GURUGRAM UNIVERSITY, GURUGRAM

(Established under Haryana Act 17 of 2017)

MASTER OF COMPUTER APPLICATIONS

(MCA)

(Two Year (four semesters) Post Graduate Program)

(Under Choice Based Credit System)

(Structure & Syllabi)

Effective from the Academic Session 2020-2021

Department of Computer Sceince
Gurugram University
Gurugram- 122018 HARYANA
(INDIA)

GURUGRAM UNIVERSITY, GURUGRAM

REVISED MCA ORDINANCE AS PER AICTE GUIDELINES 2020-21

W.E.F. Session 2020-21

Eligibility for Admission to MCA 2-year Programme:

BCA/Bachelor Degree in Computer Science Engineering or equivalent Degree/Bachelor Degree (B.Sc) with Computer Science as one of the major subjects with at least 50% marks (45% marks in case of candidates belonging to SC/ST category).

OR

Passed B.Sc./B.Com./B.A. with Mathematics at 10+2 Level or at Graduation Level with at least 50% marks (45% marks in case of candidates belonging to SC/ST category) with additional bridge Courses i.e. one year Diploma after graduation such as PGDCA or equivalent.

OR

Passed B.Sc./B.Com./B.A. with Mathematics at 10+2 Level or at Graduation Level with at least 50% marks (45% marks in case of candidates belonging to SC/ST category), along with the students admitted with this eligibility will have to simultaneously undertake additional ***Bridge Course*** as prescribed by the University during the first semester.

Note: * It is compulsory for each student to pass out Bridge Course (three additional theory papers and one practical as prescribed in scheme of examination of Bridge Course) as per University norms during the 1st year of MCA-2 year course and the degree will be awarded after the completion of Bridge Course. However, these papers under Bridge Course will be taught only in the 1st semester of the course.

Scheme of Examinations and Syllabus
for
Bridge Course to Regular MCA 2- year programme
With effect from the Session 2020-21

Course Code	Course Name	Credits* (L:T:P)	External Marks	Internal Marks	Total
MCA 001	Computer Fundamentals and Programming in C	4:0:0	80	20	100
MCA 002	Rapid Application Development with Visual Basic	4:0:0	80	20	100
MCA 003	Lab based on MCA 001	0:0:3	80	20	100
MCA 004	Lab based on MCA 002	0:0:3	80	20	100
Total Credits/Marks		**14(8:0:6)**	**320**	**80**	**400**

** Mapping of Credits to Teaching Hours & Group Size for Practical/Tutorials shall be one adopted by the Gurugram University or existing Maharshi Dayanand University, Rohtak CBCS Ordinance uptill.*

Note: It is compulsory for each student to pass out Bridge Course (two additional theory papers and two practical as prescribed in scheme of examination of Bridge Course) as per University norms during the 1st year of MCA-2 year course and the degree will be awarded after the completion of Bridge Course. However, these papers under Bridge Course will be taught only in the 1st semester of the course.

Structure and Syllabi of

MASTER OF COMPUTER APPLICATIONS (MCA)

Under Choice Based Credit System

(Effective from the Academic Session 2020-21)

SEMESTER - I

Course Code	Course Title	Credits* (L:T:P)	Maximum Marks		
			Internal Assessment	End-semester Examination	Total
MCA 101	Data Structures and Algorithms	4:0:0	20	80	100
MCA 102	System Software and Operating System	4:0:0	20	80	100
MCA 103	Object Oriented Programming Using C++	4:0:0	20	80	100
MCA 104	Data Communication and Computer Networks	4:1:0	20	80	100
MCA 105	Artificial Intelligence	4:0:0	20	80	100
MCA 106	Software Lab-01** Based on MCA 101 & MCA 102	0:0:3	20	80	100
MCA 107	Software Lab-02** Based on MCA 103 & MCA 105	0:0:3	20	80	100
MCA 108	Seminar/Discussion	0:2:0	50		50
Total Credits/Marks		**29(20:3:6)**	**190**	**560**	**750**

**Note: Mapping of Credits to Teaching Hours & Group Size for Practical/Tutorials shall be one adopted by the Gurugram University or existing Maharshi Dayanand University, Rohtak CBCS Ordinance uptill.*

*** Both practical exams of a semester may be conducted on the same day in 2 sittings each maximum of 3 hours.*

SEMESTER - II

Course Code	Course Title	Credits* (L:T:P)	Maximum Marks		
			Internal Assessment	End-semester Examination	Total
MCA 201	Database Management Systems	4:0:0	20	80	100
MCA 202	Theory of Computation and Compilers	4:0:0	20	80	100
MCA 203	The JAVA Programming Language	4:0:0	20	80	100
MCA 204	Elective-I (Any One)	4:1:0	20	80	100
MCA 204A	Software Engineering				
MCA 204B	Soft Computing				
MCA 204B	Discrete Structures and Optimization				
MCA 204B	Wireless Networks & Mobile Computing				
MCA 205	Elective-II (Any One)	4:0:0	20	80	100
MCA 205A	Computer System Architecture				
MCA 205B	Internet of Things				
MCA 205C	Programming Languages and Computer Graphics				
MCA 206	Software Lab-03** Based on MCA 201 & MCA 202	0:0:3	20	80	100
MCA 207	Software Lab-04** Based on MCA 203 & MCA 205	0:0:3	20	80	100
MCA 208	Project Report/Industry Internship Report/ Dissertation –I	0:3:0	20	80	100
FE-201	Foundation Elective***	2:0:0	20	80	100
Total Credits/Marks		**32(22:4:6)**	**180**	**720**	**900**

**Note: Mapping of Credits to Teaching Hours & Group Size for Practical/Tutorials shall be one adopted by the Gurugram University or existing Maharshi Dayanand University, Rohtak CBCS Ordinance uptill.*

*** Both practical exams of a semester may be conducted on the same day in 2 sittings each maximum of 3*

SEMESTER - III

Course Code	Course Title	Credits* (L:T:P)	Maximum Marks		
			Internal Assessment	End-semester Examination	Total
MCA 301	Machine Learning with Python	4:0:0	20	80	100
MCA 302	Object Oriented Analysis & Design with UML	4:0:0	20	80	100
MCA 303	Enterprise Architecture with .NET	4:0:0	20	80	100
MCA 304	Elective-I (Any One)	4:0:0	20	80	100
MCA 304A	Advanced JAVA				
MCA 304B	Server-Side Web Programming with PHP and MySQL				
MCA 304C	Statistical Computing				
MCA 304D	Network Programming				
MCA 304E	Modelling & Simulation				
MCA 305	Elective-II (Any One)	4:1:0	20	80	100
MCA 305A	Cloud, Edge & Fog Computing				
MCA 305B	Storage Area Networks & Data Centres				
MCA 305C	Data Mining & Warehouse				
MCA 305D	Advanced Computer Architecture				
MCA 305E	Advanced Software Engineering				
MCA 306	Software Lab-05** Based on MCA 301 & MCA 302	0:0:3	20	80	100
MCA 307	Software Lab-06** Based on MCA 303 & MCA 304	0:0:3	20	80	100
MCA 308	Seminar/Report on Digital India or any other area where Computers have made an impact	0:2:0	50	0	50
OE-309	OPEN ELECTIVE***	3:0:0	20	80	100
Total Credits/Marks		**32(23:3:6)**	**210**	**640**	**850**

SEMESTER - IV

Course Code	Course Title	Credits* (L:T:P)	Maximum Marks		
			Internal Assessment	End-semester Examination	Total
MCA 401	Android Programming	4:0:0	20	80	100
MCA 402	Client-Side Web Programming	4:0:0	20	80	100
MCA 403	Computer Security & Block Chain Technology	4:0:0	20	80	100
MCA 404	Elective-I (Any One)	4:0:0	20	80	100
MCA 404A	Advanced DBMS				
MCA 404B	Big Data Analytics				
MCA 404C	Image Processing and Computer Vision				
MCA 404D	Deep Learning				
MCA 404E	Advanced Networking				
MCA 405	Elective-II (Any One)	4:1:0	20	80	100
MCA 405A	Quantum Computing				
MCA 405B	Natural Language Processing				
MCA 405C	Bio Informatics				
MCA 405D	Internet of Everything				
MCA 405E	Software Testing & Quality Assurance				
MCA 406	Software Lab-07** Based on MCA 401 & MCA 403	0:0:3	20	80	100
MCA 407	Software Lab-08** Based on MCA 402 & MCA 404	0:0:3	20	80	100
MCA 408	Project Report/Industry Internship Report/	0:3:0	20	80	100
Total Credits/Marks		**30(20:4:6)**	**160**	**640**	**800**
GRAND TOTAL (For 2 Year Course)		**123(85:14:24)**	**740**	**2560**	**3300**

MCA-001

Computer Fundamentals and Programming in C

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Computer Fundamentals: Concept of data and information. Components of Computer. Input and Output Device, Components of CPU, Memory and Storage Devices, Classification of Computers, Advantages and Limitations of Computer, Applications of Computer, Social concerns of Computer Technology: Positive and Negative Impacts, Computer Crimes, Viruses and their remedial solutions.

Computer Software: System and Application Software, Overview of Operating System Programming Languages Machine. Assembly. High Level Language, 4GL. Language Translator, Linker and Loader.

UNIT-II

Problem Solving: Problem Identification. Analysis, Algorithms, Flowcharts. Pseudo codes. Decision Tables. Program Coding. Program Testing and Execution.

C Programming Fundamentals: Keywords, Variables and Constants, Structure of a C program.

UNIT-III

Operators & Expressions: Arithmetic, Unary, Logical. Bit-wise, Assignment & Conditional Operators.

Decision Making: Decision making using if...else. Else If Ladder; Switch, break. Continue and Goto statements.

UNIT-IV

Loops: Looping using while, do...while, for statements. Nested loops.

Functions: Defining & Accessing User defined functions. Library Functions, Function Prototype, Passing Arguments, Passing array as argument. Recursion, Use of Library Functions. Macro vs. Functions, Pointers in C.

Textbooks & Reference Books:

1. E. Balaguruswamy: Programming in C. Tata McGraw Hill.
2. Rajender Singh Chhillar: Application of IT to Business, Ramesh Publishers, Jaipur.
3. Gill Nasib Singh: Computing Fundamentals and Programming in C, Khanna Books Publishing Co., New Delhi.

MCA-002

Rapid Application Development with Visual Basic

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction to Visual Basic: VB IDE & Components, Feature of VB, VB for Rapid Application Development, VB as event-driven & object-based language, An overview of VB project types.

Programming with VB: Variables, Constants, Data types. Variable Scope.

UNIT-II

VB Controls: Default Controls in Tool Box: Label Box, Text Box, Command Button. List Box, Combo Box. Picture & Image Box, Shape box. Timer. Option button. Check Box & Frames. Exploring Project Properties.

VB Operations & Control Structures: Arithmetic operations, String Operations. Built-in Functions, I/O in VB. Branching & Looping statements.

UNIT-III

Menu in VB: Adding Menu, Modifying and Deleting Menu Items. Creating Submenus.

Forms in VB: Working with Forms: Working with multiple forms; Loading. Showing and Hiding forms; Creating Forms at Run Time, Drag and Drop operation. MDI form Arranging MDI Child Windows. Coordinating Data between MDI Child Forms.

UNIT-IV

Advanced Controls in VB: Introduction: Scroll Bar, Slider Control, Tree View, List View, Rich Text Box Control Toolbar, Status Bar, Progress Bar, Cool bar, Image List, Tab Strip.

VB & Databases: VB as perfect Front-End Language, The Data Controls and Data-Bound Controls, Using DAO, RDO, ADO.

Textbooks & Reference Books:

1. Visual Basic 6 Programming: Black Book By Steven Holzner, dreamtech PRESS
2. Mastering Visual Baisc 6 By Evangelos Petroutsos, BPB
3. Programming in Visual Basic 6.0 By Julia Case Bradley & Anita C. Millspaugh Tata

MCA-101

Data Structures and Algorithms

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Data Types: Primitive, Composite and Abstract Data Types, Data Structures: Concept, Classification, and Importance; Data Structures v/s Data Types, Linear v/s Non-Linear Data Structures.

Arrays: Single and Multidimensional arrays; Address Calculation using Column and Row major ordering; Various operations on Arrays; Vectors; Sparse Matrix; Application of Arrays; Implementation of Arrays in C/C++.

UNIT-II

Stacks and Queues: Representation of stacks and queues using arrays and linked-list. Circular queues. Priority Queue and D-Queue. Applications of stacks: Conversion from infix to postfix and prefix expressions. Evaluation of postfix expression using stacks; Implementation in C/C++.

Linked list: Singly Linked List; Operations on Linked Lists. Linked Stacks and Queues. Polynomial Representation and Manipulation using Linked Lists. Circular Linked Lists. Doubly linked lists; Implementation in C/C++.

UNIT-III

Trees: Concept, Representation and Applications of Trees, Forest, Binary Tree, Threaded Binary Tree; Binary tree representation of a general tree; Conversion of forest into tree; Binary search tree: Height balanced (AVL) tree, B-trees, B+ Tree, B* Tree.

Binary tree traversal methods: Pre-order. In-order. Post-ordered traversal. Recursive Algorithms.

Heap: Heap operations. Binomial heaps. Fibonacci heaps. Skew heaps, heap set.

UNIT-IV

Graphs: Representation: Adjacency matrix, Adjacency lists; Type of Graphs; Paths: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning.

Graph Algorithms: Breadth-First Search, Depth-First Search; Minimum Spanning Trees: Prim's and Kruskal's algorithms; Shortest-path Algorithms: Dijkstra's and Floyd's algorithm; Topological sort, Maxflow: Ford-Fulkerson algorithm, max flow -min cut.

Textbooks & References:

1. Hubbard JR: Schaum's outline of Data Structures with C++. TMH.
2. R.Kruse, C.LTonodo and B.Leung: Data Structures and Program Design in C, Pearson Education.
3. S.Chottopadhyay, D.Ghoshdastidar & M.Chottopadhyay: Data Structures Through 'C Language. BPB Publication.
4. E. Horowitz, Sahni and D. Mehta: Fundamentals of Data Structures in C++. Galgotia Publiction.
5. Y.LangsaiiL M.J.Augenstein and A.M.Tanenbaum: Data Structures Using C and C++, Prentice Hall of India.

MCA-102

System Software and Operating System

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: System V/s Application Software, Relative advantage and disadvantages of Machine, Assembly and High-Level Languages; Language Translators: Assembler, Compiler and Interpreter; Macros, Debuggers, Text editors, Debug monitor; Overview of Loading, Linking and Relocation.

Basics of Operating Systems: Evolution, Objectives & Functions, Characteristics; Classification of Operating Systems, Windows v/s Linux Operating Systems, Mobile Operating Systems, Network based Operating Systems.

Process Concepts: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching.

UNIT-II

Threads: Multicore Programming, Multithreading Models, Threading Issues.

Process Scheduling: Definition, Preemptive v/s Non-preemptive Scheduling, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, RR etc; Multiprocessor scheduling, Scheduling Algorithm Evaluation.

Process Synchronization: Critical Section Problem, Peterson's Solution, Hardware Solution, Semaphores, Classical Problems of Synchronization: Reader's & Writer Problem, Dinning Philosopher Problem; Monitors.

UNIT-III

Deadlocks - System Model. Deadlock Principles, Deadlock Characterization. Methods for Handling Deadlocks Deadlock Prevention, Deadlock Avoidance: Resource Allocation Graph Algorithm, Banker's Algorithm; Deadlock Detection, Recovery from Deadlock.

Memory Management: Basic Memory Management, Logical and Physical address map, Memory allocation, Fragmentation and Compaction, Paging and its disadvantages, Virtual Memory, Locality of reference, Page Fault, Working Set, Demand paging concept, Page Replacement policies.

Overview of Input/Output & File Management, Disk Scheduling Algorithms.

UNIT-IV

Linux Operating System: Design Principles, Kernel Modules, Shells, Editors, Process Management, Scheduling, Memory Management, File Systems, Input and Output; Interprocess Communication, Network Structure.

Linux Utilities: File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text Processing utilities and backup utilities.

Shell programming: Introduction, shell responsibilities, pipes and Redirection, Running a shell scripts, The shell as a programming language, Shell meta characters, File name substitution, Shell variables, Command substitution, Shell commands, The environment, Quoting, Test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

Textbooks & References:

1. Silberschatz & Galvin: Operating System Concepts. Wiley.
2. A.S. Tanenbaum: Modem Operating Systems, Pearson/PHI.
3. Dhamdhere: Operating Systems, Tata McGraw Hill.
4. William Stallings: Operating Systems. PHI.
5. Yashawant Kanetkar: Unix Shell Programming. BPB.
6. Jason Cannon: Linux For Beginners.

MCA-103

Object Oriented Programming Using C++

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Software crisis, Evolution of Programming Paradigms: - Procedural, Structured, Function-oriented, Object based and Object-Oriented Programming Languages; Functional Abstraction v/s Data Abstraction, Object Oriented Programming Paradigm: concept of Classes, Objects, Data Encapsulation, Inheritance, Polymorphism, Dynamic Binding and Message Passing.

Recap of C++: C vs C++, Why named C++, Tokens, Keywords, Identifiers, Constants, Data Types: Basic, User Defined and Derived, Type Compatibility, Declaring Variable, Dynamic Initialization of Variables, Reference Variables, Operators not in C but available in C++, Operator Precedence, Special Assignment Expressions, Implicit Conversion, Control Structures in C++, Structure of C++ program.

Functions in C++: Role of Main Function, Function Prototyping, Call by Reference and Return by Reference, Default Arguments, const Arguments, Function Overloading.

UNIT-II

Classes & Objects: C struct v/s C++ struct, Specifying Class, Implementing Data Hiding and Data Encapsulation through **private** and **public** Access Specifiers, Defining Member Functions, Inline Functions, Nesting of Member Functions, Arrays within Class, Creating Objects, Array of Objects, Memory Allocation for Objects, Static Data Members and Member Functions, Objects as Function Arguments, Returning Objects, Friendly Functions, **const** Member Functions, Pointers to Members, Local Classes.

Constructors: Concept, Purpose and Usage, Type of Constructors in C++: Default, Parameterized and Copy Constructors, Overloading of Constructors and Multiple Constructors, Constructors with Default Arguments, Dynamic Initialization of Objects, Dynamic Constructors, **const** Objects.

Destructors: Concept, Purpose and Usage.

UNIT-III

Inheritance: Concept of Reusability, Defining Derived Class, **protected** Access Specifier, Inheritance Types in C++: Single, Multilevel, Multiple, Hierarchical and Hybrid Inheritance; Ambiguity Resolution in Multiple Inheritance, Virtual Base Class, Abstract Class, Constructors in Derived Classes, Member Classes.

Operator Overloading: Concept, Operators that can't be overloaded, Defining Operator Overloading, Overloading Unary Operators, Overloading Binary Operators using Member Functions and Friend Functions, Rules for Operator Overloading, Operators where Friend Function cannot be used, Overlading Assignment Operator, Type Conversions.

Polymorphism: Concept, Compile Time Vs Run Time Polymorphism, Pointers in C++, **this** Pointer, Pointers to a Derived Class, Virtual and Pure Virtual Functions, Late Binding with Virtual Functions.

UNIT-IV

I/O in C++: C++ Streams and Stream Classes, Overloading '>>' and '<<' Operators, Unformatted I/O Operations, Formatted I/O Operations, Managing Output with Manipulators, Classes for File Stream Operations, Opening and Closing a File, Detecting End of File, Sequential Input and Output Operations.

Templates: Concept, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters, Overloading a Template Function, Non-Type Template Arguments,

Standard Template Library: Concept, STL in C++, Components of STL: Containers, Algorithms and Iterators.

Textbooks & References:

1. Bjarne Stroustrup: The C++ Programming Language, Addision-Wesley.
2. E. Balaguruswamy: Object Oriented Programming and C++, TMH.
3. Herbert Schildt: C++ - The Complete Reference. Tata McGraw Hill Publications
4. R.Rajaram: Object Oriented Programming and C++, New Age International.
5. Subburaj: Object-Oriented Programming with C++, VIKAS Publishing House.
6. Robert Lafore: Object Oriented Programming in C++, Galgotia.
7. V. Aklecha: A Comprehensive Guide to C++, BPB.

MCA-104
Data Communication and Computer Networks

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Computer Networks: Why Computer Networks; Network Topologies; Classification based on Size: Personal Area Networks, Local Area Networks, Metropolitan Area Networks, Wide Area Networks; Internetworks, Network Software: Protocol and Protocol Hierarchy, Design Issues for Layers; Connection Oriented Vs Connectionless Service, Service Primitives, The Relationship of Services to Protocols, Reference Models: The OSI Reference Model, The TCP/IP Reference Model, Comparison of OSI and TCP/IP Models; The ARPANET; Architecture of the Internet; Network Standardization.

Data Communication: Components of a Data Communication System, Simplex, Half-Duplex and Duplex Modes of Communication, Analog and Digital Signals, Noiseless and Noisy Channels, Bandwidth, Throughput and Latency, Digital and Analog Transmission, Repeaters, Hubs, Bridges, Switches, Routers and Gateways.

UNIT-II

The Physical Layer: Fourier Analysis, The Maximum Data Rate of a Channel: Nyquist's Theorem v/s Shannon Capacity; Guided Transmission Media: Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics; Wireless Transmission: The Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission, Light Transmission; Communication Satellites; Satellite v/s Fiber; Digital Modulation and Multiplexing: Baseband Transmission, Passband Transmission, Frequency Division Multiplexing, Wavelength Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing; Switching: Circuit Switching, Packet Switching, Message Switching;

The Data Link Layer: Design Issues: Service to Network Layer, Framing, Error Control, Flow Control; Error Detection and Correction: Error Correcting Codes v/s Error Detecting Codes, Hamming Codes, Convolution Codes, Reed Solomon Codes, Checksum, CRC; Elementary Data Link Protocols: A Utopian Simplex Protocol, A simplex Stop and Wait Protocol; Sliding Window Protocols: A One Bit Sliding Window Protocol, A Protocol Using Go-Back-N, A Protocol Using Selective Repeat; ADSL, HDLC.

UNIT-III

The MAC Sublayer: Purpose; The Channel Allocation Problem: Static v/s Dynamic Channel Allocation; Multiple Access Protocols: ALOHA, CSMA, CSMA/CD, Collision Free Protocols, Limited Contention Protocols; Wireless LAN Protocols: Hidden Terminal and Exposed Terminal Problems; Ethernet, Virtual LANs.

The Network Layer: Design Issue: Store and Forward Packet Switching, Service to Transport Layer, Connectionless v/s Connection Oriented Service; Routing Algorithms: Adaptive v/s Nonadaptive Algorithms, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing and the Count to Infinity Problem, Link State Routing, Hierarchical Routing, Broadcast v/s Multicast Routing, Unicast v/s Anycast Routing; Congestion Control Algorithms: Traffic Aware Routing, Admission Control, Traffic Throttling, Load Shedding; Concept of QoS;

The Network Layer in the Internet: IPv4 Structure and Address Space; Classful and Classless Addressing; Datagram, Fragmentation and Checksum; IPv6 Packet Format, Mapping Logical to Physical Address (ARP), Direct and Indirect Network Layer Delivery, Routing Algorithms.

UNIT-IV

The Transport Layer: Service to Upper Layer- Transport Service Primitives; Elements of Transport Protocol: Addressing, Connection Establishment and Release, Error Control and Flow Control, Multiplexing, Crash Recovery; Congestion Control.

The Internet Transport Protocols: TCP, UDP and SCTP Protocols; Flow Control, Error Control and Congestion Control in TCP and SCTP.

The Application Layer: The Domain Name System (DNS); Resolution: Mapping Names to Addresses and Addresses to Names; HTTP, Electronic Mail Architecture, SMTP, POP and IMAP, TELNET, FTP.

Textbooks & References:

1. A.S. Tanenbaum: Computer Networks, Prentice-Hall of India.
2. Behrouz Forouzan and S.C. Fegan: Data Communications and Networking, McGraw Hill.
3. W. Tomasi: Introduction to Data Communications and Networking, Pearson Education.
4. P.C. Gupta: Data Communications and Computer Networks, Prentice-Hall of India.
5. L. L, Peterson and B. S. Davie: Computer Networks: A Systems Approach, Morgan Kaufmann.
6. William Stallings: Data and Computer Communications, Pearson Education.

MCA-105
Artificial Intelligence

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Definition and applications of Artificial Intelligence; Approaches to AI: Turing Test and Rational Agent Approaches; Problem solving: Problem characteristics, Defining the problem as state space, Production System.

Search techniques: Brute Force v/s Heuristic Search, Hill climbing and issues, Best first search, A* algorithm, Problem reduction; Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.

UNIT-II

Expert Systems: Definition, Role of knowledge in expert system, Architecture of Expert Systems.

Expert System Development Life Cycle: Problem selection, Prototype construction, Formalization, Implementation, Evaluation.

Knowledge: Definition and Importance of Knowledge; Knowledge Based Systems.

Knowledge acquisition: Knowledge engineer, Cognitive behavior, Acquisition techniques.

Knowledge representation: Level of representation, Knowledge representation schemes, Formal logic, Inference Engine, Semantic net, Frame, Rules, Scripts, Conceptual Dependency and Ontologies, Handling Uncertainty in Knowledge.

UNIT-III

Artificial Neural Networks (ANN): Introduction, ANN v/s Biological Neural Networks; Learning in neural networks: Supervised, Unsupervised and Reinforcement Learning; Perceptions: Single Perceptron, Multi-Layer Perceptron; Back propagation networks, Self-Organizing Maps, Hopfield Network; Application of neural networks,

Fuzzy logic: Definition, Difference between Boolean and Fuzzy logic; Fuzzy Sets: 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 expert system, Inference process for fuzzy expert system, fuzzy controller; Fuzzy Control System and Fuzzy Rule Based Systems.

UNIT-IV

Programming in Logic (PROLOG): Introduction. Prolog variables, Using rules, Input and Output predicates. Fail and cut predicates, Recursion, Arithmetic operation. Compound object. Dynamic database, Lists, String. File operations.

Textbooks & References:

1. Elaine Rich, Kevin Knight: Artificial Intelligence. Tata McGraw Hill.
2. V.S. Janakiraman: Foundations of Artificial Intelligence and Expert Systems, Trinity Press
3. David W. Rolston: Principles of Artificial Intelligence and Expert System Development, McGraw Hill Book Company.
4. Carl Townsend: Introduction to Turbo Prolog, BPB.
5. Stamations V. Kartalopous: Understanding Neural Networks and Fuzzy Logic, PHI.
6. Dan W. Patterson: Introduction to Artificial Intelligence and Expert Systems, PHI

MCA-201

Database Management Systems

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Database System Concepts and Architecture: Traditional File Processing System vs DBMS, Characteristics & Advantages of DBMS, Three-Schema Architecture and Data Independence; Data Models, Schemas, and Instances; Database Languages and Interfaces; Classification of DBMS.

Data Modelling: Overview of Entity-Relationship Diagram, Relational Model - Constraints, Relational Database Schemas, Relational Algebra and Relational Calculus; Codd Rules.

UNIT-II

Normalization for Relational Databases: Functional Dependencies and Normalization;

SQL: SQL as 4GL, SQL Components: DDL, DML, DQL, DCL, TCL; Data Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection.

UNIT-III

Query Processing and Optimization: Translating SQL queries into Relational Algebra, Basic Algorithm for Executing Query Operations, Using Heuristic in Query Optimization, Using Selectivity and Cost Estimation in Query Optimization, Semantic Query Optimization.

Transaction Processing: Introduction, Desirable properties of Transactions, Schedules & Recoverability, Serialization of Schedulers, Transaction Support in SQL.

Basics of Database Security and Authorization.

UNIT-IV

Concurrency Control Techniques: Locking techniques for Concurrency Control, Concurrency Control based on Timestamp ordering, Multiversion Concurrency Control Techniques, Validation Currency Control Techniques, Granularity of data items and multiple granularity locking, Using locks for Concurrency Control in Indexes.

Database Recovery Techniques: Basic Concepts, Recovery Technique based on Deferred Update, Recovery Technique based on Immediate Update, Shadow Paging, The ARIES recovery algorithm, Database backup and recovery from catastrophic failure.

Textbooks & References:

1. Elmasri & Navathe: Fundamentals of Database Systems,5th edition, Pearson Education.
2. C. J. Date: An Introduction to Database Systems, 8th edition, Addison Wesley N. Delhi.
3. Thomas Connolly, Carolyn Begg: Database Systems, Pearson Education.
4. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-202

Theory of Computation and Compilers

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Theory of Computation: Formal Language, Language Vs Grammar, Non-Computational Problems, Chomsky Hierarchy of Languages

System Programming & Compiler: Introduction to System programs; Assembler Vs Compiler Vs Interpreter; **Structure of a Compiler:** Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol Table Management, Grouping of phases into passes, compiler construction tools. Applications of Compiler Technology.

Unit-II

Lexical Analysis: The role of lexical analyser, Lexical Analysis vs Parsing, Specification of Tokens, Recognition of Tokens, Basic introduction to *lex*.

Regular Language Models: Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA.

Unit-III

Syntax Analysis: Basic Concepts: Syntax definition, Parse Tree and Derivations, Ambiguity, Associativity & Precedence of Operations; Context Free Grammars Vs Regular Expressions; Lexical Analysis Vs Syntactical Analysis, Eliminating Ambiguity, Eliminating Left Recursion.

Parsing: Top Down Parsing: Recursive Descent, Predictive Parsing, LL(1) Grammars, Bottom up Parsing: Reductions, Handle Pruning, SR parsing, LR Parser, LALR Parser; Basic introduction to *Yacc*.

Unit-IV

Code Generation and Code Optimization: Control-flow, Data-flow Analysis, Local Optimization, Global Optimization, Loop Optimization, Peep-Hole Optimization.

Context Free Language: Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity, Equivalence of PDA's and Context Free Grammars; Properties of Context Free Language.

**An introduction to the Turing Machine and issue of unsolvable problem and computational complexity.*

*NOTE: * Not for examination purpose.*

Textbooks & References:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman: Compilers: Principles, Techniques & Tools, 2nd edition, Pearson Addison Wesley, 2007.
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, 3rd edition, Pearson Education, India, 2007.
3. K. L. P Mishra, N. Chandrashekaran, Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India, (2003).
4. Any other book(s) covering the contents of the paper in more depth.
5. **Note: Latest and additional good books may be suggested and added from time to time**

MCA-203

The JAVA Programming Language

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: The History and Evolution of JAVA, features of JAVA:- Platform independent, Robust etc, JAVA Environment. Hardware and Software Requirements, Byte Code, Installing JDK, Difference between C++ and JAVA, Command-Line Arguments, Environment Variables, System Utilities. Command-Line I/O Objects. PATH and CLASSPATH.

JAVA as Programming Language: Java as Object Oriented Language, JAVA Program Structure, JAVA literals, Data Type, Variable & Arrays in JAVA.

UNIT-II

JAVA Programming Constructs: Operators and Expressions, Precedence Rules and Associativity, Type conversion and casting, Control Structures in JAVA.

JAVA Object Oriented Basics: Classes and Objects in JAVA, Variables & Methods in Classes: declaration and invocation, constructors and garbage collection, *static and this* keywords.

UNIT-III

Inheritance in JAVA: Types, Access Specifiers, Class vs Interface, Extending vs Implementation of Interface, overloading vs overriding, Abstract Class, super & final keywords.

JAVA as Internet Programming Language: Applets: difference from normal application, life cycle, Applet tag, Passing parameters and display output. AWT: Basics, Component and Container Layouts, AWT vs Swings

UNIT-IV

Exception Handling: The concept of Exceptions. Types of Exceptions. Dealing with Exceptions, Exception Objects, Defining Your Own Exceptions.

Multithreading Programming: The Java Thread Model. Understanding Threads, The Main Thread, Creating a Thread, Creating Multiple Threads, Thread Priorities. Synchronization.

Input/Output in Java: I/O Basic, Byte and Character Structures, I/O Classes, Reading Console Input Writing Console Output, Reading and Writing on Files. Random Access Files, Storing and Retrieving Objects from File, Stream Benefits.

Textbooks & References:

1. The Complete Reference JAVA, TMH Publication.
2. E-Balagurusamy, "Programming with JAVA- A Primer" Tata McGraw-Hill Publishers.
3. Dietel and Dietel, "CORE JAVA"
4. Herbert Shield, "The complete reference-JAVA2", TMH
5. Beginning JAVA, Ivor Horton, WROX Public.
6. JAVA 2 UNLEASHED, Tech Media Publications.
7. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-204A
Software Engineering

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Software and its Characteristics, Evolving Role of Software, Software Product. Software Processes. Software Crisis. Software Engineering Evolution. Principles of Software Engineering. Programming-in-the-small vs. Programming-in-the-large. Software Components. Software Engineering Processes.

Software Life Cycle (SLC) Models: Water-Fall Model. Prototype Model. Spiral Model. Evolutionary Development Models. Iterative Enhancement Models. Object Oriented Models and other latest Models.

Software Requirements: Functional and Non-Functional. User requirements. System requirements. Software Requirements Document - Requirement Engineering Process: Feasibility Studies. Requirement's elicitation and analysis, requirements validation, requirements management.

UNIT-II

Software Design: Basic Concept of Software Design. Architectural Design. Low Level Design: Modularization. Design Structure Charts. Flow Charts. Coupling and Cohesion Measures; Design Strategies: Function Oriented Design. Object Oriented Design. Top-Down and Bottom-Up Design. User Interface Design. Programming practices and Coding standards.

Software Testing: Introduction. Verification vs. Validation. Software Reliability. Levels of Testing. Structural Testing (White Box Testing). Functional Testing (Black Box Testing).

UNIT-III

Software Quality: Attributes, Software Quality Assurance - plans & activities: Software Documentation.

Software Project Management: Project Management activities. Project Estimation. Project planning. Project scheduling.

Software Risk Management: Reactive versus Proactive Risk Strategies. Risk management activities: Software Risks (Risk Identification. Risk Projection. Risk Refinement. Risk Mitigation). Risks Monitoring and Management.

Software Measurement and Metrics: Process Metrics. Project metrics. Estimation - LOC, Halstead's Software Science. Function Point (FP). Cyclomatic Complexity Measures: Software Project Estimation Models- Empirical. Putnam. COCOMO I & II.

UNIT-IV

Software Maintenance: Need for Maintenance. Categories of Maintenance: Preventive. Corrective and Perfective Maintenance. Cost of Maintenance: Software Re- Engineering. Reverse Engineering, Software Documentation.

Software Configuration Management: SCM Activities. Change Control Process. Software Version Control: Software Reuse. Software Evolution.

CASE Computer Aided Software Engineering (CASE). CASE Tools.

Textbooks & References:

1. Rogers Pressman: Software Engineering. TMH.
2. Jalote. Pankaj: An Integrated Approach to Software Engineering. Narosa Publications.
3. Chhillar Rajender Singh: Software Engineering: Testing. Faults. Metrics. Excel Books. New Delhi.
4. Gill, Nasib Singh: Software Engineering, Khanna Book Publishing Co.(P) Ltd. New Delhi
5. Ghezzi Carlo: Fundaments of Software Engineering. PHI.
6. Fairley. R.E.: Software Engineering Concepts. McGraw-Hill.
7. Lewis. T.G.: Software Engineering. McGraw-Hill.
8. Shere: Software Engineering & Management. Prentice Hall.
9. Deutsch. Willis: Software Quality Engineering: A Total Technical and Management Approach. Prentice Hall.
10. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-204B
Soft Computing

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Introduction to soft computing, Soft Vs Hard Computing, Different Components of Soft Computing: Artificial Intelligence Systems, Neural Networks, Fuzzy Logic, Genetic Algorithms.

Genetic algorithms: Basic concepts; Encoding; Fitness Function; Reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections; Convergence of GA, Problem Solving using GA.

UNIT-II

Artificial Neural Networks: Introduction to biological and artificial neural network; Different artificial neural network models; Supervised, Unsupervised and Reinforcement Learning; Hebbian Learning, Generalized Hebbian learning algorithm.

Artificial Neural Networks Architecture: Basic building block of an artificial neuron, Activation functions, Introduction to Early ANN architectures: McCulloch & Pitts model; Single Perceptron, Backpropagation networks; Multi-Layer Perceptron; Hopfield Network; **Applications of Neural Network.**

UNIT-III

Fuzzy systems and applications: 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

Applications: Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Natural Language Processing.

Suggested Books:

1. M. Mitchell: An Introduction to Genetic Algorithms, Prentice-Hall.
2. J.S.R.Jang, C.T.Sun and E.Mizulani; Neuro-Fuzzy and Soft Computing, PHI, Pearson Education.
3. Timothy J.Ross: Fuzzy Logic with Engineering Applications, McGraw-Hill.
4. Davis E. Goldberg: Genetic Algorithms: Search, Optimization and Machine Learning. Addison Wesley.
5. S. Rajasekaran and G.A.V.Pai: Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI.
6. D. E. Goldberg: Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley.
7. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-204C

Discrete Structures and Optimization

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Mathematical Logic: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.

Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering.

UNIT-II

Counting, Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction, Probability, Bayes' Theorem.

Boolean Algebra: Boolean Functions and its Representation, Simplifications of Boolean Functions.

UNIT-III

Group Theory: Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Colouring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut-Sets.

UNIT-IV

Optimization: Linear Programming - Mathematical Model, Graphical Solution, Simplex and Dual Simplex Method, Sensitive Analysis; Integer Programming, Transportation and Assignment Models, PERT-CPM: Diagram Representation, Critical Path Calculations, Resource Levelling, Cost Consideration in Project Scheduling.

Suggested Books:

1. C L Liu, Elements of Discrete Mathematics, Second Edition, Tata McGraw-Hill.
2. J P Tremblay and R Manohar, Discrete mathematical structures with applications to Computer Science, Tata McGraw-Hill.
3. Bernard Kolman, Robert C Busby, and Sharon Cutler Ross, Discrete Mathematical Structures, fifth edition, Prentice-Hall of India.
4. Lipschutz, Seymour: Discrete Mathematics, Schaunvs Series
5. Babu Ram: Discrete Mathematics. Vinayek Publishers, New Delhi.
6. Kenneth H. Rosen: Discrete Mathematics and its applicatioas, TMH.
7. Doerr Alan & Levasseur Kenneth: Applied Discrete Structures for Computer Science, Galgolia Pub. Pvt. Ltd.
8. Gersting: Mathematical Structure for Computer Science, WH Freeman & Macmillan.
9. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-204D

Wireless Networks & Mobile Computing

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: History and challenges of wireless communications; Wireless Channel Characterization: Multipath propagation environment, LTI channel model, Channel correlation function, Large scale path loss, Small scale multipath fading.

WLAN technologies: Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART.

Unit-II

Mobile Technology: Evolution of Mobile Radio Communication, Generations upto 5G; Cellular concept: Spectrum reuse and re-farming; Cell cluster concept; Co-channel and adjacent channel interference; Cell site call blocking and delay; Channel allocation strategies, Hand off strategies.

Mobile Radio Propagation: Large Scale Fading: Free space propagation model. Three basic propagation mechanisms. Reflection, Ground Reflection (Two-Ray) Model, Diffraction,

Scattering, Small Scale Fading: Multipath Propagation, Types of small scale fading, Fading effects due to multipath time delay Spread and Doppler spread.

Unit-III

Mobile Network Layer: Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol; Mobile ad-hoc networks: Introduction, Routing: Source vs Destination Initiated, IoT: CoAP
Mobile Transport Layer: Implications of mobility on Classical TCP, TCP enhancements for wireless networks, Indirect TCP, Snooping TCP, Mobile TCP, TCP over 3G.

Unit-IV

3G Overview: Overview of UTMS, Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment.
4G Overview: 4G vision, 4G features and challenges, Applications of 4G, 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.
5G Overview: 5G architecture and design objective, 5G spectrum requirements, Millimeter wave propagation, 5G Protocol Stack, 5G RAN & Dynamic CRAN, Distributed massive MIMO principle.

Suggested Books:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice. 2nd Edition. Pearson Education, 2003.
2. Andreas F.Molisch - Wireless Communications, John Wiley, 2nd Edition, 2006.
3. Kamilo Feher - Wireless Digital Communications. PHI, 2003
4. W.C.Y. Lee - Mobile Cellular Communications. 2nd Edition, MC Graw Hill. 1995.
5. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.
   Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-205A

Computer System Architecture

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Number System: Binary. Octal Hexadecimal and Decimal I's and 2's Complements, Inter conversion of numbers. Codes: Weighted and Non-weighted codes, BCD Codes, Gray codes, Self-complementing codes, Error-Detecting /Correcting codes, Alphanumeric Codes Hamming Codes. Floating Point Numbers. Binary Arithmetic: Binary Addition and Subtraction, 2's Complement Arithmetic, Booth Coding. Binary Multiplication.
Logic Design: Logic Gates, Truth Tables. Boolean Algebra, Boolean Expressions-Variables and Literals. Boolean Expressions-Equivalent and Complement, Theorems of Boolean Algebra. Simplification Techniques. SOPs & POSs Boolean Expressions.

UNIT-II

Combinational Circuits: Combinational Logic. Arithmetic Circuits- Adder and Subtracter BCD Adder. Code Converters, Magnitude Comparator, Parity Generators/Checkers, Multiplexers, Demultiplexers, Decoders. Encoders.
Sequential Circuits: Latches. R S Flip Flop, Level Triggered and Edge Triggered Flip Flops JK Flip-Flop, Master-Slave Flip Flops. T Flip-Flop. D Flip-Flops.
Registers and Counters: Controlled Buffer Registers, Shift Registers, Applications of Shift-registers; Ripple Counter, Synchronous Counter, Modulus Counter. Binary Ripple Counters, Up/Down Counters. Decade and BCD Counters.

UNIT-III

Basic Computer Design: Computer Instructions and types. Instruction Set. Instruction Cycle, Instruction Formats, Addressing Modes. Computer Registers. Bus System. Register Transfer Language terminology.

Programming in 8086/8088 Assembly Language: A/L program structure, segments, registers, instructions, macros, A/L directives.

CPU Design: CPU Registers, Micro-operations and its types, Design of ALU. Control Unit Design- Microprograms. Control Unit of a basic computer-Timing and Control: Hardwired and Micro-programmed controlled unit. Architectures -RISC. CISC, Scalar. Superscalar and pipelined architectures.

UNIT-IV

Input/Output Organization: Peripheral Devices, Input-output Interface. Asynchronous Data Transfer. Mode of Transfer, Priority Interrupt, Direct Memory Access, Input-output Processor. Serial Communication.

Advance Architecture: Introduction to parallel processing- Pipelining. Parallel Computer structures. Architectural classification. Pipelining & Vector processing; Instruction and Arithmetic pipelines. Principles of designing pipelined processors. Structures for array processors: SIMD Array processor, SIMD Interconnection networks. Parallel Processing Applications.

Suggested Books:

1. Mano,M.M.:Digital Logic and Computer Design. Prentice-Hall of India.
2. Gill Nasib Singh and Dixit J.B: Digital Design and Computer Organisation, University Science Press (Laxmi Publications).New Delhi.
3. Stallings, William: Computer Organisation & Architecture.
4. Anand Kuman: Fundamentals of Digital Circuits. PHI.
5. Kai Hwang: Advanced Computer Architecture, McGraw Hill International
6. Mano, M.M.: Computer System Architecture, Prentice-Hall of India.
7. Tokheim: Digital Electronics, TMH.
8. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-205B
Internet of Things

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Definitions, Motivation, Impact & Challenges, IoT vs WoT, Functional Requirements; Web 3.0 view of IoT, DNA of IoT: Device, Connect & Manage; IoT Security & Vulnerability.

Four Pillars of IoT: M2M, RFID, WSN, SCADA, Communication Middleware for IoT.

UNIT-II

Communicating smart objects: *Standard Wireless Access Technologies:* IEEE Technologies - IEEE 802.15.4, IEEE 802.15.4e, IEEE 802.11ah, IEEE 1901.2a, Mobile - 2G, 3G, Standard LTE, 4G; *Private Long Range Access Technologies:* LoRAWAN, ZigBee, SigFox, DASH7; *Portable Short Range Access Technologies:* NB-IoT, Z-Wave, Bluetooth Low Energy;

IoT Network Layer: IP as IoT Network layer, 6LoWPAN, 6Lo, 6T1SCH, RPL, CORPL, CARP.

UNIT -III

IoT Application Layer: MQTT, SMQTT, CoAP, AMQP, XMPP, DDS.

Protocol Standardization for IoT: IoT Protocol Standardization Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Introduction of Unified Data Standards.

UNIT-IV

Implementing IoT: Examples and working principles of sensors and actuators, Setting up the board, Reading from Sensors Communication: Arduino microcontroller and programming.

Ubiquitous IoT: IoT in Big Data, Cloud Computing, Applications of IoT: Smart Building, Smart Home, Smart City, Smart Grid, Smart Transportation, Smart Manufacturing, Smart Healthcare.

Suggested Reading:

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou — CRC Press.
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison: Fbrian Michahelles- (Eds.) - Springer.
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press.
4. The Internet of Things: Applications to the Smart Grid and Building Automation by- Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, 'The Internet of Things — Key applications and Protocols", Wiley.
6. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-205C

Computer Graphics

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Basics of Computer Graphics: Computer Graphics. Classification. Applications of computer graphics, Display devices. Random and Raster scan systems, Graphics input devices. Graphics software and standards.

Graphics Primitives: Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-filL character generation, line attributes, area-fill attributes, character attributers.

UNIT-II

2D Transformation and Viewing: Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (Cohen-Sutherland. Liang-Barsky, NLN), polygon clipping.

3D Concepts and Object Representation: 3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods. Bazier curves and surfaces, B-spline curves and surfaces.

UNIT-III

3D Transformation and Viewing: 3D scaling, rotation and translation, composite transformation, viewing pipeline and coordinates, parallel and perspective transformation, view volume and general (parallel and perspective) projection transformations. Modelling: Wireframe and Solid.

Hidden Surfaces: Visible surface detection concepts, Back-face detection. Depth Buffer method. Illumination. Light sources. Illumination methods (ambient, diffuse reflection, specular reflection). Color models: properties of light, XYZ, RGB. YIQ and CMY color models. Shading: Flat, Gouraud and Phong.

UNIT-IV

Multimedia Basics: Concepts of Multimedia. Multimedia applications. Multimedia system architecture, Evolving technologies for multimedia. Defining objects for multimedia systems, Multimedia data interface standards. Multimedia databases. Compression and decompression: Data and file format standards. Multimedia I/O technologies. Digital voice and audio. Video image and animation. Full motion video. Storage and retrieval technologies.

Multimedia Authoring: Concept of Multimedia Authoring, Hypermedia messaging, Mobile messaging. Hypermedia message component. Creating hypermedia message. Integrated multimedia message standards. Integrated document management. Distributed multimedia systems.

Case Study (FLASH/ BLENDER): Drawing Basic Shapes. Modeling. Shading & Textures, Creating a multimedia project.

Suggested Books:

1. Donald Hearn and M.Pauline Baker: Computer Graphics, PHI Publications
2. Plastock : Theory & Problem of Computer Graphics. Schaum Series.
3. Foley & Van Dam: Fundamentals of Interactive Computer Graphics. Addison-Wesley.
4. Newman : Principles of Interactive Computer Graphics. McGraw Hill.
5. Tosijasu. L.K. : Computer Graphics. Springer-Verlag.
6. S Gokul: Multimedia Magic, BPB Publication.
7. Bufford: Multimedia Systems. Addison Wesley.
8. Jeffcoate : Multimedia in Practice. Prentice-Hall.
9. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-205D

Advanced Algorithms

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

The Role of Algorithms in computing: Analyzing Algorithms, Time and Space Analysis of Algorithms, Big-Oh and Theta Notations, Average. Best and Worst case analysis. Designing Algorithms, Growth of functions. Asymptotic Notations. Divide and Conquer. Recurrences, Maximum sub-array problem, Stressan's Method, Substitution method. Recurrence tree method. The Master method, Floors and Ceilings.

UNIT-II

Trees : Binary tree traversal methods: Pre-order, In-order, Post-ordered traversal. Recursive Algorithms. Traversal methods. Representation of trees and its applications: Binary tree representation of a general tree. Conversion of forest into tree. Threaded binary trees. Binary search tree: Height balanced (AVL) tree, B-trees, Splay tree. Heap: Heap operations, Binomial heaps. Fibonacci heaps, Skew heaps, heap set.

UNIT-III

Graphs & Algorithms: Representation. Type of Graphs. Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs. Isomorphism, Graph Coloring. Covering and Partitioning, Depth-and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms. Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Maxflow: Ford-Fulkerson algorithm, max flow -min cut.

UNIT-IV

Dynamic Programming: Backtracking Algorithms. Design Methodologies, Travelling salesperson problem, 0/1 Knapsack problem, multistage graphs. All Pair Shortest Path, 8-

Queens problem Advanced String Matching Algorithms: Naive string matching algorithm, Robin-Karp algorithm, string matching with finite automata, Knuth-Morris-Pratt algorithm. P, NP and Approximation Algorithms: Basic Concepts, Non-Deterministic algorithms, NP Complete and NP-hard classes. NP complete Problems.

Implementation of above-mentioned data structures & algorithms through C++/Java programming.

Suggested Books:

1. Thomas H. Cormen. Charles E. Leiserson. Ronald L. Rivest: Introduction to Algorithms, PHI Learning Pvt. Ltd.
2. Gilles Brassard. Paul Bratley: Fundamentals of Algorithms. PHI Learning Pvt. Ltd, 2011.
3. Hubbard JR: Schaum's Outline of Data Structures with C++, Tata McGraw Hills, New Delhi.
4. R. Sedgewick: Algorithms in C++, Pearson Education Asia.
5. Y.Langsam, M.J.Augenstein and A.M.Tanenbaum: Data Structures Using C and C++, Prentice Hall of India.
6. R.Kruse, C.L.Tonodo and B.Leung: Data Structures and Program Design in C, Pearson Education. New Delhi
7. G.L. Heileman: Data Structutes: Algorithms and Object Oriented Programming, Tata McGraw Hill, New Delhi
8. E. Horowitz, Salmi and D. Mehta: Fundamentals of Data Structures in C++, Galgotia Publication, New Delhi.
9. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-301
Machine Learning with Python

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Machine Learning Introduction: Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations. Tools and software for machine learning, Introduction to Machine learning Paradigms.

Supervised Learning: Introduction to Supervised learning, Supervised Learning concepts, Linear Regression, Logistic regression, K-NN classification, Naïve Bayesian classifiers; SVM - (Support Vector Machines), Multiclass SVM, Regression Algorithms, Model Evaluation: Overfitting & Underfitting.

UNIT-II

Unsupervised Learning: Unsupervised Learning concepts, Clustering approaches, K-Means clustering, Hierarchical clustering, Introduction to Semi Supervised Learning, Self-learning, Co-training, Gaussian Model, Label Propagation, Graph Models, Decision Tree.

Ensemble Learning: Introduction to Ensemble Learning, Different Ensemble Learning Techniques, Bagging, Boosting, Random Forests, Stacking, Featurization, Model Selection & Tuning, Feature extraction, Model Defects & Evaluation Metrics, Model selection and tuning, Comparison of Machine Learning models.

Reinforcement Learning: Introduction to Reinforcement Learning, Reinforcement Learning framework, Dynamic programming, Monte Carlo, Temporal difference methods, Q-learning, Actor-Critic.

UNIT-III

Python Programming: Introduction to Python, Basic Syntax, Data Types, Variables, Operators, Input/output, Flow of Control , (Modules, Branching), If, If- else, Nested if-else, Looping, For, While, Nested loops, Control Structure, Break, Continue, Pass, Strings and Tuples, Accessing Strings, Basic Operations, String slices, Working with Lists, Accessing list, Operations, Function and Methods, Files, Modules, Dictionaries, Functions and Functional Programming, Declare, assign and retrieve values from Lists, Introducing Tuples, Accessing tuples, matplotlib, seaborn.

UNIT-IV

Advanced Python: Object Oriented (OOPS) concept, Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Operations Exception, Exception Handling, Python Libraries, Data migration and visualization: Pandas and Matplotlib, Database Interaction in Python, Case Studies: Mathematical computing with Python,

Data migration and visualization: Pandas and Matplotlib, Pycharm, Anaconda, Data manipulation with Pandas.

Textbooks:

1. Flach, P, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, 2012
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", First Edition, 2017.

References:

1. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies", The MIT Press
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press,
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition,
4. Tom Mitchell, "Machine Learning", McGraw-Hill,
5. Stephen Marsland, "Machine Learning - An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition,
6. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-302

Object Oriented Analysis & Design with UML

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

INTRODUCTION TO UML: Introduction to object-oriented concepts like Inheritance, Polymorphism, Information Hiding, Importance of modelling, Principles of modelling, Object oriented modelling, An overview of UML, Conceptual model of the UML, Architecture, Software development life cycle.

BASIC STRUCTURAL MODELING: Classes: Terms and concepts, Common modelling techniques; Relationships Modelling simple dependencies, Single inheritance, and structural relationships; Common mechanisms and diagrams.

ADVANCED STRUCTURAL MODELING: Advance classes, Advance relationships, Interfaces, Types and Roles, Packages, Instances.

Unit-II

THE OBJECT-ORIENTED DESIGN PROCESS: The Object and Class concepts, identifying classes, Identifying responsibilities, Relationships between Classes, Use Cases, CRC cards, UML class diagrams, Sequence diagrams, State diagrams, Using Java doc for design documentation.

GUIDELINES FOR CLASS DESIGN: An overview of the date classes in the java library, designing a day class, the importance of encapsulation, analysing the quality of an interface, programming by contract, unit testing.

Unit-III

INTERFACE TYPES AND POLYMORPHISM: The icon interface type, polymorphism, drawing shapes, the comparable interface type, anonymous classes, frames and user interface components, user interface actions, timers, designing an interface type.

PATTERNS AND GUI PROGRAMMING: Iterators, the pattern concept, the observer pattern, layout managers and the strategy pattern, components, containers, and the composite pattern, scroll bars and the decorator pattern, how to recognize patterns, putting patterns to work.

Unit-IV

INHERITANCE AND ABSTRACT CLASSES: The concept of inheritance, graphics programming with inheritance, abstract classes, the template method pattern, protected interfaces, the hierarchy of swing components, the hierarchy of standard geometric shapes, the hierarchy of exception classes, when not to use inheritance.

FRAMEWORKS: Frameworks, applets as a simple framework, the collections framework, a graph editor framework, enhancing the graph editor framework.

MULTITHREADING: Thread basics, Thread synchronization, Animations.

Textbooks:

1. Grady Booch, James Rumbaugh and Ivar Jacobson, "The Unified Modeling Language User guide.", 2nd edition, Pearson Education, New Delhi, India (2009).
2. Cay Horstmann, "Object-Oriented Design and Patterns.", Wiley India edition, New Delhi, India (2004).

References:

1. Meilir Page-Jones, "Fundamentals of Object Oriented Design in UML.", Pearson Education and NewYork (200).
2. Craig Larman, "An introduction to Object –Oriented Analysis and Design and Unified Process Appling UML and Patterns.", 3rd edition, Pearson Education, New Delhi, India (2005).
3. John W. Satzinger, Robert B Jackson and Stephen D Burd, "Object-Oriented Analysis and Design with the Unified Process.", Cengage learning, India (2004).
4. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-303

The Enterprise Architecture with .NET

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Introduction: Understanding Previous Technologies, Benefits of .NET Framework, Architecture of .NET Framework 4.0, .NET Execution Engine, Components of .NET Framework 4.0: CLR, CTS, Metadata and Assemblies, .NET Framework Class Library, Windows Forms, ASP .NET and ASP .NET AJAX, ADO .NET, Windows workflow Foundation, Windows Presentation Foundation, Windows Communication

Creating a Simple C# Console Application, Identifiers and Keywords. System Data Types, Variables and Constants: Value Types, Reference Types, Understanding Type Conversions, Boxing and UnBoxing. Namespaces, The System namespace, .NET Array Types.

UNIT-II

Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, Creating an Array of Objects, Using the Nested Classes, Defining Partial Classes and Method, Returning a Value from a Method and Describing Access Modifiers. Static Classes and Static Members, Properties: Read-only Property, Static Property, Indexers; Structs: Syntax of a struct and Access Modifiers for structs, System.Object Class, Encapsulation, Inheritance and Constructors, Polymorphism.

UNIT-III

Events: Event Sources, Event Handlers, Events and Delegates, Multiple Event Handlers.

Exception Handling: The try/catch/throw/finally statement, Custom Exception, System.Exception, Handling Multiple Exception

Understanding ADO.NET: Describing the Architecture of ADO.NET, Entity Framework. Creating Connection. Syntax for Connection Strings. Creating a Connection to a Database: OLEDB, SQL Server Database, Creating a Command Object. Working with DataAdapters: Creating DataSet from DataAdapter.

UNIT-IV

Windows Forms: Introduction, Windows Forms, A Simple Event- Driven GUI, Control Properties and Layout, Multiple Document Interface (MDI) Windows.

Web Designing: Introduction, Web Basics, Multitier Application Architecture, Your First Web Application: Building Web-Time Application, Examining Web-Time. ASPX's Code- Behind File, Understanding Master pages, Standard Web Controls: Designing a

Form, Validation Controls, GridView Control, Drop Down List, Session Tracking, ASP.NET.

AJAX: Exploring AJAX, Need for AJAX, AJAX and other Technologies, AJAX Server Controls, Script Manager control, Update Panel, Update Progress Control, Creating Simple Application using AJAX Server Controls.

Textbooks:

1. .NET 4.0 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiley- Dream Tech Press. (Chapters: 1,10,11,12,13,14 and 19).
2. Paul Deitel and Harvey Deitel, "C# 2010 for Programmers.", 4th Edition, Pearson Education.

References:

1. Andrew Trolsen, "Pro C# 5.0 and the .NET 4.5 Framework.", 6th Edition, Wiley-Appress.
2. Bart De Smet, "C# 4.0 Unleashed.", Pearson Education- SAMS Series.
3. Herbert Schildt, "Complete Reference C# 4.0.", Tata McGraw Hill, 2010
4. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-304A
Advanced JAVA

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Java Swing: Introduction to Swing, Swing features, Components Containers, Create Swing Applet, Exploring Swing: JLabel, JTextField, Swing buttons, JTabbedPane, JList, JTree, JTable.

Spring: Introduction, Architecture, Spring modules, Dependency Injection, IOC containers, Constructor Injection, Dependent Object: Constructor Injection with maps, collections, Bean Definition, Constructor Injection inheriting Bean, Developing simple Applications.

UNIT-II

JDBC: Types of JDBC Drivers, The Connectivity Model, Navigating the ResultSet object's contents, Manipulating records of a ResultSet Object through user Interface, Database Connectivity, Data Manipulation using prepared Statements;

JAVA RMI: Remote Method Invocation: RMI Architecture, A simple server client applications using RMI, Spring JDBC framework.

UNIT-III

SERVLETS: Background, Life cycle of servlet, A Simple servlet, Servlet API, Get and Post request, Accessing a Servlet using an HTML page;

JSP: – Basics and Overview , JSP architecture, JSP tags and JSP expressions, Lifecycle of a JSP Model, View Controller, JSP Objects, Working with Databases.

UNIT-IV

STRUTS AND HIBERNATE MVC Architecture: POJO class, Struts: Overview, Architecture, Struts Action Class, Using Struts HTML Tags, Developing Application with Struts, Struts –JDBC connection; Introduction to Hibernate, Hibernate Architecture, Hibernate Application.

Textbooks:

1. K.Santhosh Kumar, "Spring and Hibernate", McGraw Hill, 2013.
2. Herbert Schildt, "Java – The Complete Reference", Tata McGraw Hill, 8th edition, 2011.

References:

1. Dietel and Nieto, "Internet and World Wide Web – How to program?", PHI/Pearson
   Education Asia.
2. Hans Bergstan, "Java Server Pages".
3. Bill Siggelkow, S P D O'Reilly, "Jakarta Struts, Cookbook."
4. Wang-Thomson, "An Introduction to Web Design and Programming."
5. Knuckles, "Web Applications Technologies Concepts,", John Wiley.
6. Sebesta, "Programming world wide web.", Pearson.
7. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-304B

Server-Side Web Programming with PHP and MySQL

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Client Server Programming: Client-side programming: Creating sockets, implementing generic network client, Parsing data using String Tokenizer, Retrieving file from an HTTP server, Retrieving web documents by using the URL class, Server-side programming: Steps for creating server, accepting connection from browsers, creating an HTTP server, Adding multithreading to HTTP server.

UNIT-II

PHP Introduction: Basics: Why PHP, Features & limitations, creating dynamic webpages with PHP, creating PHP scripts; Variables, data types & constants; String literals and character encoding; variable assignment and substitution; Type conversion: explicit & automatic, Expressions and operators in PHP.

PHP Control Structures: Conditions & Branching: 'if' statement, 'switch' statement, conditional expressions; Looping structures: while, do-while & for statements.

UNIT-III

Functions in PHP: user defined functions, parameter types & return types, passing parameters by value v/s passing by refence, default parameters, include & require statements.

Arrays in PHP: creating arrays, associative arrays, array order & remove elements from array, heterogenous arrays & multidimensional arrays, 'foreach' statement, functions to create arrays, count number of elements & find min, max values in the array; sorting arrays. Strings: find length, comparing strings, finding & extracting substrings; convert strings to arrays and vice-versa; sprintf() & printf() functions.

PHP as Object Oriented programming language: Classes & Objects in PHP.

UNIT-IV

MySQL Introduction: Importance of and situations where to deploy database server; MySQL as RDBMS, Relative advantages & disadvantages of MySQL compared with other popular RDBMS like SQL Server, ORACLE etc, Reason behind popularity of MySQL for building websites, Installing MySQL & MySQL command interpreter.

Managing Database with MySQL: DDL Commands: Creating & modifying databases & tables, Defining constraints in databases, deleting database & tables; **DML Commands:** insert, update & delete data in tables, default values of attributes, auto-increment modifier; **DQL Command:** Querying with Select command, sorting & grouping command output, limiting output of command, joining two or more tables.

PHP & MySQL: Why so popular as combination, Limitations, Opening & using database connection over web database, Querying web database, Error handling, working with table structures, Formatting results, Passing data from (client) browser to the server: Processing Form data, Relative advantages & disadvantages of GET & POST methods, Passing data with URLs, Passing data with embedded links; Setting & accessing variables with $_COOKIE, $_ENV, $_SESSION, $_SERVER etc.

Suggested Books:

1. Hugh E Williams & David Lane, "PHP & MySQL", O'Reilly, Second Edition, 2019.
2. Steven Holzner, "PHP: The complete Reference.", McGraw-Hill.
3. Lynn Beighley & Michael Morrison, "Head First PHP & MySQL.", O'Reilly Press
4. Vikram Vaswani, "PHP: A Beginner's Guide.", McGraw-Hill Education.
5. Joel Murach & Ray Harris, "Murach's PHP and MySQL.", Mike Murach & Associates.
6. Robin Nixon, "Learning PHP, MySQL, JavaScript, & CSS: A Step-by-Step Guide to Creating Dynamic Websites.", O'Reilly Press
7. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-304C
Statistical Computing

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Basic Statistics: Frequency distribution, Data Charts: Histogram, Pie charts, Bar charts, Pareto charts, Scatter plots, Line charts; Moments, Measures of central tendencies (Grouped & Ungrouped data): Mean, Median, Mode, Percentiles, Quartiles, and their relative characteristics.

Measures of dispersion: Range, Interquartile range, Mean absolute deviation, variance, standard deviation, coefficient of variance, z-scores; Measure of shape: Skewness & Kurtosis; Correlation coefficient, Regression.

UNIT-II

Probability Distributions: Basic concepts: Probability, Laws of probability, Conditional probability, Bayes' rule; Discrete Probability Distributions: Binomial distribution, Poisson distribution, Applications; Continuous Probability Distributions: Normal distribution, Exponential distribution, Applications.

Sampling: Need for Sampling, Random v/s non random sampling, Sampling errors, Central Limit Theorem.

UNIT-III

Time Series Forecasting: Introduction to forecasting, time-series forecasting, applications, measurement of forecasting error, mean absolute deviation, mean square error, smoothing techniques, trend analysis, seasonal effects, autocorrelation and autoregression.

Tests of significance: Null Hypothesis, Alternate Hypothesis, z-test, t-test, Analysis of Variance (ANOVA), Applications.

UNIT-IV

The R Language: Introduction to R Package, Important Features, Why is R used for Statistical Computing, Start & Quit R, R environment, Data Structures, Variables, Vectors and Vector Arithmetic, Matrices & Arrays, Relational Operators, Flow Control: for, if, while loops; Functions, Statistical Computing with R: Data analysis using graphical displays in R, Regression, Analysis of Variance.

Suggested Books:

1. Affi, A.A., "Statistical Analysis: A Computer Oriented Approach". Academic Press, New York, 1979. Hogg. R. V. et. al., "Introduction to Mathematical Statistics", American Publishing, New York. 1980.

2. Ken Black, "Business Statistics for Contemporary Decision Making", Wiley Student
Edition, 2010.
3. David P. Doane, Lori E. Seward, "Applied Statistics in Business and Economics" Tata McGraw-Hill, 2010
4. Anderson, Sweeney, Williams, "Statistics for business and economics", 9th edition,
5. Bharat Jhunjhunwala, "Business Statistics", first edition, S Chand, 2008.
6. Richard Levin, David Rubin, "Statistics for Management", 7th edition, PHI
7. Nabendu Pal, Sahadeb Sarkar, "Statistics-Concepts and Applications", 2nd edition, PHI
8. J. Susan Milton & Jesse Arnold, "Introduction to Probability & Statistics: Principles & Applications for Engineering & Computing Sciences", McGraw-Hill Education
9. S P Gupta, "Statistical Methods", 30th edition, S Chand.
10. Alain F. Zuur, Elena N.Leno and Erik H.W.G. Meesters, "A Beginner's Guide to R.", Springer.
11. W. John Braun and Duncan J. Murdoch, "A First Course in Statistical Programming with R." Cambridge University Press.
12. Brain S. Everitt and Torsten Hothorn, "A Handbook of Statistical Analyses using R." CRC Press.
13. Any other book(s) covering the contents of the paper in more depth

Note: Latest and additional good books may be suggested and added from time to time

MCA-304D
Network Programming

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Introduction: Network architecture: Overview of TCP/IP protocols, TCP & IP headers, IPv4 & IPv6 address structures.

Web Programming & Security: Java network programming, packages, RMI, Overview of Javascript, WAP architecture & WAP services, Web databases, Component technology, CORBA concept, CORBA architecture, CGI programming, Firewall & security technique, Cryptography, Digital Signature.

UNIT-II

Socket Programming: Introduction, Creating sockets, socket address structures, JAVA socket programming, Berkeley sockets, Byte manipulation & address

conversion functions, Elementary socket system calls – socket, connect, bind, listen, accept, fork, exec, close; TCP ports (ephemeral, reserved), TCP Echo Server, TCP Echo Client, POSIX Signal handling, I/O asynchronous & multiplexing models, select & poll functions, socket implementation (client & server programs), UNIX domain protocols.

Unit-III

Elementary UDP sockets: UDP echo Server, UDP echo Client, Multiplexing TCP and UDP sockets. Ipv4 and Ipv6 interoperability, Threaded servers, Mutexes, Raw sockets: raw socket creation, raw socket output, raw socket input; ping program, trace route program.

APIs & Winsock Programming: Windows socket API, Window socket & blocking I/O model, blocking sockets, blocking functions, timeouts for blocking I/O, API overview, Different APIs & their programming technique, DLL & new API's, DLL issues.

Unit-IV

Software Defined Networking: Evolving network requirements, The SDN Approach: Requirements, SDN Architecture, Characteristics of Software Defined Networking; SDN data plane: Data plane Functions, Data plane protocols; SDN Control Plane Architecture: Control Plane Functions; SDN Application Plane; Network-Function Virtualization (NFV) and Virtual Network Functions (VNF).

Suggested Books:

1. William Stallings, "Foundations of Modern Networking", Pearson Ltd.,2016.
2. W.Richard Stevens, "Advanced Programming in the UNIX Environment", Addison Wesley.
3. W. Stevens, Bill Fenner, Andrew Rudoff: UNIX Network Programming -Volume 1 (The Sockets Networking API), Pearson Education/Prentice-Hall International.
4. Meeta Gandhi,Tilak Shetty and Rajiv Shah: The 'C' Odyssey Unix –The open Boundless C, BPB Publications.
5. Steven.W.R: UNIX Network Programming (Volume I& II), PHI.
6. Bobb Quinn and Dave Schutes: Window Socket Programming by
7. Davis.R.: Windows Network Programming, Addison Wesley.
8. Baner .P.: Network Programming With Windows Socket, Prentice Hall.
9. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014.
10. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013W.C.Y. Lee - Mobile Cellular Communications. 2nd Edition, MC Graw Hill. 1995.
11. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.
12. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-304E
Modeling & Simulation

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Introduction: System, environment, input and output variables; State variables; Static and Dynamic systems; Hierarchy of knowledge about a system and Modeling strategy.

Introduction to Simulation: Simulation, Why simulation: Advantages & Disadvantages, Areas of application, Model of a system, Types of models; Steps in a simulation study, Simulation of continuous and discrete processes, Hybrid Simulation, Representation of time, Simulation Clock and Time Management.

Unit-II

Models of Arrival Processes: Importance & Characteristics, Poisson Processes, Non-Stationary Poisson Processes, Batch Arrivals, Probability and Monte Carlo Simulation.

Models of Queuing System: Queuing system importance, Characteristics & applications, Models of Queuing System, Single server and Multiple server Queueing Systems, Measurement of performance.

Random Numbers: Importance & characteristics, Pseudo Random Numbers, generation of random numbers, Tests for Randomness.

Unit-III

Analysis of Simulation Output: Input Modelling: Data collection, Identification and distribution with data, parameter estimation; Stochastic nature of output data, Measures of Performance and their estimation, Goodness of fit tests, Confidence Intervals and Hypothesis Testing, Estimation methods, Simulation run statistics, Elimination of initial bias.

Verification and Validation: Model Building: Design & verification of simulation models, Validation of models & calibration, Three-Step Approach for Validation of Simulation Models.

Simulation Software: Selection of Simulation Software, Simulation packages, Trend in Simulation Software.

Unit-IV

Modelling & Simulation of Cloud, Fog & Edge Computing: Concept of and differences between Cloud, Fog & Edge Computing, Application of Cloud, Edge & Fog in healthcare centre, Computing implementation issues, iFogSim simulator and its components, Installing iFogSim, Simulating with iFogSim.

Case Study: Simulation of smart healthcare system.

Suggested Books:

1. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004
2. Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation", 2 nd Edition, Academic press 2000.
3. Shannon, R. E., "System Simulation: the Art and Science", Prentice Hall Inc. 1990.
4. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978
5. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, Discrete Event system Simulation,Pearson Education, Asia, 4th Edition, 2007
6. Rajkumar Buyya & Satish Narayana Srirama, "Fog and Edge Computing", Willey Series on Parallel and Distributed Computing.
7. Amir Vahid Dastjerdi and Rajkumar Buyya: Fog Computing: Helping the Internet of Things Realize its Potential||, University of Melbourne.
8. Zaigham Mahmood: Fog Computing: Concepts, Frameworks and Technologies, Kindle Edition.
9. Assad Abbas, Samee U. Khan, Albert Y. Zomaya: Fog Computing – Theory and Practice, John Wiley & Sons, 2020.
10. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-305A
Cloud, Edge & Fog Computing

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Cloud computing: Concept & definitions, Characteristics of Cloud, Cloud Computing Benefits and Limitations, Evolution of Cloud Computing, NIST model, cloud cube model, Cloud Computing v/s Client Server Architecture, Cloud computing vs. Cluster computing vs. Grid computing.

Models & Services: Deployment models: public, private, hybrid & community, Deploying a web service from inside and Outside of a Cloud. Service models: IaaS, PaaS, SaaS, IDaaS, CaaS and others.

Applications: Applications areas of Cloud Computing. Cloud computing as indispensable to modern smart healthcare system, Role played by cloud computing/services during outbreak of pandemics (like Covid-19) in keeping the life moving.

UNIT-II

Cloud Management: Concept of Service Oriented Architecture, Service Oriented Architecture & Service Level Agreements (SLAs). Monitoring of an entire cloud computing deployment stack, lifecycle management of cloud services.

Virtualization: Objectives, Benefits of Virtualization, Importance of virtualization in cloud computing, Load Balancing and Virtualization, Improving Performance through Load Balancing, Hypervisors, Machine Imaging, Case Study: VMware.

Cloud Security Concepts: Cloud security challenges, Cloud security approaches, Cloud Security Alliance standards, cloud security models and related patterns.

Case Study: Cloud services offered by popular vendors like Amazon, Microsoft, Oracle. GI Cloud initiative.

UNIT-III

Fog Computing: Concept of Fog computing: Background, Motivation & Application Scenarios, Characteristics & Issues, Pros and Cons, Myths about Fog Computing, Fog Computing Services, Fog Computing Components.

Fog Protocols: Fog Protocol, Fog Kit, Proximity Detection Protocols- DDS/RTPS computing protocols.

Privacy-Preserving Computation in Fog Computing: Introduction, Concept of Block Chain, Multi-Party Computation and Block Chain.

Simulating with iFogSim

Case study: Exploiting Fog computing in Health Monitoring.

UNIT-IV

Edge Computing: Introduction, Application Scenarios, Characteristics & Issues, Edge Architectures, Edge Computing Applications. Difference between Cloud, Edge & Fog computing(s), Mobile Edge Computing.

Challenges in Federating Edge Resources: Network challenges, management challenges, other miscellaneous challenges.

Middleware for Fog & Edge Computing: Concept & importance, middleware infrastructures.

Security management in Edge Cloud Architecture.

Case study: Smart surveillance video stream processing at edge

Suggested Books:

1. Toby Velte, Anthony Velte , Robert Elsenpeter, "Cloud Computing: A Practical Approach", The McGraw-Hill.
2. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more."
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance.", O'Reilly Media Inc.
4. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms.", Wiley.
5. Nikos Antonopoulos, Lee Gillam, "Cloud Computing: Principles, Systems and Applications.", Springer, 2012.
6. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing.", Wiley-India.

7. Barrie Sosinsky, "Cloud Computing Bible.", Wiley-India.
8. Rajkumar Buyya & Satish Narayana Srirama, "Fog and Edge Computing", Willey Series on Parallel and Distributed Computing.
9. Amir Vahid Dastjerdi and Rajkumar Buyya, "Fog Computing: Helping the Internet of Things Realize its Potential.", University of Melbourne.
10. Zaigham Mahmood, "Fog Computing: Concepts, Frameworks and Technologies.", Kindle Edition.
11. Assad Abbas, Samee U. Khan, Albert Y. Zomaya, "Fog Computing – Theory and Practice.", John Wiley & Sons, 2020.
12. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-305B

Storage Area Networks & Data Centres

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Introduction: Introduction to Information storage, Evolution of storage architecture, Data center infrastructure, Virtualization and Cloud Computing, Key challenges in Managing information, Information lifecycle.

Data Center Environment: Concept**,** Components: Application, Host & Connectivity, Disk Drive components, Disk Drive Performance, Fundamental laws governing disk performance, logical components of the host, Application requirements and disk performance.

UNIT-II

Data Protection: RAID: Implementation of RAID, RAID array components, RAID Techniques, RAID levels, RAID Impact on disk performance.

Intelligent Storage System: Components of an Intelligent Storage System, Storage Provisioning, Intelligent Storage array.

Direct-Attached Storage and Introduction to SCSI: Types of DAS, DAS benefits and limitations, disk drive interfaces, Introduction to parallel SCSI, SCSI command model.

UNIT -III

Storage Area Network Technologies: The SAN and Its evolution, components of SAN, Fibre Channel Storage Area Network (FCSAN), Fibre Channel architecture, FCSAN topologies, Zoning, IP SAN and FCoE: iSCSI, FCIP, FCoE.

Network Attached Storage: Concept & Importance, General purpose servers vs NAS Devices, benefits of NAS, NAS Implementations, Components of NAS, NAS file sharing protocols, NAS I/O operations, Factors effecting NAS Performance and availability.

Storage Virtualization: Concept & importance of virtualization, Forms of Virtualization, Virtualization in SAN, SNIA Storage virtualization taxonomy, Storage virtualization configurations, Storage virtualization challenges, Types of storage virtualization.

UNIT-IV

Securing and Managing Storage Infrastructure: Information Security Framework, Risk Triad: Confidentiality, Integrity, and Availability, Storage Security Domains, Security Implementations in Storage Networking.

Managing the Storage Infrastructure: Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering.

Concept of Backup, Archive, Recovery and Replication.

Suggested Reading:

1. G. Somasundaram, A. Shrivastava, "EMC Corporation: Information Storage and Management.", 1st Edition, Wiley publishing, 2009.
2. Robert Spalding, "Storage Networks: The Complete Reference.", 1st Edition, TMH, 2003.
3. Clark Tom, "Storage Virtualization.", Addison Wesley.
4. Marc Farley, "Building Storage Networks.", 2nd Edition, Tata McGraw Hill, Osborne, 2001.
5. Meeta Gupta, "Storage Area Network Fundamentals.", 2nd Edition, Pearson Education Limited, 2002
6. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-305C

Data Mining & Warehouse

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Data Warehouse: Need for data warehouse, Definition, Goals of Data Warehouse, Challenges faced during Warehouse Construction, Advantages, Types of Warehouse: Data Mart, Virtual Warehouse and Enterprise Warehouse. Components of Warehouse: Fact data, Dimension data, Fact table and Dimension table, Designing fact tables. Pre-requisite Phases: Extract, Transform and load process. Warehouse Schema for Multidimensional data: star, snowflake and galaxy schemas.

UNIT-II

Data Warehouse and OLAP technology: Difference between OLTP and OLAP, Strengths of OLAP, Applications of OLAP. Multidimensional data models: Data Cubes & Data Cuboids, Lattice; OLAP operations: Advantages, Types (Roll up, Drill down, Pivot, Slice & Dice operations), Applications; OLAP Server: Need, Features, Types (ROLAP, MOLAP and HOLAP).

Data warehouse Implementation, Introduction to efficient computation of data cubes.

UNIT-III

Data Mining Concepts: Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues, Applications, Data Objects and Attribute types, Statistical description of data; Data Pre-processing – Cleaning, Integration, Reduction, Transformation and Discretization; Data Visualization, Data similarity and dissimilarity measures.

Frequent Pattern Analysis: Mining Frequent Patterns, Associations and Correlations; Mining Methods- Pattern Evaluation Method, Pattern Mining in Multilevel; Multi-Dimensional Space – Constraint Based Frequent Pattern Mining; Classification using Frequent Patterns.

UNIT-IV

Classification and Clustering: Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Model Evaluation and Selection, Techniques to improve Classification Accuracy, Clustering Techniques: Cluster analysis, Partitioning Methods - Hierarchical Methods, Density Based Methods, Grid Based Methods; Evaluation of clustering, Clustering high dimensional data, Clustering with constraints, Outlier analysis-outlier detection methods.

WEKA Tool: Introduction to Datasets, WEKA sample Datasets, Data Mining Using WEKA tool.

Suggested Books:

1. Jiawei Han & Micheline Kamber, "Data Mining - Concepts & Techniques.", Harcourt India PVT Ltd. (Morgan Kaufmann Publishers).
2. I.H. Whiffen, "Data Mining, Practical Machine Learning tools & techniques with Java.", Morgan Kanffmen
3. A.K. Pujari, "Data Mining Techniques.", University Press.
4. Pieter Adriaans, Dolf Zantinge, "Data Mining.", Addition Wesley.
5. David Hand, Heikki Mannila and Padhraic Smyth, "Principles of Data Mining." , PHI Publication.
6. W.H. Inmon, "Building Data Ware House.", John Wiley & Sons.
7. S . Anahory and D.Murray, "Data warehousing.", Pearson Education, ASIA.
8. Jiawei Han and Micheline Kamber, "Data Mining - Concepts & Techniques: Harcourt India PVT Ltd.", Morgan Kaufmann Publishers.
9. Michall Corey, M.Abbey, I Azramson and Ben Taub, "Oracle 8i Building Data Ware Housing." , TMH.
10. A.K. Pujari, "Data Mining Techniques.", University Press.
11. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-305D
Advance Computer Architecture

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Evolution of Computer Architecture: Introduction of computer architecture, Elements of Modern Computers, Evolution of Computer Architectures, Classification of parallel computers, System attributes to performance; Multiprocessors and Multicomputer: Shared Memory Multiprocessors, Distributed Memory Multicomputer; Multivector and SIMD Computers; PRAM and VLSI Models.

Program and Network Properties: Conditions of Parallelism - data and resource dependences, Bernstein's conditions, hardware and software parallelism; Program Partitioning and Scheduling; Program Flow Mechanisms - Control Flow versus Data Flow, Data Flow Architecture, Demand Driven Mechanisms, Comparison of flow mechanisms.

UNIT-II

System Interconnect Architectures: Network properties and routing, Static connection Networks –Linear Array, Ring & Chordal Ring, Barrel Shifter, Fat Tree, Mesh & Torus, Systolic Arrays, Hypercubes.

Dynamic connection Networks: Digital Buses, Switch modules, MINs, Omega Network, Baseline Network, Crossbar Network.

Principles of Scalable Performance: Performance metrics and measures, Parallel processing applications: Scalability of Parallel Algorithms; Speedup Performance Laws: Amdahl's Laws for Scaled Problems, Gustafson's Law for Scaled Problems; Scalability Analysis.

UNIT-III

Memory Hierarchy Design: Memory hierarchy, Inclusion, coherence & locality; memory capacity planning; Virtual Memory technology – Models, TLB, Paging and Segmentation.

Cache Memory Organization - Cache basics & cache performance, cache addressing models & mapping, multilevel cache hierarchies, interleaved memory.

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline design, Superscalar and Superpipeline design.

UNIT-IV

Multiprocessor and Multicomputer Architectures: Multiprocessor System Interconnects – Hierarchical bus systems, Crossbar Switch and Multiport memory, Multistage and Combining networks; Symmetric shared memory architectures, distributed shared memory architectures, Cache coherence problem, Snoopy cache coherence protocol, directory-based protocols; Multicomputer Generations, Message passing mechanisms – message routing schemes, deadlock and virtual channels, flow control strategies, multicast routing algorithms.

Suggested Books:

1. Kai Hwang & Naresh Jotwani, "Advanced Computer Architecture.", McGraw-Hill.
2. Kai Hwang, "Advanced computer architecture.", TMH.
3. D.Sima, T.Fountain and P.Kasuk, "Advanced Computer Architecture-A Design space Approach.", Addison Wesley.
4. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design.", Narosa Publishing.
5. D. A. Patterson and J. L. Hennessey, "Computer organization and design.", Morgan Kaufmann
6. J.P.Hayes, "Computer Architecture and Organization.", MGH.
7. Harvey G. Cragon, "Memory System and Pipelined processors.", Narosa Publication.
8. V.Rajaraman and C.S.R.Murthy, "Parallel computer: Architecture & Programming.", PHI.
9. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization.", 5th Edition, MGH.
10. Kai Hwang and Zu, "Scalable Parallel computing.", MGH.
11. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA-305E
Advance Software Engineering

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions. All questions shall carry equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner shell set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions. Apart from compulsory Question Number 1 they will have to attempt one question from every unit.*

UNIT-I

Emerging Software Engineering Practices: Aspect Oriented Software Development, Agile Methods, Security Engineering, Client/Server Software Engineering, Software Engineering Aspects of Programming Languages.

Cleanroom Software Engineering: Approach, functional specification, design and testing.

Component-Based Software Engineering: Software Component and its Elements, Component Models - Concepts and Principles, COTS Myths, CBSE process, domain engineering, component-based development, classifying and retrieving components, economics of CBSE.

Engineering Web Applications: Web-based applications and their attributes, Web Engineering process, framework for Web Engineering, formulating, analysing web-based systems, design and testing for web-based applications.

UNIT-II

Agile Software Development: Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges.

Agile and Scrum Principles: Agile Manifesto, Twelve Practices of Extreme Programming (XP), Scrum Practices, Applying Scrum, Need of scrum, working of scrum, advanced Scrum Applications, Scrum and the Organization, scrum values.

Agile Requirements: User Stories, Backlog Management. Agile Architecture: Feature Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools.

Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test.

UNIT-III

Agile Management: Agile Metrics and Measurements, Agile approach to estimating and project variables, Agile Measurement. Agile Control: the 7 control parameters, Agile approach to Risk, Agile approach to Configuration Management, Atern Principles, Atern Philosophy, Rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools.

Scaling Agile for Large Projects: Scrum of Scrums, Team collaborations, Scrum, Estimate a Scrum Project, Track Scrum Projects, Communication in Scrum Projects, Best Practices to Manage Scrum.

UNIT-IV

DevOps: History of DevOps, DevOps vs Agile, Advantages and Disadvantages of DevOps, DevOps Stakeholders, Architecture, Components and features of DevOps, SDLC models of DevOps, Workflow and Principles of DevOps, DevOps tools, DevOps automation and automation tools, Pipeline and Methodology, Azure DevOps, AWS DevOps.

Laboratory Work: Exploring the tools related to Agile Development and DevOps, and developing small projects using this technology.

Suggested Books:

1. Roger S. Pressman, "Software Engineering a Practitioners Approach.", McGraw-Hill, Latest Edition.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices.", Alan Apt Series.
3. Cohen Mike, "Succeeding with Agile : Software Development Using Scrum.", Pearson.

4. Robert Oshana and Mark Kraeling, "Software Engineering for Embedded Systems: Methods, Practical Techniques, and Applications.", Newnes Publisher.
5. Kristin Runyan, "Introduction to Agile Methods Sondra Ashmore.", Addison-Wesley.
6. Pekka Abrahams, OutiSalo, Jussi Ronkainen and Juhani Warsta, "Agile Software Development Methods.", Review and Analysis.
7. Jim Highsmith, "Agile Project Management: Creating Innovative Products.", Second Edition, Addison-Wesley Professional.
8. James A. Crowder and Shelli Friess, "Agile Project Management: Managing for Success.", Springer.
9. Andrew Stellman, Jennifer Greene, "Learning Agile: Understanding Scrum, XP, Lean, and Kanban.", O Reilly
10. Sricharan Vadapalli, "DevOps: Continuous Delivery, Integration, and Deployment with DevOp.", Packt.
11. Janet Gregory, Lisa Crispin, "More Agile Testing: Learning Journeys for the Whole Team.", Addison Wesley.
12. http://agilemanifesto.org/
13. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time

MCA 401

Android Programming

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Mobile Applications, Characteristics and Benefits, Application Model, Infrastructure and Managing Resources, Mobile Software Engineering, Frameworks and Tools, Mobile devices Profiles.

Application Design: Memory Management, Design patterns for limited memory, Workflow for Application Development, Techniques for composing Applications, Dynamic Linking, Plug-ins and rules of thumb for using DLLs, Concurrency and Resource Management.

UNIT-II

Google Android: Introduction, JDK & ADK, Android Application Architecture, Traditional Programming Model and Android, Activities, Intents, Tasks, Services.

Android Framework: GUI and MVC Architecture, Fragments and Multi-platform development, Creating Widgets: Layouts, Shadows, Gradients; Applications with multiple screens.

Development: Intents and Services, Storing and Retrieving data, Graphics and Multimedia, Telephony, Location based services, Packaging and Deployment.

UNIT-III

Android Applications: Working with Android, Various life cycles for applications, Building an User Interface: Blank UI, Folding and Unfolding a scalable UI, Making Activity, Fragment, Multiple layouts; Content Provider, Location and Mapping: location based services, Mapping, Google Maps activity, Working with Map View and Map Activity; Sensors and Near Field Communication; Native libraries and headers, Building client server applications.

UNIT-IV

Using Google Maps, GPS and Wi-Fi Integration, Android Notification, Audio manager, Bluetooth; Camera and Sensor integration, Sending SMS, Phone Calls. Runtime Environment for Applications, Callbacks and Override in application, Concurrency, Serialization, Application Signing, API keys for Google Maps, Publishing Android Application; Introduction to Flutter, Android features, UI, implementation.

Textbooks & References:

1. Zigurd Mednieks, Laird Dornin, G, BlakeMeike and Masumi Nakamura: Programming Android, O'Reilly Publications.
2. Wei-Meng Lee: Beginning iPhone SDK Programming with Objective-C, Wiley India Ltd.
3. James C.S: Android Application development, CENGAGE Learning.
4. Gargenta M., Nakamura M.: Learning Android, O'Reilly Publications.
5. Reto Meier: Professional Android 2 Application Development, WROX Publication- Wiley-India.
6. James Edward: J2ME: The Complete Reference, James Edward – Publication.
7. Chris Haseman: Android Essentials, Apress Publication.

8. Mark L Murphy: Beginning Android - Wiley India Pvt Ltd.
9. Sayed Y Hashimi and Satya Komatineni: Pro Android – Wiley India Pvt Ltd.
10. Lauren Darcey, Shane Conder: Android Wireless Application Development, 2nd edition –Pearson Education.
11. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA-402
Client-Side Web Programming

Max. Marks: 100 (80+20) *Time: 3Hrs*

***Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I (Introduction)

Introduction: History of World Wide Web, HTML & HTTP, Scripting Language, Scripting v/s Non-Scripting Languages, Webpages: Static v/s Dynamic, Anatomy of a Webpage, The Document Object Model & Containment Hierarchy, Object Referencing, Script and 'Script For' Tag, Script Library, Role of Browsers, Role of Operating System, Concept of Client-Side Programming, Difference between Server-Side Programming and Cline Side Programming, Necessity of Client-Side Programming, Pros and Cons of Client-Side Programming.

Client-Side Scripting Languages*: Brief introduction, basic features, relative advantages & disadvantages of popular Client-Side Scripting Languages: HTML, XHTML, CSS, Java Script, JQuery, React, Angular, Vue, VB Script, AJAX.

** Create basic awareness among students about these language without getting into details.*

UNIT-II (JavaScript)

JavaScript: The JavaScript Language-History and Versions, Java v/s JavaScript, JavaScript v/s VBScript; Dynamic HTML & JavaScript, Applications of JavaScript.

JavaScript Programming Constructs: Variables and Data Types, Literals, Built-in Objects: String, Math and Date Objects; Data type conversion, Expressions and Evaluation, Operators, Control Structures, Functions: Function parameters, Variable Scope; Arrays: Creating, Accessing Array data, Parallel Arrays, Document objects in Arrays.

Host Objects: Introduction, The Window Object: Accessing Window properties & methods, creating a window, Window Properties & Methods; Location Object; History Object; Document Object; Link Object.

UNIT-III (JavaScript)

Forms: Form Object, Form Controls as Objects: Text Related Objects, Button Object, Checkbox Object, Radio Object, Select Object, Image Object & Image Rollovers; Passing Form Data and Elements to Functions; Submitting & Pre-validating Forms.

Scripting Frames: Frames: Parents & Children, Referencing among Family Members; Controlling Navigation Frames: Navigation Bars.

Other Topics: JavaScript Debuggers; Browsers and the Document Object Model (DOM), Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-Accommodating Noncompliant Browsers Properties of window.

UNIT-IV (CSS)

CSS: Introduction and Features; Difference between CSS1, CSS2 & CSS3; Style Rules, Style Rule Locations: style tag, External Style Sheets, Style definition in individual tags; CSS core syntax; Text properties; CSS box model: Box dimensions, Padding, Border, Margins; Selectors: Matching Element by Name, Universal Selector, Matching Element by Class, Matching Element by Identifier, Matching Element that contains a specific attribute, Matching child, descendent and adjacent sibling elements; Element Positioning; Control Element Visibility; Inheritance; Pseudo-Classes & Pseudo-Elements; Shorthand Expression, Property Value Metrices.

Styles & Formatting: Fonts and Text Formatting: Web typography; Describing Fonts; Font Families; Font Style & Size; Colors & Backgrounds: Foreground & Background Color; Sizing Element's Background; Background Images; Repeating & Scrolling Background Images; Positioning Background Images. Tables: Define Table Style; Control Table Attributes.

Textbooks & References:

1. Danny Goodman, "JavaScript Bible", Gold Edition, Hungry Minds
2. Brian Pfaffenberger, Steven M. Schafer, Charles White and Bill Karow, "HTML, XHTML and CSS Bible", Wiley Publishing House
3. Reference Books
4. Robin Nixon, "Learning PHP, MySQL, JavaScript, & CSS: A Step-by-Step Guide to Creating Dynamic Websites.", O'Reilly Press
5. Dietel and Nieto, "Internet and World Wide Web – How to program?", PHI/Pearson Education Asia.
6. Wang-Thomson, "An Introduction to Web Design and Programming."
7. Sebesta, "Programming world wide web.", Pearson.
8. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 403

Computer Security & Blockchain Technology

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Security Problem in Computing: meaning of Computer Security, Computer Criminals, Methods of Defense, Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption Algorithms, The Data Encryption Standard, The AES Encryption Algorithm, Public Key Encryptions, Uses of Encryption.

UNIT - II

Program Security: Secure Programs, Non-malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General-Purpose operating system protected objects and methods of protection, File protection Mechanisms, User Authenticat ion Designing Trusted O.S : Security polices, models of security, trusted O.S. design, Assurance in trusted OS. Implementation examples.

UNIT - III

Database Security: Security requirements, Reliability and integrity, Sensitive data, Inference, multilevel database, proposals for multilevel security.

Security in Network: Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-mail.

Administering Security: Security Planning, Risk Analysis, Organizational Security policies, Physical Security. Legal Privacy and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime, Praia, Ethical issues in Computer Security, Case studies of Ethics

UNIT - IV

Blockchain Technology: Cryptography - Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof; **Blockchain Overview:** Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

Blockchain Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Textbooks & References:

1. Mike Shema: Anti-Hacker Tool Kit, McGraw Hill
2. Nina Godbole and Sunit Belpure: Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
3. Achyut S.Godbole: Data Communication and Networking, McGraw –Hill Education New Delhi.
4. Forouzan: Data Communication and Networking (Global Edition) 5/e, McGraw Hill Education India.
5. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder: Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press.
6. Wattenhofer: The Science of the Blockchain.
7. Antonopoulos: Mastering Bitcoin - Unlocking Digital Cryptocurrencies.
8. Satoshi Nakamoto: Bitcoin: A Peer-to-Peer Electronic Cash System
9. Forouzan, B.A.: Cryptography & Network Security. Tata McGraw-Hill Education.
10. Kahate, A. Cryptography and Network Security. McGraw-Hill Higher Ed.
11. Peter Szor , The Art of Computer Virus Research and Defense, Symantec Press.
12. Markus Jakobsson and Zulfikar Ramzan, Crimeware, Understanding New Attacks and Defenses, Symantec Press, 2008, ISBN: 978-0-321-50195-0.
13. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
14. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', CSI Publishing Platform, 2017.
15. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 404 A
Advanced DBMS

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction to Advance Database Systems: Overview of advance database systems, their importance and Applications; **EER Model -**The ER model revisited, EER model: Super classes, Subclasses, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Category.

Object Model: Overview of Object-Oriented concepts, Object identity, Object structure, Type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Complex objects, Schema design for OODBMS, OQL, Persistent Programming language, OODBMS architectures and storage issues, Transaction and concurrency control.

Object Relational Database and Information Retrieval: Database design for an ORDBMS – Nested relations and collections; Storage and access methods, Query processing and Optimization, Advance Querying: User define data types, manipulating objects table, object views; Information Retrieval & ways to retrieve information.

UNIT - II

Parallel Database: Architectures for parallel databases, Inter and Intra Query parallelism, Inter and Intra Query operations, Parallelizing individual operations, Sorting, Joins, Pipelining.

Distributed Database: Architectures for Distributed Database, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Query processing in Distributed Databases; Concurrency Control and Recovery in Distributed Databases.

Overview of Client Server Architectures: Centralized and Client-Server architectures, Server architectures.

UNIT-III

Enhanced Data Models for Advanced Applications: Active database- syntax and semantics (DB2, Oracle), applications, design principles for active rules, Temporal database concepts, Spatial databases, Deductive databases.

Emerging Database Technologies: Mobile databases, Multimedia Databases, Geographic Information systems (GIS); XML and Internet Databases: Structured, Semi-structured and Unstructured Data, Introduction to web databases and XML, Structure of XML data.

UNIT – IV

Data Warehouse and OLAP Technology: Need for data warehouse, Definition, Goals of data Warehouse, Challenges faced during Warehouse Construction, Advantages, Types of Warehouse: Data Mart, Virtual Warehouse and Enterprise Warehouse;

Components of Warehouse: Fact data, Dimension data, Fact table and Dimension table, Designing fact tables; Pre-requisite Phases: Extract, Transform and load process; Warehouse Schema: star, snowflake and galaxy schemas; OLTP vs OLAP, Strengths of OLAP, Applications of OLAP.

Multidimensional data models: Data Cubes & Data Cuboids, Lattice; OLAP operations: Advantages, Types: Roll up, Drill down, Pivot, Slice & Dice operations, Applications; OLAP Server: Need, Types: ROLAP, MOLAP and HOLAP, Features; Data Warehouse Implementation, Introduction to Efficient computation of data cubes.

Textbooks & References:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education.
2. Korth, Silberchatz, Sudarshan: Database System Concepts, McGraw-Hill.
3. Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems, McGraw-Hill
4. Peter Rob and Coronel: Database Systems, Design, Implementation and Management, Thomson Learning.
5. C.J.Date, Longman: Introduction to Database Systems, Pearson Education.
6. Thomas Connolly, Carolyn Begg: Database Systems, Pearson Education
7. W.H.Inmon: Building Data Ware House, John Wiley & Sons.
8. S . Anahory and D.Murray: Data warehousing, Pearson Education, ASIA.
9. Jiawei Han & Micheline Kamber: Data Mining - Concepts & Techniques: Harcourt India PVT Ltd. (Morgan Kaufmann Publishers).
10. Michall Corey, M.Abbey, I Azramson & Ben Taub: Oracle 8i Building Data Ware Housing, TMH.
11. A.K. Pujari: Data Mining Techniques, University Press.
12. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 404 B

Big Data Analytics

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction To Big Data And Analytics: Classification of Digital Data, Structured and Unstructured Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Traditional Business Intelligence versus Big Data – Data Warehouse and Hadoop Environment Big Data Analytics: Classification of Analytics – Challenges – Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments - Basically Available Soft State Eventual Consistency - Top Analytics Tools.

UNIT-II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

UNIT-III

Understanding Map Reduce Fundamentals and HBase: The Map Reduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFC Files, File system types, commands, org.apache.hadoop.io package, HDF, HDFS High Availability; Introducing HBase, Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS.

UNIT - IV

Big Data Technology Landscape and Hadoop: NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFC (Hadoop Distributed File System), HDFC Daemons, read, write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets; Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

Textbooks:

1. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. Big Data, Black Book™, DreamTech Press, 2015 Edition.
3. Business Analytics 5e, BY Albright | Winston.

References:

1. Rajiv Sabherwal, Irma Becerra- Fernandez," Business Intelligence –Practice, Technologies, and Management", John Wiley 2011.
2. Lariss T. Moss, Shaku Atre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 404 C

Image Processing & Computer Vision

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Image Processing Foundations: Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

Shapes and Regions: Binary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and

shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT - II

Hough Transform: Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – Generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT - III

3D Vision and Motion: Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT - IV

Applications: Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces; Application: Surveillance – foreground- background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis; Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Textbooks & References:

1. D. L. Baggio et al.: Mastering OpenCV with Practical Computer Vision Projects||, Packt Publishing.
2. E. R. Davies: Computer & Machine Vision||, Fourth Edition, Academic Press.
3. Jan Erik Solem: Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly Media.
4. Mark Nixon and Alberto S. Aquado: Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press.
5. R. Szeliski: Computer Vision: Algorithms and Applications||, Springer.
6. Simon J. D. Prince: Computer Vision: Models, Learning, and Inference||, Cambridge University Press.
7. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA - 404 D
Deep Learning

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Concept of Deep Learning, Characteristics of Deep Learning, The "deep" in Deep Learning, Relation between Artificial Intelligence, Machine Learning and Deep

Learning, Artificial Intelligence v/s Machine Learning, Learning from data, Historical context and motivation for Deep Learning, Mechanism of Deep Learning.

Machine Learning to Deep Learning: Deep Learning v/s Machine Learning, Machine Learning: Supervised Learning, Unsupervised Learning and Self-supervised Learning; Choosing between Machine Learning and Deep Learning, Uniqueness about Deep Learning, The Modern Machine Learning landscape, Factors leading to advent of Deep Learning: Hardware, Data, Algorithms; A new wave of investment and democratization of Deep Learning.

Deep Learning at Work: Achievements thus far; Applications areas of Deep Learning like Image Recognition, NLP, Healthcare, Stock analysis, Fraud Detection, News Analysis, Self-Driving Cars etc, DeepMind & Deepfakes, Future of Deep Learning.

Unit-II

Shallow to Deep Learning: Earlier Machine Learning algorithms, Early Neural Networks, Feedforward v/s Feedback Networks.

Deep Neural Networks: Difficulty of Training Deep Neural Networks, Greedy Layer-wise Training.

Deep Learning Models*: Supervised: Classical Neural Networks (Linear Models, Multilayer Perceptron); Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN); Unsupervised: Self-Organizing Maps, Boltzmann Machines, Autoencoders.

Optimization: Division of Dataset for Training & Testing, Average Loss, Optimization Algorithms*: Gradient Descent, Stochastic Gradient Descent, Stochastic Gradient Descent with Momentum, Adam, RMSProp, AdaGrad; Regularization: Overfitting and Underfitting; Hyperparameters: Tunning/Optimization and Model Validation.

UNIT-III

Deep Reinforcement Learning: Reinforcement Learning (RL); Supervised Learning v/s Reinforcement Learning; Unsupervised Learning v/s Reinforcement Learning; Deep Reinforcement Learning (DRL); DRL v/s RL; Model Free v/s Model Based RL Algorithms; Model Free RL Algorithms*: Q-Learning, Deep Q-Networks, Policy Gradient; DRL Applications.

Deep Learning Implementation: Hardware, Datasets, Models, Frameworks; Responsible AI: Bias, Accountability & Explainability, Reproducibility, Robustness, Privacy; **Preparing to Implement:** Data pre-processing: Vectorization, Value Normalization, Handling Missing Values, Feature Engineering and Feature Learning; **Create and Train Deep Learning Models:** Training from scratch, Transfer learning and Feature Extraction; Accelerating Deep Learning with GPU.

UNIT-IV

Deep Learning for Computer Vision: Image Classification: Shortcoming of Neural Networks and Desired properties of an Image Classifier; Convolutional Neural Networks: Structure of CNN, Stacking, Striding and Pooling; Implementation in Python; **Deep Learning for Small Data Problems:** Relevance, Issue of Overfitting: Data Augmentation and Dropout layer; Implementation in Python.

Deep Learning for Text and Sequences: Recurrent Neural Network (RNN): Basic Concept, Importance, Python Implementation of Simple RNN; Vanishing Gradient Problem; Resolve with Long-Short Term Memory (LSTM) and Gated Recurrent Units (GRU); Vectorizing Text: Tokenization, Vector Encoding using one-hot encoding of tokens, Implementation in Python; Improve Performance of RNN: Recurrent Dropout, Stacking Recurrent Layer, Bidirectional Recurrent Layer; Time Series Forecasting.

* ***Basic idea, significance, and relative comparison only without mathematical details.***

Textbooks & References:

1. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville: Deep Learning, MIT Press.
2. Jeff Heaton: Deep Learning and Neural Networks, Heaton Research Inc.
3. Mindy L Hall: Deep Learning, VDM Verlag.
4. Li Deng, Dong Yu: Deep Learning: Methods and Applications (Foundations and Trends in Signal Processing), Now Publishers Inc.
5. Richard S. Sutton and Andrew G. Barto: Reinforcement Learning: An Introduction, Second Edition, MIT Press.
6. Wiering, Marco, and Martijn Van Otterlo: Reinforcement learning - Adaptation, Learning, and Optimization.
7. Russell, Stuart J., and Peter Norvig: Artificial Intelligence: A Modern Approach, Pearson Education Limited.
8. Francois Chaollet: Deep Learning with Python, Manning, 2017.
9. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 404 E

Advanced Networking

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Wireless LAN: History; Wireless Standards and Regulatory Committees: Federal Communications Commission (FCC), Institute of Electrical and Electronics Engineers (IEEE), ITU, TRAI; RF Signals: Electromagnetic Radio Spectrum, Unlicensed Frequency Bands and their importance; Modulation Techniques: DSSS, OFDM, Multiple-Input Multiple-Output (MIMO); IEEE Wireless Standards: IEEE 802.11, IEEE 802.15, IEEE 802.16; Influences on Wireless Transmission: Free Path Loss Model, Absorption, Reflection, Multipath, Scattering, Refraction, Line of Sight;

Wireless Fidelity (Wi-Fi): Concept, Wi-Fi Alliance; Wi-Fi Ubiquitous Connectivity, Wi-Fi Standards and Features, Measuring and Optimizing Wi-Fi Performance.

Bluetooth: Bluetooth Architecture, Bluetooth Applications, The Bluetooth Protocol Stack, The Bluetooth Frame Structure Wi-Fi v/s Bluetooth.

UNIT – II

Optical Networks: Optical Point to Point Links, SONET/SDH; Multiplexing: Time Division Multiplexing (TDM), Space Division Multiplexing (SDM), Wavelength Division Multiplexing (WDM); Optical TDM Networks; Optical WDM Networks; Control and Management of Optical Networks; End to End Optical Networks; Optical Switching Networks; Security in Optical Networks; Building Blocks: Components, Transmitters and Receivers; Transmission Impairments: Attenuation, Dispersion, Nonlinearities, Crosstalk, Noise.

UNIT – III

Optical Access & Local Area Network: Benefits; Ethernet Passive Optical Networks (EPONs): Fiber to the Premises (FTTP), Fiber to The Home (FTTH), IEEE 802.3ah, IEEE

Optical Access & Local Area Network: Benefits; Ethernet Passive Optical Networks (EPONs): Fiber to the Premises (FTTP), Fiber to The Home (FTTH), IEEE 802.3ah, IEEE 802.3av; Gigabit Ethernet (GbE): IEEE 802.3z, Physical Layer, MAC Layer; 10-Gigabit Ethernet (10GbE), Recent Advancements in Ethernet.

Network Layer in Internet: Basic Principles; Working of Network Layer in Internet; IPv6: Design, Header, Extension Header, Controversies, IPv4 v/s IPv6, Adoption of IPv6 in India and its expected impact; Network Address Translator: NAT Traversal, STUN, TURN and ICE; Internet Control Protocols: IMCP, ARP, DHCP; Label Switching and MPLS, OSPF, BGP, Routing in the Internet: Introduction to Intra-domain and inter-domain routings, Unicast Routing Protocols, Multicast Routing Protocols, Mobile IP.

UNIT – IV

Transport Layer in Internet: TCP v/s UDP; TCP Three Way Handshaking; TCP Congestion Control; Bandwidth Delay Product; Optimization for TCP; Transport Layer Security (TLS): TLS Handshake, TLS Session Resumption, Chain of Trust and Certificate Authorities, Certificate Revocation, TLS Record Protocol and Optimizing for TLS.

Network Latency and Bandwidth: Introduction; Bandwidth, Speed & Latency: Speed Is a Feature, Components of Latency, Speed of Light and Propagation Latency, Last-Mile Latency; Bandwidth, Delivering Higher Bandwidth and Lower Latencies.

Multimedia over Internet: Introduction to Multimedia Services; Transmission of Multimedia over the Internet; Real Time Services & QoS Parameters: Bandwidth, Delay, Jitter, Throughput; Real Time Transport Protocol (RTCP); VoIP.

Textbooks & References:

1. William Stallings, "High-Speed Networks and Internets, Performance and Quality of Service", Pearson Education, Second Edition, 2002.
2. Brandon James Carroll, "CCNA Wireless, Official Exam Certification Guide", Cisco Press
3. Martin Mayr, "Optical Switching Networks", Cambridge University Press, 2008
4. Tanenbaum and Wetherall, "Computer Networks", Prentice Hall, Fifth Edition.
5. Prof. Mayank Agarwal Prof. Dayanand Ambawade, Dr. Deven Shah and Prof. Mahendra Mehra, "Advanced Computer Network", Wiley India
6. Ilya Grigorik, "High-Performance Browser Networking", 2013: First Edition, O'Reilly E-book book also available https://hpbn.co/
7. Douglas E. Comer, "Internetworking with TCP/IP - (Vol. 1) Principles, Protocols, and Architecture", 6th Edition, Prentice Hall of India (PHI) Publishers.
8. Behrouz A. Forouzan, "TCP/IP Protocol Suite", 4th Edition, McGraw-Hill
9. W. Richard Stevens, G. Gabrani, "TCP/IP- Illustrated, Vol. 1 (The Protocols)", Pearson Publishers.
10. Chris Sanders, "Practical Packet Analysis using Wireshark to solve real world problems", No Starch Press, Inc.
11. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 405 A

Quantum Computing

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner*

will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

UNIT-I

Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms

Quantum Computation: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.

UNIT – II

Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.

UNIT – III

Quantum Information: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.

UNIT – IV

Quantum Error Correction: Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.

Textbooks & References:

1. Micheal A. Nielsen. & Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction (Scientific and Engineering Computation)", Oct 2014
3. Computing since Democritus by Scott Aaronson
4. Computer Science: An Introduction by N. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 405 B

Natural Language Processing

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction to Natural Language Processing: NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity.

Regular Expressions: Regular Expressions, Automata, Similarity Computation: Regular Expressions, patterns, FA, Formal Language, NFSA, Regular Language and FSAs, Raw Text Extraction and Tokenization, Extracting Terms from Tokens, Vector Space Representation and Normalization, Similarity Computation in Text.

Morphology and Finite-State Transducers: Inflection, Derivational Morphology, Finite-State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Combining FST Lexicon and Rules, Lexicon-free FSTs: The Porter Stemmer, Human Morphological Processing.

UNIT - II

Matrix Factorization and Topic Modeling: Introduction, Singular Value Decomposition, Nonnegative Matrix Factorization, Probabilistic Latent Semantic Analysis, Latent Dirichlet Allocation

Computational Phonology and Text-to-Speech: Speech Sounds and Phonetic Transcription, The Phoneme and Phonological Rules, Phonological Rules and Transducers, Advanced Issues in Computational Phonology, Machine Learning of Phonological Rules, Mapping Text to Phones for TTS, Prosody in TTS .

Probabilistic Models of Pronunciation and Spelling: Dealing with Spelling Errors, Spelling Error Patterns, Detecting NonWord Errors, Probabilistic Models, Applying the Bayesian method to spelling, Minimum Edit Distance, English Pronunciation Variation, The Bayesian method, Pronunciation in Humans.

N-gram Language Models: The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Smoothing, Backoff, Deleted Interpolation, N-grams for Spelling and Pronunciation, Entropy.

UNIT - III

HMMs and Speech Recognition: Speech Recognition Architecture, Overview of Hidden Markov Models, The Viterbi Algorithm Revisited, Advanced Methods for Decoding, Acoustic Processing of Speech, Computing Acoustic Probabilities, Training a Speech Recognizer, Waveform Generation for Speech Synthesis, Human Speech Recognition.

Word Classes and Part-of-Speech Tagging: Tagsets for English, Part of Speech Tagging, Rule-based Part-of-speech Tagging, Stochastic Part-of-speech Tagging, Transformation-Based Tagging.

Context-Free Grammars for English: Context-Free Rules and Trees, Sentence-Level Constructions, The Noun Phrase, Coordination, Agreement and The Verb Phrase and Sub-categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence & Normal Form, Finite State & Context-Free Grammars, Grammars & Human Processing.

UNIT - IV

Parsing with Context-Free Grammars and Features and Unification: Parsing as Search, A Basic Top-down Parser, The Earley Algorithm, Finite-State Parsing Methods, Feature Structures, Unification of Feature Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints, Types and Inheritance

Lexicalized and Probabilistic Parsing: Probabilistic Context-Free Grammars, Problems with PCFGs, Probabilistic Lexicalized CFGs, Dependency Grammars, Human Parsing, The Chomsky Hierarchy, How to tell if a language isn't regular, Natural Language Context-Free or not, Complexity and Human Processing.

Representing Meaning and Semantic Analysis: Computational Desiderata for Representations, Meaning Structure of Language, First Order Predicate Calculus, Some Linguistically Relevant Concepts, Alternative Approaches to Meaning, Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating

Semantic Analysis into the Earley Parser, Idioms and Compositionality, Robust Semantic Analysis

Text Sequence Modeling and Deep Learning: Statistical Language Models, Kernel Methods, Word-Context Matrix Factorization Models, Neural Language Models, Recurrent Neural Networks.

Textbooks & References:

1. Daniel Jurafsky and James H.Martin: Speech and Language Processing(2nd Edition),Prentice Hall:2 edition,2008.
2. Charu C.Aggarwal: Machine Learning for Text Springer,2018 edition
3. Christopher D.Manning and Hinrich Schuetze: Foundations of Statistical Natural Language Processing MIT press.
4. Steven Bird,Ewan Klein and Edward Loper: Natural Language Processing with Python,O'Reilly Media.
5. Roland R.Hausser: Foundations of Computational Linguistics:HumanComputer Communication in Natural Language,Paperback,MIT press..
6. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 405 C

Bioinformatics

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Introduction: Bioinformatics computing, Bioinformatics technologies, Structural bioinformatics, Data format and processing, Secondary resources and applications, Role of Structural bioinformatics, Biological Data Integration System.

Data Warehousing and Mining in Bioinformatics: Bioinformatics data, Data warehousing architecture, data quality, Biomedical data analysis, DNA data analysis, Protein data analysis, Machine learning, Neural network architecture and applications in bioinformatics.

UNIT – II

Modelling for Bioinformatics: Hidden Markov modelling for biological data analysis, Sequence identification, Sequence classification, Multiple alignment generation, Comparative modelling, Protein modelling, Genomic modelling, Probabilistic modelling, Bayesian networks, Boolean networks, Molecular modelling, Computer programs for molecular modelling.

UNIT – III

Pattern Matching and Visualization: Gene regulation, motif recognition, motif detection, strategies for motif detection; Visualization – Fractal analysis, DNA walk models – one dimension, two dimension, higher dimension; Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

UNIT – IV

Microarray Analysis: Microarray technology for genome expression study, image analysis for data extraction, pre-processing, segmentation, gridding, spot extraction,

normalization, filtering, cluster analysis, gene network analysis; Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

Textbooks & References:

1. Yi-Ping Phoebe Chen (Ed): BioInformatics Technologies, Springer Verlag.
2. Bryan Bergeron: Bio Informatics Computing, Pearson Education.
3. Arthur M Lesk: Introduction to Bioinformatics, Oxford University Press
4. Stanley I. Letovsky: Bioinformatics: Databases and Systems.
5. SorinDraghici: Bioinformatics Databases- Design, Implementation, and Usage, Chapman & Hall/ CRC Mathematical Biology & Medicine.
6. Arthur M.Lesk: Database Annotation in Molecular Biology- Principles and Practices.
7. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.

MCA 405 E

Software Testing & Quality Assurance

Max. Marks: 100 (80+20) *Time: 3Hrs*

Note: *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

UNIT-I

Testing Strategy and Environment: Minimizing Risks, Writing a Policy for Software Testing, Economics of Testing, Testing-an organizational issue, Management Support for Software Testing, Building a Structured Approach to Software Testing, Developing a Test Strategy Building Software Testing Process: Software Testing Guidelines, workbench concept, Customizing the Software Testing Process, Process Preparation checklist - Software Testing Techniques: Dynamic Testing – Black Box testing techniques, White Box testing techniques, Static testing, Validation Activities, Regression testing.

UNIT-II

Software Testing Strategies: Approach, Issues; integration, incremental, System, alpha, Beta testing etc; Comparative evaluation of techniques: Testing tools; Dynamic analysis tools, test data generators, Debuggers, test drivers etc.

Technical Metrics for Software: Quality Factors, framework; Metrics for analysis, design, testing source code.

UNIT-III

Object Oriented Testing: Introduction to Object Oriented testing, Path Testing, State Based Testing, Class Testing, Testing Web Applications: Web testing, Functional Testing, User interface Testing, Usability Testing, Configuration and Compatibility Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing.

Rational Rose Software: Introduction, Features, Various types of software testing using Rational Rose.

UNIT-IV

Software Quality Assurance and Standards: Software Quality, Software Quality Challenges, Software Quality factors. Software Quality Assurance: concept, components, importance and essence; FTR, structured walk through technique etc. Software Quality Management Standards, Management and its role in Software Quality Assurance, Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI.

Textbooks & References:

1. Meyers, G.: The art of Software Testing, Wiley-Inter-Science.
2. Deutsch, Willis: Software Quality Engineering: A Total Technical and Management Approach, Prentice Hall.
3. Pressman: Software Engineering, TMH.
4. Gill, Nasib Singh: Software Engineering: Reliability, Testing and Quality Assurance, Khanna Book Publishing Co.(P) Ltd, N. Delhi
5. Ghazzi, Carlo: Fundaments of Software Engineering, PHI.
6. Chhillar Rajender Singh: Software Engineering: Testing, Faults, Metrics, Excel Books, New Delhi.
7. Jalote, Pankaj: An Integrated Approach to Software Engineering, Narosa Publications.
8. Doug Bell, Ian Murrey, John Pugh: Software Engineering-A Programming Approach, Prentice Hall.
9. Any other book(s) covering the contents of the paper in more depth.

Note: Latest and additional good books may be suggested and added from time to time.