, hive and spark.
- To understand the specialized aspects of big data with the help of different big data applications.
- To represent the analytical aspects of Big Data along with the knowledge of bigdata database such as mongodb and nosql.
- To know the recent research trends related to Hadoop File System, MapReduce and Google File System etc

Syllabus

UNIT-I Introduction Concept of Big Data

Big Data- Define Data, Web Data, Classification of Data- Structured, Semi-Structured, and Unstructured. Big Data Definitions, Challenges of Conventional system, Why We Need Big Data, Difference between Big Data and Small Data, Importance of Big Data.Big Data Characteristics(4V's Volume, Velocity, Variety,and Veracity), Big Data Types, Big Data Handling Techniques.Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Big Data Business Value. Big Data AnalyticsApplication. Big Data Challenges and Future Scope.

UNIT-II INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE

Big Data – Apache Hadoop&HadoopEcoSystem:Hadoop Core Component, Features of Hadoop, The Hadoop Distributed File System: HDFS data Storage, Hadoop Physical Organization, HDFS Commands, MapReduce Framework, MapReduce Programming Model,MapReduce Map task,Reduce Task and MapReduceExecution,Hadoop YARN, Hadoop2 Execution Model, Hadoop Ecosystem Tools, Hadoop Ecosystem.

UNIT-III NoSQL Big Data Management, Mongo DB

NoSQL: What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vsNoSQL, NoSQLDataStore, NoSQL Data Architecture pattern, NOSQL to Manage Big Data.Data Base for the Modern Web: Introduction to MongoDB, features of MongoDB, Data Types,Mongo DB Query Language and Database Command.

UNIT-IV Hive and Pig:

Pig: Apache Pig, Application of Apache Pig, Feature, Pig Architecture, Pig- Grunt Shell, Installing Pig, Pig Latin Data Model, Pig Latin and Developing Pig Latin Scripts: Apache Pig Execution, Commands.
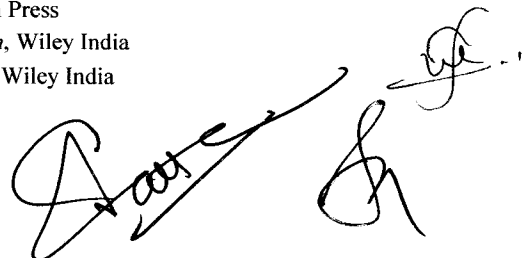HIVE AND HIVEQL.Hive: Introduction, Characteristics, limitation, Hive Architecture and Installation, Comparison with Traditional Database (RDBMS), Hive Datatype and File Formats, Hive Data Model,Hive Integration and Workflow Steps, Hive Built-in Functions, HiveQL.

UNIT 5:Hadoop Environment, Analytics and Spark

Installing HBase, Fundamentals of HBase, Running MapReduce jobs on HBase (table input/output), Zookeeper.Visualizations: Visual Data Analysis techniques, and interaction techniques.SPARK: Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.

RECOMMENDED BOOKS:

1. **Big Data Analytics**, *Raj Kamal and PreetiSaxena*, McGrawHill Education
2. **Big Data: Black Book**, *DT Educational Services*, Dreamtech Press
3. **Big Data Analytics**,*SeemaAcharya&ShubhashiniChellappan*, Wiley India
4. **Big Data Analytics**,*M. Vijayalakshmi&RadhaShankarmani*, Wiley India

Elective IV: 2. Cloud Computing
Subject Code – MCA305

Max Marks : 100

Min Marks : 40

- Students will be able to perform cloud oriented analysis.
- Students will be able to model cloud candidate derived from existing businessdocumentation.
- Students will be able to design the composition of a cloud services.
- Students will be able to design application services for technology abstraction
- student will be able to appreciate the cloud computing paradigm, recognize its various forms and able to implement some cloud computing features

Syllabus

Unit – I
Introduction: Cloud Computing: Vision, Definition, Reference Model, Characteristics, Benefits and Challenges, Historical Developments, Cloud Computing Environments, Cloud Platforms and Technologies; The Evolution of Cloud Computing: Parallel Computing vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing, Introduction of Grid Computing.

Unit – II
Virtualization: Introduction, Characteristics, Taxonomy of Virtualization, Levels of Virtualization, Structure and Mechanism of Virtualization, Virtualization and Cloud Computing, Advantages and Disadvantages, Virtualization Technology Examples: Xen, VMware, Microsoft Hyper-V.

Unit – III
Cloud Computing Architecture: Service Oriented Architecture, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Data Storage as a Service (DSaaS). Types of Clouds; Economics of the Cloud and Open Challenges; **Security and Organizational aspects**: Host Security and Data Security.

Unit – IV
Migration to the Cloud: Adoption and use of Cloud by Businesses (Small and Enterprise), Pace of Adoption, Benefits and Phases of Adoption, Cloud Service Provider's Capabilities and Liabilities, Success factors and Issues. **Migrating Applications**: Key Aspects, Migration Techniques, Phases of Migration. **Service Level Agreement (SLA)**: Aspects and Requirements, Availability and Outages, Credit Calculations, SLA Samples.

Unit – V
Industry Platforms: Amazon Web Services, Google AppEngine, Microsoft Azure; **Cloud Applications**: Scientific Applications, Business and Consumer Applications; Advanced Topics: Energy Efficiency in Clouds, Market Based Management, Federated Clouds / InterCloud, Third Party Cloud Services.

RECOMMENDED BOOKS:
1. **Mastering Cloud Computing**, *RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi*, McGraw Hill Education
2. **Cloud Computing: Black Book**, *KailashJayaswal et al.*,Kogent Learning Solutions, Dreamtech Press
3. **Cloud Computing: Principals and Paradigms**, *RajkumarBuyya et al.*, Wiley India
4. **Cloud Computing: Concepts, Technology & Architecture**, *Erl*, Pearson Education India
5. **Cloud Computing Bible**, *Barrie Sosinsky*, O'Reilly Media
6. **Cloud Computing: A Practical Approach**, *Toby Velte, Anthony Vote and Robert Elsenpeter*, McGraw Hill
7. **Cloud Application Architectures: Building Applications and Infrastructures in the Cloud**, *George Reese*, O'Reilly Media.
8. **Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance**, *Tim MathermSubraKumaraswamy and ShahedLatif*, O'Reilly Media.

Elective IV: 3. Soft Computing
Subject Code – MCA305

Max. Marks: 100   **Min Marks : 40**

Course Outcomes

- Students will be able to understand Artificial Neural Network concept with the help of Biological Neural Network.
- Students will be able to implement algorithms to train ANN by using learning algorithms.
- Students will be able to test fuzzy set operations and binary relations.

Syllabus

UNIT - I: Introduction to Fuzzy Logic System
Fuzzy Sets Operation Of Fuzzy Sets, Properties Of Fuzzy Sets, Fuzzy Relations, Fuzzy Arithmetic, Membership Functions, Fuzzy To Crisp Conversion. Fuzzy Logic, Fuzzy Rule Based Systems, Fuzzy Decision Making, Fuzzy Database, Fuzzy Intelligent System.

UNIT - II: Introduction to Artificial Neural Networks
Introduction to Artificial Neural Network, Artificial Neuron, Classification of Artificial NeuralNetwork, Architecture of a Artificial Neural Network, Activation Function, Training an Artificial Neural Network, Application of Artificial Neural Network.

UNIT - III: Perceptron and Associative Memories
Amari General Learning Rule, HEBB Learning Rule, ADLINE, Perceptron Layer Network, Associative memory: Auto associative Memory, Bi-directional memory, Back-propagation Network: Architecture, Training Algorithm Application of Back-propagation algorithm

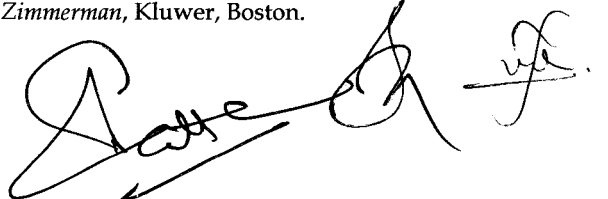**UNIT - IV: Evolutionary Computing**
Introduction, overview of evolutionary computing, Genetic algorithms and optimization, The schema theorem: the fundamental theorem of genetic algorithms, Genetic algorithm operators, Integration of genetic algorithms with neural networks, Integration of genetic algorithms with fuzzy logic, Known issues in GAs.

UNIT - V: Soft Computing Tools
Introduction to MATLAB, Features, Matrix Operations, Curve Plotting, Toolbox Introduction, Introduction to Simulink.

RECOMMENDED BOOKS:

1. **Soft Computing**, SarojKaushik, TMH Publications.
2. **Fuzzy systems and Fuzzy Logic**, *Klir and Uuna*, PHI Publications.
3. **Introduction to Artificial Neural Networks**, *S. N. Sivanandam and M. Paulraj*, Vikas publication.
4. **Soft Computing and Intelligent systems Design**, *Fakhreddine O. Karry and Clarence de Silva*
5. **Neural Network Design**, *Hagan & Demuth*, Vikas Pub. Comp.
6. **Fundamentals of Artificial Neural Networks**, *M.A.Hassaoun*.
7. **Fuzzy sets, uncertainty and information**, *George J. Kir, & TA Folger*.
8. **Fuzzy sets, Decision making and Expert system**, *HJ Zimmerman*, Kluwer, Boston.
9. **Fuzzy set theory and its applications**, *H. J. Zimmerman*, Kluwer, Boston.

MASTER OF COMPUTER APPLICATIONS (2 Years) 2022-2024

SCHEME OF TEACHING AND EXAMINATIONS

FOURTH SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Sessional Marks of Project Work	Project Viva-Voce	Pr	Total	Sessional Marks of Project Work	Project Viva-Voce	Pr	Total
MCA401	System Development Project (System Design & Implementation) / Research Project.	-	-	30	15	200	200	-	400	120	100	-	220
	TOTAL	-	-	30	15	200	200	-	400	120	100	-	220