SCHEME OF EXAMINATION FOR MASTER OF COMPUTER APPLICATIONS (MCA) w.e.f. 2017-18 (CBCS)

Semester – I					
Paper No.	Title of the Paper	Credit	Maximum Marks		Total
			External	Internal	
MCA-17-11	Programming in C & Numerical Analysis	5	80	20	100
MCA-17-12	Software Engineering	5	80	20	100
MCA-17-13	Digital Electronics and Computer Organization	5	80	20	100
MCA-17-14	Web Technologies	5	80	20	100
MCA-17-15	Discrete Mathematics	5	80	20	100
MCA-17-16	Software Lab – I C (Based on MCA-101)	3	80	20	100
MCA-17-17	Software Lab - II Shell Programming (Based on MCA-104)	3	80	20	100
MCA-17-18	Seminar	1		20	20
	Total	32			720

Semester – II					
Paper No.	Title of the Paper	Credit	Maximum Marks		Total
			External	Internal	
MCA-17-21	Object Oriented Modeling and Programming using C++	5	80	20	100
MCA-17-22	Data Communication and Computer Networks	5	80	20	100
MCA-17-23	Advanced Computer Architecture	5	80	20	100
MCA-17-24	Operating System	5	80	20	100
MCA-17-25	Computer Oriented Optimization Techniques	5	80	20	100
MCA-17-26	Software Lab - III (Based on MCA-201)	3	80	20	100
MCA-17-27	Software Lab - IV (Based on MCA- 203& 204)	3	80	20	100
MCA-17-28	Seminar	1		20	20
	Total	32			720

* **Sessional Marks in each theory paper will be awarded by the concerned teacher in accordance to MCA Ordinance (CBCS)**

Note: Size of Groups for all practical and viva-voce examinations should not be more than thirty.

MCA -17- 11 PROGRAMMING WITH C& NUMERICAL ANALYSIS

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Overview of C: History of C, Importance of C, Structure of a C Program.
Elements of C: C character set, identifiers and keywords, Data types, Constants and Variables.
Operators: Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators and their hierarchy & associativity.
Input/output: Unformatted & formatted I/O function in C.
Control statements: Sequencing, Selection: if and switch statement; alternation, Repetition: for, while, and do-while loop; break, continue, goto.

UNIT-II

. Functions: Definition, prototype, passing parameters, recursion.
Storage classes in C: auto, extern, register and static storage class, their scope, storage, & lifetime.
Arrays: Definition, types, initialization, processing an array, passing arrays to functions, Strings.
Pointers: Declaration, operations on pointers, pointers and arrays, dynamic memory allocation, pointers and functions, pointers and strings.
Structure & Union: Definition, processing, Structure and pointers, passing structures to functions.
Data files: Opening and closing a file, I/O operations on files, Error handling during I/O operation, Random access to files.

UNIT-III

Computer Arithmetic: Floating-point representation of numbers, arithmetic operations with normalized floating point numbers and their consequences. Error in number representation - pitfalls in computing.
Iterative Methods: Bisection, False position, Newton-Raphson methods, Discussion of convergences, Graeffe's Root Squaring Method and Bairstow's Method.

UNIT-IV

Solution of Simultaneous Linear Equations and ordinary Differential Equations: Gauss elimination method, Ill-conditioned equations, Gauss-Seidal iterative method, Euler method, Euler's Modified Method, Taylor-Series Method, Runge-Kutta method, Predictor-Corrector methods.
Numerical Differentiation and Integration: Differentiation formulae based on polynomial fit, Pitfalls in differentiation, Trapezoidal, Simpson's rules and Gaussian Quadrature

Text Books:

1. Rajaraman V., "Computer Oriented Numerical Methods", Prentice Hall, India.
2. Gottfried Byron S., "Programming with C", Tata McGraw Hill.

3. Balagurusamy E., "Programming in ANSI C", Tata McGraw Hill.

Reference Books:

1. Jain M.K., Iyengar S.R.K. & Jain R.K., "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers.
2. Saxena H.C., "Finite Differences & Numerical Analysis, S. Chand Publishers.
3. Irving Allen Dodes Modes A., "Numerical Analysis for Computer Science", North- Holland.
4. Jeri R. Hanly & Elliot P. Koffman, "Problem Solving & Program Design in C, Addison Wesley.
5. Yashwant Kanetker, "Let us C", BPB.

MCA -17- 12 SOFTWARE ENGINEERING

Maximum marks: 100
Time:3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Introduction: Software Crisis-problem and causes, Software Processes, Software life cycle models: Waterfall, Prototype, Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001,SEI CMM, CMMI, PCMM, Six Sigma.

Software Metrics: Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cyclomatic complexity, Halstead Complexity measures.

UNIT - II

Software Project Planning: Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management, project scheduling, personnel planning, team structure, Software configuration management, quality assurance, project monitoring .
Software Requirement Analysis and Specifications: Structured Analysis, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Behavioral and non-behavioral requirements.

UNIT - III

Software Design: Design fundamentals, problem partitioning and abstraction, design methodology, Cohesion & Coupling, Function Oriented Design and User Interface Design.
Coding: Programming style, structured programming.
Software reliability: Metric and specification, Musa and JM reliability model, fault avoidance and tolerance, exception handling, defensive programming.

UNIT - IV

Software Testing: Functional testing: Boundary Value Analysis, Equivalence class testing, Cause effect graphing, Structural testing: Control flow based and data flow based testing, loop testing, mutation testing, load, stress and performance testing, software testing strategies: unit testing, integration testing, System testing, Alpha and Beta testing, debugging.
Static Testing: Formal Technical Reviews, Walk Through, Code Inspection.
Software Maintenance: Types of Maintenance, Maintenance Process, Maintenance characteristics, Reverse Engineering, Software Re-engineering.

Text Books:

1. Pressman R. S., "Software Engineering - A practitioner's approach", Tata McGraw Hill.
2. Sommerville, "Software Engineering", Pearson Education.

Reference Books:

1.Pfleeger, "Software Engineering: Theory and Practice", Pearson Education.
2. Jalote P, "An Integrated approach to Software Engineering", Narosa Publications.
3.Fairley R., "Software Engineering Concepts", Tata McGraw Hill.

MCA -17- 13 DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.

Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT-I

Information Representation: Number systems, BCD codes, Character codes - ASCII, EBCDIC, Unicode,Error Detecting and Correcting codes, Fixed-point and Floating-point representation of numbers. Binary arithmetic, Booths multiplication.

Binary Logic: Boolean algebra, Boolean functions, truth tables, canonical and standard forms, simplification of Boolean functions- K-maps and Quine McCluskey procedures, Digital logic gates.

UNIT-II

Combinational Logic: Design procedure, Adders, Subtractors, Code Conversion, Analysis procedure,Multilevel NAND & NOR Circuits, XOR &XNOR functions Encoders, Decoders, BCD to Seven segment, Decoder. Multiplexers, Demultiplexers and Comparators, Binary Parallel Adder, BCD Adder. Sequential Logic: Flip-flops, Shift registers and Counters.

UNIT.III

CPU Organization: Processor organization, Machine instructions, instruction cycles, instruction formats and addressing modes, microprogramming concepts, and micro program sequencer.

UNIT-IV

Memory Organization: Hierarchical memory system, associative memory, cache memory - associative, direct and set associative mappings, replacing & writing data in cache, cache performance.

I/O Organization: I/O interface, Interrupt structure, transfer of information between CpU/memory and I/O devices, and IOPs.

Text Books:

1. Mano, M. Morris Digital Logic and Computer Design, Prentice Hall of India pvt. Ltd.
2. Rajaraman, V., Radhakrishanan,T., An Introduction To Digital Computer Design, prentice Hall of IndiaPvt. Ltd.

Reference Books:

1. Hayes, J.P., computer Architecture and organization,McGraw Hill
2. Tanebaum A.S., Structured Computer Organization,Prentice Hall of India pvt. Ltd.
3. Stallings W., Computer Organization and Architecture, Prentice Hall of India pvt. Ltd.

MCA -17- 14 WEB TECHNOLOGIES

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT - I

Introduction to web Engineering: Categories and characteristics of Web Applications, Web Applications vsConventional Software, Need for an Engineering Approach.
Web Essentials: The Internet, Basic Internet Protocols, WWW, Web Browser and its functions, URL, Web Servers and its functions.

UNIT - II

MarkUp Languages: Introduction to HTML, Characteristics, Elements, Lists, Tables, Frames, Forms, Creating HTML pages.
Cascading Style Sheets: Features, Core Syntax, Types, Style Sheets and HTML, StyleRules - Cascading andInheritance, Text Properties, CSS Box Model, Normal Flow, Box Layout, Positioning and other useful-StyleProperties.

UNIT - III

Client-Side Programming: Introduction to JavaScript, Perspective, Basic Syntax, VariablesStatements, Operators, Literals, Functions, Objects, Arrays, Built-in Objects, Debuggers.
Server-Side Programming: Servlet Architecture, Generating Dynamic Content, Servlet Lifecookies, URL Rewriting, servlet capabilities, Servlets and concurrency.

UNIT - IV

XML: Relation between XML, HTML, SGML, Goals of XML, Structure and Syntax of XML, Well FormedXML, DTD and its Structure, Namespaces and Data Typing in XML, Transforming XML Documents. XPATH.

Text Books:

1. Jeffrey C. Jackson, "Web Technologies", Pearson Education, India.
2. Thomas Powell, "The complete Reference HTML",TataMcGraw Hill, India.
3. William Pardi, "XML in Action", IT Professional, New York. USA.

Reference Books

1. Andrew King, "Website Optimization", Shroff publishers, India.
2. AchyutGodbole,"Web Technologies", Tata McGraw Hill, India.

MCA -17- 15 DISCRETE MATHEMATICAL STRUCTURES

Maximum marks: 100 **External: 80**
Time:3 hours **Internal: 20**
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number I will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT- I

Set Theory: Basic Set Theory, operations on Sets, Algebra of sets, venn Diagrams.
Relations: Binary Relations, Complement of relations, Inverse of Relations, Composite relations, properties, Equivalence, Partial Order and Total order relations.
Functions: Functions on Set, Domain, Co-domain, Representation of Functions, Types, Identity and Inverse Functions, Composition of Functions, Applications

UNIT -II

Propositional Calculus: Propositional logic, Equivalences, Predicates, Quantifiers, Nested quantifiers, Rules of Inference, Normal Forms, Proofs: Methods, strategy.
Counting: Pigeonhole Principle, Inclusion-Exclusion Principle, Permutations and Combinations, Binomial Coefficients, Counting Principles, Applications.

UNIT _III

Advanced counting Techniques: Recurrence Relations, Solving Recurrence Algorithms and Recurrence Relations, Solution of Recurrence Relations Function.
Latices and boolean algebra: Lattices, Hasse Diagram, Principle of Duality, Types of Lattices, Special Lattices, Boolean Expression, Equivalent circuits, Dual, Normal Forms.

UNIT -IV

Graphs: Introduction, Terminology, Types of Graphs, Representation of Graphs, paths and Circuits, Cutset and Cut - Vertices, Graph Isomorphism, Homomorphism, Connectivity, Bipartite Graphs, Subgraphs, Operations on Graphs, Euler and Hamiltonian Paths, Shortest Path Problem, Planar & Dual Graphs, Coloring Covering and Partitioning.
Tree: Tree Notations, Properties of tree, Types of Tree, Minimum Spanning Tree (MST).

Text Books:

1. Kenneth G. Rosen, "Discrete Mathematics and Its Applications", Tata McGraw Hill.
2.Koshy T, "Discrete Mathematics with Applications", Elsevier India.

Reference Books:

1.Eric Gosett, "Discrete Mathematics with Proof", Wiley India Pvt. Ltd.
2.Seymour Lipshutz, "Shaum's Outlines of Discrete Mathematics", Tata McGraw Hill.
3.Olympia Nicodemy, "Discrete Mathematics", CBS publisher.

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MCA 17-21 **OBJECT-ORIENTED MODELING & PROGRAMMING USING C++**

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT-I

Object-Orientation: Object, Class, Abstraction, Encapsulation, Modularity, Hierarchy, Typing, Concurrency, Persistence of objects. Object Oriented system development life cycle. Benefits of OO Methodology. OO Methodologies: The Rumbaugh OMT, The Booch methodology, Jacobson's OOSE methodologies, Unified Process.
Purpose of modeling, Introduction to UML, Diagrams in UML – Class diagram, Object diagram, Use-Case diagram, Sequence diagram, Collaboration diagram, Statechart diagram, Activity diagram, Component diagram. Deployment diagram.

UNIT-II

Structure of C++ program: Data-types, Variables, Static Variables, Operators in C++, Arrays,
Strings, Structure, Functions, Recursion, Control Statements.
Introduction to Class: Class Definition, Classes and Objects, Access Specifiers: Private, Public and Protected, Member functions of the class, Constructor and Destructor, Parameterized Constructor, Copy Constructors.
Inheritance: Reusability, Types of Inheritance: Single inheritance, Multiple, Multilevel, Hybrid Inheritance, Public, Private, and Protected Derivations, Using derived class, Constructor and destructor in derived class, Object initialization and conversion, Nested classes(Container classes), Virtual Inheritance and Virtual base class.

UNIT-III

Polymorphism: Function Overloading, Static Class Members, Static Member Functions, Friend Functions, Operator Overloading: Unary and Binary Operator Overloading.
Abstract class, Virtual function, Pure virtual function, Overloading vs. Overriding.
Memory management: new, delete, object Creation at Run Time, This Pointer. Exception handling: Throwing, Catching, Re-throwing an exception, specifying exceptions, processing unexpected exceptions, Exceptions when handling exceptions, resource capture and
release.

UNIT-IV

Templates: Introduction, Class templates and Function templates, Overloading of template
function, namespaces. Introduction to STL: Standard Template Library: benefits of STL, containers, adapters, iterator, vector, list. Working with files: C++ streams, C++ stream classes, creating, opening, closing and deleting
files, file pointers and their manipulators, updating file, random access to file, Error handling
during file operations.

Text Books:

1. Bjarne Stroustrup, The C++ Programming Language, Pearson
2. Herbert Scildt, C++, The Complete Reference, Tata McGraw-Hill

Reference Books:

1. Robert Lafore, Object Oriented Programming in C++,
2. Lippman, C++ Primer, 3/e, Addison-Wesley
3. Balaguruswami, E., Object Oriented Programming In C++, Tata McGraw-Hill

MCA 17-22 DATA COMMUNICATION AND COMPUTER NETWORKS

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Introduction to Computer Networks and its uses, Network categorization and Hardware: Broadcast and point-to-point networks, Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Internetworks, Topologies, Wireless networks, Network Software: Protocols, Services, network architecture, design issues, OSI Reference model, TCP/IP Reference model, Comparison of OSI and TCP/IP Models. Introduction to Example Networks: Internet, Connection-Oriented Networks – X.25, Frame Relay, ATM.

UNIT-II

Data Communication Model, Digital and Analog data and signals, bit rate, baud, bandwidth, Nyquist bit rate, Guided Transmission Media – Twisted Pair, Coaxial cable, Optical fiber; wireless transmission – Radio waves, microwaves, infrared waves; Satellite communication.

Switching: Circuit Switching, Packet Switching; Multiplexing: Frequency Division Multiplexing Time Division Multiplexing, Synchronous and Asynchronous TDM, Modems, Transmission Impairments, Manchester and Differential Manchester encoding, ADSL Versus Cable.

UNIT-III

Data Link Layer Design issues: Framing, error control, Flow Control, Error Detection and correction; Elementary Data Link Protocols, Sliding Window Protocols; Medium Access Control: Aloha, CSMA protocols, Collision free protocols, Limited Contention Protocols; Wavelength division Multiple access protocol, Wireless LAN Protocol: MACA; IEEE 802.3 Ethernet, IEEE 802.4 Token Bus; IEEE 802.5 Token ring, Binary Exponential Backoff algorithm, Digital Cellular, Radio: Global System for Mobile Communication (GSM), Code Division Multiple Access(CDMA), Fiber Distributed Data Interface, Distributed Queue Dual Bus (DQDB).

UNIT-IV

Network Layer, Design issues , Virtual Circuit and Datagram Subnet, Routing Algorithms, Optimality principle, Shortest path Routing, Flooding , Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast and Multi Cast Routing, Routing for Mobile hosts, Routing in Adhoc Networks,, congestion Control Algorithms, General Principals Traffic Shaping, Leaky bucket token bucket, choke packets, Load Shedding.

MCA 17 – 23 ADVANCED COMPUTER ARCHITECTURE

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Computational Model: Basic computational models, evolution and interpretation of computer architecture,concept of computer architecture as a multilevel hierarchical framework. Classification of parallelarchitectures, Relationships between programming languages and parallel architectures
Parallel Processing:: Types and levels of parallelism, Instruction Level Parallel (ILP) processors,
dependencies between instructions, principle and general structure of pipelines, performance measures ofpipeline, pipelined processing of integer, Boolean, load and store instructions, VLIW architecture, CodeScheduling for ILP-Processors - Basic block scheduling, loop scheduling, global scheduling

UNIT – II

Superscalar Processors: Emergence of superscalar processors, Tasks of superscalar processing – paralleldecoding, superscalar instruction issue, shelving, register renaming, parallel execution, preserving sequentialconsistency of instruction execution and exception processing, comparison of VLIW & superscalarprocessors
Branch Handling: Branch problem, Approaches to branch handling – delayed branching, branch detectionand prediction schemes, branch penalties and schemes to reduce them, multiway branches, guardedexecution

UNIT – III

MIMD Architectures: Concepts of distributed and shared memory MIMD architectures, UMA, NUMA, CC-NUMA& COMA models, problems of scalable computers.
Direct Interconnection Networks: Linear array, ring, chordal rings, star, tree, 2D mesh, barrel shifter,
hypercubes.

UNIT – IV

Dynamic interconnection networks: single shared buses, comparison of bandwidths of locked, pended & splittransaction buses, arbiter logics, crossbar, multistage networks – omega, butterfly
Cache coherence problem, hardware based protocols – snoopy cache protocol, directory schemes,
hierarchical cache coherence protocols, software based protocols.

Text Books:

1. Sima, Fountain, Kacsuk, Advanced Computer Architecture, Pearson Education, 2006.
2. D. A. Patterson and J. L. Hennessey, Computer Architecture – A Quantitative Approach, Fifth Edition,Morgan Kaufmann, 2012.

Reference Books:

1. Kai Hwang, Advanced Computer Architecture, Tata McGraw Hill, 2005
2. Nicholas Carter, Computer Architecture, McGraw Hill, 2006
3. Harry F. Jordan, Gita Alaghband, Fundamentals of Parallel Processing, Pearson Education, 2003.

MCA -17- 24 OPERATING SYSTEM

Maximum marks: 100
Time:3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number I will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT- I

Operating System Services, System Calls, System Programs. CPIJ Scheduling: Process concepts, Process Operations, Interprocess Communication, Scheduling Criteria, Scheduling Algorithms, Comparative Study of Scheduling Algorithms.

UNIT - II

Concurrent Processes: Critical Section Problem, Semaphores, Classical Process Co-ordination Problems and their Solutions, Monitors, Synchronization Examples.
Deadlocks: Deadlock Characterization, Deadlock Prevention and Avoidance, Deadlock detection and Recovery.

UNIT - III

Memory Management: Swapping, Paging, Segmentation, Virtual Memory Concepts: Demand Paging, Page Replacement Algorithms, Thrashing: Storage Management: File Concepts, File Access and Allocation Methods.
Directory Systems: Structured Organizations, Directory Protection Mechanisms, Recovery, Disk Scheduling.
Protection & Security: Goals & Principles of Protection, Domains of Protection, Access Matrix, Access Controls. Security: Security problem, Threats, Security tools, Classification.

UNIT -IV

Linux/Unix Operating System: Architecture, Features, Accessing Linux System, General-Purpose Commands, File Oriented Commands, Directory Oriented Commands, Communication-Oriented Commands, Process Oriented Commands.
Regular Expressions & Filters in Linux: Regular Expressions, head, tail, cut, paste, sort, uniq, grep, sed.
Shell Programming: vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating shell scripts.

Text Books:

1. Godbole A.S. "Operating Systems", Tata McGraw Hill.
2. Tanenbaum A.S., "Operating System - Design and Implementation", Prentice Hall of India.
3. Das Sumitabha, "Your Unix - The Ultimate Guide", Tata McGraw Hill.

4. Silberschatz A., Galvin P.B. and Gagne G., "Operating System Concepts", Wiley India Pvt. Ltd.

Reference Books:

1. Deitel H.M., "Operating Systems", Addison -Wesley Publishing Company, New York.
2. Stalings William, "Operating System", Prentice Hall of India.
3. John Goerzen, "Linux Programming Bible", IDG Books, New Delhi.

MCA-17-25 COMPUTER ORIENTED OPTIMIZATION TECHNIQUES

Total Credit : 5
Maximum Marks: 100 **Time: 3 hours**
Minimum Pass Marks: 40

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

UNIT – I

Introduction: The Historical development, Nature, Meaning and Management Application of Operations research. Modelling, Its Principal and Approximation of O.R.Models, Main characteristic and phases, General Methods of solving models, Scientific Methods, Scope, Role on Decision Making and Development of Operation Research.

Linear Programming: Formulation, Graphical solution, standard and matrix form of linear programming problems, Simplex method and its flow chart, Two-phase Simplex method, Degeneracy.

Assignment Models: Formulation of problem, Hungarian Method for Assignment Problems, Unbalanced Assignment Problems.

UNIT – II

Goal Programming : Single Goal with Multiple Subgoals, Equally Ranked Multiple Goals, Ranking and Weighing of Unequal Multiple Goals, Graphical Solution Method for Goal Programming.

Decision Theory and Decision Trees: Steps of Decision Making Process, Types of Decision Making environment, Decision Making under Uncertainty, Decision Making under Risk, Posterior Probabilities and Bayesian Analysis, Decision Tree Analysis, Decision Making with Utilities.

UNIT – III

Queuing Models: Introduction, Applications, Characteristic, Waiting and Ideal time costs, Transient and Steady states, Kendall's Notations, M/M/1, M/M/C, M/Ek/1 and Deterministic Models. (No Mathematical derivations included).

PERT and CPM: Basic steps in PERT/CPM, Techniques, Network Diagram Representation, Forward and Backward Pass-computation, Representation in Tabular form, Determination of Critical path, Critical activity, Difference between CPM and PERT, Floats and Slack Times.

UNIT – III

Simulation: Steps of Simulation Process, Advantages and Disadvantages of Simulation, Stochastic Simulation and Random Numbers, Simulation of Queuing Problems, Simulation of PERT Problems, Role of Computers in Simulation, Applications of Simulation.

Dynamic Programming : Developing Optimal Decision Policy, Dynamic Programming under Certainity : Shortest Route Problem, Multiplicative Separable Return Function and Single Additive Contraint, Additive Separable Return Function and Single Additive Constraint, Additively Separable Return Function and Single Multiplicative Constraint.

Text Books:

1. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.
2. Kanti Swarup, Gupta P.K. & Man Mohan, Operation Research, Sultan Chand & sons, New Delhi.
3. Mittal, K.V., Optimization Methods in Operations Research and System Analysis, New Age International (P) Ltd., New Delhi.

Reference Books:

1. Rao S.S., Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi.
2. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York.
3. Bazara, Operation Research & Networking, Wiley.
4. Sharma, S.D., Operations Research, Kedar Nath and Ram Nath, Meerut.

Approved by Academic Council vide Resolution No. 16 in its 9th Meeting held on 5th July, 2018. —105—

Session - 2018-19

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

SCHEME OF EXAMINATION FOR

MASTER OF COMPUTER APPLICATIONS (MCA)

w.e.f. Batch 2017-18 (CBCS)

Semester – III

Paper Code	Title of the Paper	Credit	Maximum Marks		Total
			External	Internal	
MCA-17-31	Computer Oriented Statistical Methods	5	80	20	100
MCA-17-32	Data and File Structures	5	80	20	100
MCA-17-33	Artificial Intelligence	5	80	20	100
MCA-17-34	Data Base Management System	5	80	20	100
MCA-17-35	Software Lab - III (Based on MCA-17-31 & 17-32 using C++)	3	80	20	100
MCA-17-36	Software Lab - IV (Based on MCA- 17-34 SQL Queries and PL/SQL Programming)	3	80	20	100
MCA-17-37	Seminar	1		20	20
To be assigned by Examination Branch	*Open Elective* : Blockchain	5	80	20	100
	Total	32			720

Semester – IV

Paper Code	Title of the Paper	Credit	Maximum Marks		Total
			External	Internal	
MCA-17-41	Data Warehousing and Mining	5	80	20	100
MCA-17-42	Unified Modeling Language	5	80	20	100
MCA-17-43	Programming with Java	5	80	20	100
MCA-17-44	*Core Elective* : (i) Advanced Database Systems (ii) Theory of Computation (iii)Design and Analysis of Algorithms	5	80	20	100
MCA-17-45	Software Lab - III (Based on MCA-17-41 (Rapid Miner) & 17-42)	3	80	20	100
MCA-17-46	Software Lab - IV (Based on MCA- 17-43)	3	80	20	100
MCA-17-47	Seminar	1		20	20
To be assigned by Examination Branch	*Open Elective* : Computer Fundamentals and Data Processing	5	80	20	100
	Total	32			720

Semester – V					
Paper Code	Title of the Paper	Credit	Maximum Marks		Total
			External	Internal	
MCA-17-51	Programming with R and Python	5	80	20	100
MCA-17-52	Compiler Construction	5	80	20	100
MCA-17-53	Mobile Application Development	5	80	20	100
MCA-17-54	Computer Graphics	5	80	20	100
MCA-17-55	*Core Elective* : (i) Big Data Analytics (ii) Cloud Computing (iii) Bio-Informatics	5	80	20	100
MCA-17-56	Software Lab - III (Based on MCA-17-51)	3	80	20	100
MCA-17-57	Software Lab - IV (Based on MCA- 17-53)	3	80	20	100
MCA-17-58	Seminar	1		20	20
	Total	32			720

Semester – VI					
Paper Code	Title of the Paper	Credit	Maximum Marks		Total
			External	Internal	
MCA-17-61	(i) Industrial Project or (ii) Dissertation	5	300	100	400
	Total	5			400

Note :

1. **Internal Marks in each paper will be awarded by the concerned teacher on the basis of MCA Ordinance (CBCS)**
2. **Size of Groups for all practical and viva-voce examinations should not be more than thirty.**
3. **Core Elective paper adopted by minimum 10 students will be taught.**
4. **Candidate need to inform the Chairperson of Department in writing about Open Elective and Core Elective within one week of commencement of classes of the current semester**

MCA 17-31 COMPUTER ORIENTED STATISTICAL METHOD

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Probability: Probability Rules, Random Variables and Probability Functions, Expected Values, Bivariate Expected Values.

Data, Data Types, Sources of Data, Data Summarization, Central Tendency, Variance, Standard Deviation, Correlation Analysis : Correlation Coefficient and Rank Correlation, Linear Regression, Weighted Least Square Regression, Log Linear Regression.

UNIT-II

Sampling : Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Quota Sampling, Minimax Sampling, Line Intercept Sampling, Panel Sampling, Snowball Sampling, Methods of Producing Random Samples, Random Walk Monte Carlo Methods, Training Based Markov Chain Monte Carlo Methods, Sample Size Determination, Sampling and Data Collection, Sampling Errors and Biases, Non Sampling Errors.

UNIT-III

Statistical Interference: Parameters and Likelihoods

Point Estimation: Bias, Method of Moment, Least Square, Weighted Least Square, Maximum Likelihood,

Interval Estimation: Confidence Intervals, Single Sample Interval for Gaussian Parameters, Two Sample Interval for Gaussian Parameters, Wald Intervals, Likelihood Intervals, Delta Method Intervals, Bootstrap Intervals.

UNIT-IV

Testing Hypothesis: T-Test, F-Test, Chi-Square Test, One-Way Anova, Two-Way Anova, Single Sample Test for Gaussian Parameters, Two Samples Test for Gaussian Parameters, Wald Test, Likelihood Ratio Test.

Text Books:

1. Levin, Richard, David S. Rubin, Sanjay Rastogi and HM Sidiqqui, *Statistics for Management*, 7th Edition, Pearson Education, 2015.

MCA 17-32 DATA AND FILE STRUCTURES

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Stacks and Queues : Representation of Stacks, Stack Operations, Applications of Stacks, Queues, Dequeue, Circular Queue, Operation on Queues, Application of Queues.
Linked List : Introduction, Types, Operations (Insertion, Deletion, Traversal, Searching, Sorting), Applications, Dynamic Memory Management, Implementation of Linked Representation.

UNIT-II

Trees: Definition and Basic Terminologies, Representation of Tree, Types of Tree, Binary Tree, Representation of Binary Tree, Tree Traversals, Creation of tree from traversals, Threaded Binary Tree, Binary Search Tree, Operations on Binary Search Tree, Conversion of General Tree to Binary Tree, Minimum Spanning Tree, AVL Tree, Heap, m-way Search Tree, B Tree, B+ Tree, Applications.
Advance Trees : Introduction to 2-3 Trees, Red Black Tree, Splay Tree, Forest.

UNIT-III

Graph : Definitions and Basic Terminologies, Matrix Representation of Graph, Walks, Traits, Paths, Circuit, Connectivity, Components, Operations on Graph, Labelled Graph, Homomorphism, Isomorphism, , Reachability, Depth First Search, Breadth First Search, Single Pair Shortest Path, All Pair Shortest Path, Maximum Flow in a Transport Network,.

UNIT-IV

Hashing: Hash Table, Hashing Functions, Collision Resolution Techniques, Sequential File Organisation, Random File Organisation, Indexed Sequential File Organisation, Multi Key File Organisation, Access Methods.

Text Books:

1. Seymour Lipschutz *Shaum's Outlines Data Structures*, Tata McGraw Hill, Special India Edition, 2013.
2. A A Puntabedkar, *Data and File Structures*, Technical Publications, 2009.

Reference Books:

1. Trembley, J.P. and Sorenson P.G., *An Introduction of Data Structures with Applications*, Tata Mc Graw Hill, 2nd Edition.
2. Rohit Khurana , *Data and File Structures* Vikas Publishing, 2nd Edition.

MCA-17-33 ARTIFICIAL INTELLIGENCE

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit: 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.

Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Introduction: Background, Overview of AI applications, The predicate calculus: Syntax and semantic for propositional logic and FOPL, Clausal form, inference rules, resolution and unification. Knowledge representation: Network representation through Associative network & conceptual graphs, Structured representation- Frames & Scripts.

UNIT-II

Search strategies: Strategies for state space search-data driven and goal driven search; Search algorithms- uninformed search (Depth first search, Breadth first search) and informed search (Hill climbing, Best first, A* algorithm, mini-max), computational complexity, Properties of search algorithms (Admissibility, Monotonicity, Optimality, Dominance).

UNIT-III

Production system: Definition, Types of production system (Commutative, Non-commutative, Decomposable, Non-decomposable), Control of search in production systems. Expert System: Definition, Concept, Types of expert system, Rule based expert system: Architecture, Development, Managing uncertainty in expert systems - Bayesian probability theory, Stanford certainty factor algebra, Non-monotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer and other approaches to uncertainty.

UNIT-IV

Knowledge acquisition: Definition of Knowledge, Types of learning (Learning by automata, Genetic algorithms, Intelligent editors, Learning by induction). Natural Language Processing (NLP): Problems in understanding natural languages, Different stages of language analysis, Chomsky Hierarchy of formal languages, Transition network parsers (TNP), Augmented Transition Network Parsers (ATNP).

Text Books:

1. George F. Luger, *Artificial Intelligence*, Pearson Education, 5th Edition.
2. Dan W. Patterson *Introduction to Artificial Intelligence and Expert system*, PHI, 1st Edition.

Reference Books:

1. Ben Coppin, *Artificial Intelligence Illuminated*, Narosa Publishing House, 1st Edition.
2. Eugene Charniak, Drew McDermott *Introduction to Artificial Intelligence*, Pearson Education, 2016.
3. Nils J. Nilsson *Principles of Artificial Intelligence*, Narosa Publishing House, 1st Edition.
4. Jackson Peter, *Introduction to Expert Systems*, Pearson-Education, 3rd Edition.

MCA-17-34 **DATABASE MANGEMENT SYSTEM**

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT – I

Basic Concepts: Definition of Data Base and Data Base management system, File Systems vs. DMBS, Characteristics of the Database Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of DBMS.
Database Systems Concepts and Architecture: Data Models, Schema and Instances, DBMS architecture, Data Independence, Database languages, DBMS functions.
Entity Relationship Model: Purpose of ER Model, Entity Types, Entity Sets, Attributes, keys, Relationships, Roles and Structural Constraints, E-R Diagrams, Design of an ER Database Schema, Reduction of an ER schema to Tables.
Relational Data Model: Relational Model Concepts, Integrity Constraints over Relations, Relational Algebra – Basic Operations.

UNIT – II

SQL: Data Definition and Data Types, DDL, DML, and DCL, Views & Queries in SQL, Specifying Constraints & Indexes in SQL.
Relational Database Management System: ORACLE-Basic structure, Storage Management in ORACLE Database Structure & implementation in ORACLE, Programming ORACLE Applications.
Conventional Data Models: Network and Hierarchical Data Models.

UNIT – III

Relational Database Design: Functional Dependencies, Decomposition, Normal forms based on primary keys- (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF.
Practical Database Design: Role of Information systems in Organizations, Database design process, Physical database design in Relational Database.

UNIT – IV

Transaction Processing Concepts: Introduction to Transaction, Properties of Transaction, Transaction Processing System Concepts, Schedules and Recoverability, Serializability of Schedules.
Concurrency Control Techniques: Concept of Concurrency, Granularity of Data items , Concurrency Control Techniques (Locking Techniques, Timestamp ordering, Multi-version Techniques, Optimistic Techniques)..
Recovery Techniques: Concept of Recovery, Recovery Techniques in centralized DBMS.
Database Security: Introduction to Database Security issues.

Text Books:

1. Elmasri & Navathe: *Fundamentals of Database systems*, Pearson Education, 7th Edition.
2. Thomas Connolly Carolyn Begg: *Database Systems*, Pearson Education, , 3rd Edition.

BLOCKCHAIN

(Open Elective : Code to be assigned by Examination Branch)

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Blockchain : Introduction, Peer to Peer, Cryptographically Secure, Append Only, Updateable via Consensus, blockchain working, accumulation of blocks, pros and cons of blockchain, tiers of blockchain technology, features of blockchain.

Types of Blockchain: Distributed Ledger, Public Blockchains, Private Blockchains, Semiprivate Blockchains, Sidechains, Permissioned Ledger, Shared Ledger, Fully Private and Proprietary Blockchains, Tokenized Blockchains, Tokenless Blockchains.

UNIT-II

Consensus: Mechanism, Types of Consensus Mechanism, Consensus in Blockchain.

Decentralization: Disintermediation and Contest Driven Decentralization, Routes to Decentralization, Full Ecosystem Decentralization, Smart Contracts, Decentralized Organizations, Platforms for Decentralization.

UNIT-III

Symmetric Cryptography, Security Characteristics.

Cryptographic Primitives: Stream Ciphers, Block Ciphers, Data Encryption Standards, Advanced Encryption Standards, Public and Private Key.

UNIT-IV

Asymmetric Cryptography, Digital Signature and Digital Certification, Encryption and Decryption using RSA Algorithm.

Trading, Exchanges, Orders and Orders Properties, Order Management and Routing System, Components of a Trade, The underlying instrument, General Attributes, Economics, Sales, Counterparty, Trade Life Cycle, Order Anticipators, Market Manipulation.

Text Books:

1. Imran Bashir, *Mastering Blockchain*, 2nd Edition, Packt Publishing, 2018.
2. Alan Wright, *Blockchain*, Google Books, 2017.
3. Daniel Dresher, *Blockchain Basics*, Apress, 2017.

MCA-17-41 DATA WAREHOUSING AND MINING

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT – I

Introduction: Data Warehouse – A Brief History, Characteristics, Operational Database Systems and Data Warehouse, Data Marts, Metadata, Principles of Data Warehousing, Three Tier Architecture of Data Warehouse.
Multidimensional Data Models: Types of Data and their Uses, Transformation from Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Designing Fact Tables, Data Warehouse Schemas – Star, Snowflake and Fact constellations, OLAP Operations, Steps for designing Data Warehouse.
Data Cube Computation Methods, Processing advance kind of Queries by exploring Cube technology, Multidimensional Data Analysis in Cube Space.

UNIT – II

Data Mining : Motivation, Importance, Kamber's Model of KDD, Data Mining vs Query Tools, Kinds of Data and Pattern can be mined, Predictive and Descriptive Data Mining, Major Issues in Data Mining.
Data Preprocessing : Data Cleaning, Data Integration and Transformations, Data Reduction, Data Transformation, Data Discretization.
Mining Association Rules: Market Basket Analysis, Types of Association Rules, Methods of Mining Association Rules in Transaction Databases, Pattern Evaluation Methods, Pattern Mining in Multidimensional Space, Constraint Based Frequent Pattern Mining, Mining High Dimensional Data, Compressed or Approximate Patterns.

UNIT – III

Issues regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Backpropagation, Support Vector Machines, Associative Classification, Lazy Learners, Classification through Evolutionary Algorithms, Rough Set Approach of Classification, Fuzzy Set Approach of Classification. Classifier Accuracy Measures, Prediction, Predictor Error Measures, Evaluating the accuracy of Classifier and Predictor, Methods to increase the accuracy, Estimating Confidence Interval, ROC Curves.

UNIT – IV

Cluster Analysis: Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data, Constraint Based Cluster Analysis, Outlier Analysis.
Applications of Data Mining, Social Impact of Data Mining

MCA-17-42 **UNIFIED MODELING LANGUAGE**

Maximum marks: 100 **External**: 80
Time: 3 hours **Internal**: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.

Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

UML: Introduction, Principles of modeling, UML Things (Structural, Behavioral, Grouping, Annotational), Relationships in UML (Dependency, Association, Generalization, Realization), Overview of diagrams in UML (Class diagram, Object diagram, Use-Case diagram, Sequence diagram, Collaboration diagram, State chart diagram, Activity diagram, Component diagram, Deployment diagram), UML Semantic Rules (Names, Scope, Visibility, Integrity, Execution), Mechanisms in UML (Specifications, Adornments, Common Divisions, Extensibility).

UNIT-II

Modeling as a Design Technique: Purpose of modeling, Abstraction, Encapsulation, Modularity, Hierarchy, Typing, Concurrency, Persistence of objects.
Class Model: Representation of Class, Object, Associations, Links, Link attributes, Link class, Generalization, Inheritance, Association Ends (Multiplicity, Role names, Ordering, Qualification), Aggregation, , Abstract class, Metadata, Constraints. Construction of Class diagram.

UNIT-III

State Modeling: Event, State, Activity, Action, Transitions, Conditions, State diagrams, Nested state diagrams, signal generalization, concurrency, relationships between class and state models.
Interaction Modeling: use case models, use case relationships, sequence models, procedural sequence models, activity models, special constructs for activity models.

UNIT-IV

System Analysis: System development stages, system conception, analysis, domain class model, domain state model.
Application interaction model, application class model, application state model, adding operations
System Design: estimating performance, make a reuse plan, organize the system into subsystem, identifying concurrency, allocating subsystems to processors and tasks, management of data stores, handling global resources, choosing software control strategies, handling boundary conditions, setting trade-off priorities, selecting an architect style.
Class Design: bridging gap, realize use cases with operations, designing algorithms, design optimization, adjustment of inheritance, organize classes & associations.

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson, *The Unified Modeling Language User Guide*, Pearson Education, 2007
2. M. Blaha, J. Rumbaugh, *Object-Oriented Modeling and Design with UML*, Pearson Education, 2nd Edition.

Reference Books:

1. Satzinger, Jackson, Burd, *Object-Oriented Analysis & Design with the Unified Process*, Thomson Course Technology,2007.
2. Grady Booch, *Object Oriented Analysis & Design*, Addison Wesley, 3rd Edition.

MCA 17-43 PROGRAMMING WITH JAVA

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Introduction: Java Features, Java Virtual Machine(JVM), Byte code, Java API, Java Development Kit (JDK), Garbage Collection.
Language Basics: Keywords, Constants, Variables and Data Types, Operators and Expressions, Decision Making , Branching and Looping.
Introducing Classes, Objects and Methods: Defining a Class, Methods Declaration, Creating Objects and accessing Class members, Constructors, Methods Overloading, Wrapper Classes, Inheritance, Methods Overriding, Final Class, variables and methods, Abstract Class and Methods, Interfaces.

UNIT-II

Arrays, Strings and Vectors: Creating and using Arrays, String operations, String Buffer, String Builder, and StringTokenizer class, Vector class.
Packages and Exceptions: Java API packages, Creating and using packages, static import, Exceptions handling, Types of Exceptions, multiple catch statements, 'throw' and 'throws', using 'finally' statement, Creating your own exceptions.

UNIT-III

Multithreaded Programming: Single threaded and multi-threaded program, Creating threads using Thread class, Life cycle of a Thread, Stopping and blocking a Tread, getting and setting the Thread Priority, Synchronization, implementing the Runnable interface.
Managing Input/Output Streams: Concept of streams, Byte and Character streams, Reading and Writing from Console and Files. Input output exceptions.

UNIT-IV

Applet Programming: How Applets differs from Java Application, Applet Life Cycle, APPLET Tag, Running an Applet, Passing Parameters to Applet.
Event Handling: Mechanism, The Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and inner classes.
GUI Programming: Working with Frame Window, Graphics and Text, AWT Controls and classes. Layout Managers, working with Menus.

MCA-17-44(i) ADVANCED DATABASE SYSYEMS

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.

Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT – I

Object Model: Object, Object identity, Object structure, Type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Complex objects. Query Processing and Optimization: Using Heuristics in Query Optimization, Semantic Query Optimization.

UNIT – II

Databases for Advance Applications: EER Model, Architecture for parallel database; Distributed database concepts: Data fragmentation, Replication and allocation techniques, Temporal Databases, Spatial and Multimedia Databases, Deductive Databases, XML Schema, Documents and Databases.

UNIT – III

Principles of Big Data: Definition of Ontologies, Ontologies and Semantics, Classifications of Ontologies, Simplest of Ontologies, Classes with Multiple Parents, Choosing a Class Model. Data Integration and Software Interoperability, Stepwise Approach to Big Data Analysis.

UNIT – IV

NoSQL Databases: Concepts, Schema, Schema Free, Two Phase Commit, Sharding & Share Nothing Architecture, Types of NoSQL Databases, CAP & BASE Theorems, Elastic Scalability, High Availability & Fault Tolerance, Tunable Consistency.

Text Books:

1. Elmasri and Navathe, *Fundamentals of Database Systems*, Pearson Education, 7th Edition.
2. Jules J. Berman, *Principles of Big Data*, Elsevier India, 1st Edition.

Reference Books:

1. Date C.J., *An Introduction to Database Systems*, Pearson Education, 8th Edition.
2. Hector G.M., Ullman J.D., Widom J., *Database Systems: The Complete Book*, Pearson Education, 2nd Edition.
3. Silberschatz A., Korth H., Sudarshan S., *Database System Concepts*, Tata McGraw Hill, 5th Edition.

MCA-17-44 (ii) THEORY OF COMPUTATION

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT - I

Language Paradigm, Language Criteria, Variables and Data Types, Abstraction, Formal Languages, Chomsky Hierarchy of Formal Languages.

Finite Automata, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA),statement of Kleen's Theorem, Regular Expressions, Equivalence of DFAs, NFAs and Regular Expressions, Closure properties of Regular Language, Non-Regular Languages, Pumping Lemma. Myhill Nerode Theorem.

UNIT - II

Context Free Languages: Context Free Grammar (CFG), Parse Trees, Push Down Automata (deterministic and nondeterministic) (PDA), Equivalence of CFGs and PDAs, Closure properties of CFLs, Pumping Lemma, Parsing (including LL(1) , SLR and LR(1) Parsing Method).

UNIT - III

Linear Bounded Automata, Closure Properties of Linear Bounded Automata.

Turing Machines and Computability Theory: Definition of Turing Machine, Extensions of Turing machines, Non – deterministic Turing machines, Equivalence of various Turing Machine Formalisms, Church – Turing Thesis, Decidability, Halting Problem, Reducibility, Recursion Theorem.

UNIT - IV

Complexity Theory: Time and Space measures, Hierarchy theorems, Complexity classes P, NP, space complexity , Savich theorem, L, NL, PSPACE complexity , Post correspondence problem, Probabilistic computation.

MCA-17-44(iii) DESIGN AND ANALYSIS OF ALGORITHMS

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.

Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT – I

Introduction: Definition of Algorithm, Role of algorithms in computing, Complexity of algorithms, Analyzing algorithms, designing algorithms, asymptotic notations.
Divide and Conquer: Complexity of iterative programs and recursive programs, solving recurrence equations: back substitution method, recursion tree method, masters theorem.
Analysis of heap sort and quick sort; Counting sort, Radix sort, Bucket sort, Lower bounds for sorting.

UNIT – II

Hash Tables, Concept of Hashing, Hash functions, Collision handling in hashing, analyzing various operations on Binary search tree.
Dynamic Programming (DP): Elements of DP, Matrix chain multiplication, Longest common subsequence, optimal binary search trees.

UNIT – III

Greedy Techniques (GT): Elements of GT, Activity selection problem, Huffman codes, Knapsack Problem.
Graph Algorithms: Single source shortest path: Analysis of Dijkstra's Algorithm, Limitations of Dijkstra's Algorithm, Negative weight cycle, Bellman-Ford algorithm. All Pairs Shortest Path: Relation of Shortest path and matrix multiplication, Analysis of Floyd Warshall algorithm. Maximum Flow: Flow network, Ford-Fulkerson method.

UNIT – IV

Strings: Storage of strings, naive string-matching algorithm, Rabin-Karp string matching algorithm.
Computational complexity: Notion of Polynomial time algorithms, Complexity classes: P, NP, NP-Hard and NP-Complete, Polynomial time verification, Reducibility, NP-Completeness, Examples of NP-Complete and NP-Hard problems: Traveling Salesman Problem, Knapsack, Bin Packing, Satisfiability, Vertex Cover, Clique, Independent Set.

Text Books:

1. Cormen, Leiserson, Rivest, *Introduction to Algorithms*, PHI India, 3rd Edition.
2. Neapolitan R., *Foundations of Algorithms*, Jones and Bartlett Learning. 5th Edition.

Reference Books:

1. Cooper A., *Computability Theory*, Chapman and Hall/CRC. 2008..
2. Robert Sedgewick, *Algorithms in C*, Pearson Education India, 3rd Edition.
3. Steven Skiena, *The Algorithm Design Manual*, Springer India.2nd Edition, Indian Reprint.
4. Reiter, Johnson, *Limits of Computation*, Chapman and Hall/CRC, 2012, Indian Reprint.

MCA 17-51 PROGRAMMING WITH R AND PYTHON

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

R Programming Introduction: Statistical programming, Why Use R for Statistical Work, Installing and running R, Features of R, Boolean algebra, Data Types- Vectors, Matrices, Lists, Factors, Data Frames, Operators- Arithmetic, Assignment, Relational, Logical, String handling in R.
R Decision Making and Loops- If...else, if...elseif...else, and switch statements, repeat, while and for loops, break and next statement.

UNIT-II

R Functions - Function Definition, Components, Built-in functions, User defined functions, Scope of variables, Set Operations, Built-In Random Variate Generators.
R Input / Output - scan(), readline() and print() function, Reading From a URL Connection, Reading a Matrix or Data Frame From a File, Reading and Writing a File One Line at a Time, Writing a Table or List to a File, Redirecting R output using sink( )
Statistical graphics in R- Plotting Bar charts, dot charts, Pie charts, and Histograms.

UNIT-III

Python Programming Introduction: Features of Python, Installing and running Python, Identifiers, Keywords, Data Types- Numbers, Strings, Lists, Tuples and Dictionary, Conversion methods for Data types, Operators- Arithmetic, Comparison, Assignment, Bitwise, Logical, Membership, Identity.
Python Decision Making and Loops- if, if ...else, elif statement, nested if, while and for loop, else statement with loop, break, continue and pass statement.
Python Functions- Defining and calling a function, Passing by reference and passing by values, Scope of variables. Input / Output - Reading from keyboard, Writing on Screen, Input and output from files, File positions.

UNIT-IV

Exceptions in Python- assert statement, Handling an exception, user defined exceptions.
Object oriented programming: creating class and instance, Accessing Attributes, Data Hiding, Inheritance, Overriding Methods.
Database Access: MySQLdb, SQLite, Database Connection, Creating Tables, Performing SQL operations, Disconnecting Database.

MCA-17-52 COMPILER CONSTRUCTION

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT – I

Compilers: Phases and passes, analysis-synthesis model of translation, compiler construction tools.
Lexical Analysis: Process of lexical analysis, finite state automata, DFA and NFA, recognition of regular expressions, LEX.
Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

UNIT – II

Parsing Techniques: top down & bottom-up parsing, Shift reduce parsing, operator precedence parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables, constructing LALR sets of items.

UNIT – III

Intermediate Code Generation: Issues in the design of a code generator, Intermediate languages, generating intermediate code for declarative statement, assignment statement, Boolean expression, and case statement, Symbol Table Management.

UNIT – IV

Code Optimization: potential cases of code optimization, optimization of basic blocks, loops in flow graphs, code improving transformation.
Code Generation :

Text books:

1. Aho, Sethi, & Ullman, *Compilers Principles, Techniques and Tools*, Addison Wesley, 2013
2. Donovan J. John, *System Programming*, Tata McGraw Hill, 2001

Reference Books:

1. Beck L. Leland, *System Software*, 3/e, Addison Wesley - 2000.
2. Alfred V Aho and Jeffery D Ullman, *Principles of Compiler Design*, Narosa/Addison Wesley,1998

MCA 17-53 MOBILE APPLICATION DEVELOPMENT

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Introduction: mobility and mobile platforms, Android overview, Setting up Development environment, Mobile OS architectures of android, iOS and Windows, Android App project structure, Setting up an Android Virtual Device (AVD) or Emulator, Logical components of an Android App., Tool repository, installing and running App devices.

UNIT-II

Building Blocks: Activity- states and life cycle of an Activity, User Interface resources, events, interaction among Activities, working with Threads, Services- states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs,

UNIT-III

App data handling - Flat Files, shared preferences, Relational data- SQLiteDatabase, Graphics and animations- custom views, canvas, animation APIs, Multimedia- audio/video playback and record, location services and maps, Sensors.

UNIT-IV

Testing Mobile Application: debugging mobile application, White box testing, black box testing, and test automation of mobile apps using JUnit for android, Signing and packaging mobile apps, Distributing apps on market place.

Text Books:

1. Anubhav Pradhan and Anil V. Deshpande, *Composing Mobile Apps: Learn, Explore, Apply using Android*, Wiley India, 1st Edition.
2. Valentino Lee, Heather Schneider, Robbie Schell, *Mobile Applications: Architecture, Design, and Development*, Hewlett-Packard Professional Books, 2004.

Reference Books:

1. Barry A Burd, *Android Application Development All-in-one for Dummies*, John Wiley & Sons Inc., 1st Edition.
2. Jeff McWherter , Scott Gowell , *Professional Mobile Application Development* 1st Edition, WROX Publishing.

MCA-17-54 COMPUTER GRAPHICS

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit: 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.

Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT – I

Computer Graphics: Introduction, applications, Components, Types of Computer Graphics (Interactive, Passive).
Video Display Devices: Raster scan, Random Scan, Interlacing, Display Processors, Resolution, Aspect Ratio, Refresh CRT, Color CRT monitors, Look-Up tables, Plasma Panel, LCD monitors, Interactive Input and Output Devices: keyboard, mouse, trackball, joystick, light pen, digitizers; image scanners, Touch Panels; Voice systems; printers, plotters; Graphics Software; Coordinate Representations;

UNIT – II

Drawing Geometry: Symmetrical and Simple DDA line drawing algorithm, Bresenham's line Algorithm; loading frame buffer; Symmetrical DDA for drawing circle, Polynomial method for circle drawing; circle drawing using polar coordinates, Bresenham's circle drawing; Generation of ellipse; parametric representation of cubic curves, drawing Bezier curves;
Filled-Area Primitives: Flood fill algorithm, Boundary fill algorithm, Scan-line polygon fill algorithm.

UNIT – III

2-D Transformations: translation, rotation, scaling, matrix representations and homogeneous coordinates, composite transformations, general pivot point rotation, general fixed point scaling, Shearing; Reflection, Reflection about an arbitrary line.
2-D Viewing: window, viewport; 2-D viewing transformation, zooming, panning; Clipping operations: point and line clipping, Cohen-Sutherland line clipping, mid-point subdivision line clipping, Liang-Barsky line clipping, Sutherland-Hodgman polygon clipping.
Pointing and positioning techniques; rubber band technique; dragging;

UNIT – IV

3-D Graphics: 3-D modeling of objects, 3D transformation matrices for translation, scaling and rotation, parallel projection: Orthographic and oblique projection; perspective projection; Hidden surface removal: Z-buffer, depth-sorting, area subdivision, BSP-Tree method; Ray casting; Shading: Modelling light intensities, Gouraud shading, Phong shading; Introduction to Animation, Tweening, Morphing, Fractals;

Text Books:

1. Donald Hearn, M. Pauline Baker, *Computer Graphics,* Pearson Education, 2nd Edition.
2. John F. Hughes. Amdries Van Dam. Foley etc., *Computer Graphics Principles & Practice*, Pearson Education, 3rd Edition.

Reference Books:

1. D.P. Mukherjee, *Fundamentals of Computer Graphics and Multimedia*, PHI, 2nd Edition.
2. Newmann & Sproull, *Principles of Interactive Computer Graphics*, McGraw Hill, 3rd Edition.
3. Rogers, *Procedural Elements of Computer Graphics*, McGraw Hill, 2nd Edition.

MCA 17-55 (i) BIG DATA ANALYTICS

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Big Data : Introduction, Mining Unstructured Data, Challenges of Big Data Analytics, Context Building through Multilevel Data Mining, Big Data and Learning, Text Analytics and Big Data, Crawling the Web and Information Retrieval.

Data Cleaning, Sorting and Categorization of Data, Protection and Security to Data, Data Storage Technologies, Data Mining with Big Data.

UNIT-II

Context, Importance of Context in Unstructured Big Data, Use of Contextually Enabled Data, Context Types, Contexts in User Data, Contextual Analysis,

Text Mining, Text Categorization and Context Learning, Corpus Representation, Context Based Learning, Topic Modeling, Situation Modeling, Big Data and Text Classification.

UNIT-III

Multi Label Big Data Mining : Introduction, Phases in Multi Label Unstructured Text Mining, Graph Based Model, Graph Representation, Text Operations using Graph Model.

Applications of Distributed Subspace Clustering, High Dimensional Data Clustering, Dimensionality Reduction, Subspace Clustering, Distributed System, Distributed Clustering, Text Data Clustering, Big Data Clustering.

UNIT-IV

Big Data and Machine Learning, Incremental Learning, Incremental Techniques to Handle Big Data.

Business Values of Analytics, Building Business Case for Analytics, Idealism and Realism in Business Analytics, Building Trust in Analytics, Impact of Big Data, Rising Importance of Text in Analytics.

Text Books:

1. Parag Kulkarni, Sarang Joshi and Meta S Brown, *Big Data Analytics*, PHI Learning Private Limited, 2017.
2. Y Lakshmi Prasad, *Big Data Analytics : Made Easy*, Notion Press, 2016.

MCA 17-55 (ii) CLOUD COMPUTING

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Introduction, Layers and Types of Cloud, Features of Cloud, Infrastructure as a Service, Platform as a Service, Software as a Service.

Broad Approaches of Migrating to a Cloud, Seven Step Model of Migration into a Cloud.

UNIT-II

The Onset of Knowledge Era, Evolution of SaaS, Challenges of SaaS Paradigm, Approaching the SaaS integration Enigma, New Integration Scenarios, Integration Methodologies, SaaS Integration Products and Platforms, SaaS Integration Services, Business to Business Integration Services.

Issues of Enterprise Applications on Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers towards marketplace for Enterprise Cloud Computing, Cloud Supply Chain.

UNIT-III

Virtual Machine, Provisioning and Manageability, Virtual Machine Migration Services, Anatomy of Cloud Infrastructure, Distributed Management of Virtual Infrastructure, Scheduling Techniques of Advanced Reservation of Capacity, Capacity Management to meet SLA Commitments.

Logical Design of Cluster as a Service, Cloud Storage from LAN to WAN, Technologies for Data Security in Cloud.

UNIT-IV

Integration of Private and Public Cloud, Resource Provisioning Service, Hybrid Cloud Implementation, Importance of Quality and Security in Cloud, Business Ready Dynamic Data Centre, Dynamic ICT Services.

Workflow Management System and Clouds, Utilizing Clouds for Workflow Execution,

MCA 17-55 (iii) BIO - INFORMATICS

Maximum marks: 100
Time: 3 hours

External: 80
Internal: 20
Credit : 5

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 8 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 24 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 14 marks.
Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting One question from each Unit.

UNIT-I

Bioinformatics objectives and overviews, Interdisciplinary nature of Bioinformatics, Data integration, Data analysis, Major Bioinformatics databases and tools. Metadata: Summary & reference systems, finding new type of data online.

Molecular Biology and Bioinformatics: Systems approach in biology, Central dogma of molecular biology, problems in molecular approach and the bioinformatics approach, Overview of the bioinformatics applications.

UNIT-II

The Information Molecules and Information Flow: Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, -Translation, Genes- the functional elements in DNA, Analyzing DNA,DNA sequencing. Proteins: Amino acids, Protein structure, Secondary, Tertiary and Quaternary structure, Protein folding and function, Nucleic acid-Protein interaction.

UNIT-III

Nucleotide sequence data: Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses.

UNIT-IV

Biological data types and their special requirements: sequences, macromolecular structures, chemical compounds, generic variability and its connection to clinical data. Representation of patterns and relationships: alignments, regular expressions, hierarchies and graphical models.

Text Books:

1. Rastogi, Mendiratta, Rastogi, *Bioinformatics :Concepts, Skills & Applications*, CBS Publishers, 2008.
2. Dan E Krane, *Fundamental Concepts of Bioinformatics,* Pearson Education, 2003

Reference Books:

1. Jin Xiong, *Essential Bioinformatics*, Cambridge University Press, 2006
2. David Edwards, Jason Stajich, David Hanson, *Bioinformatics Tools and Applications*, Springer, 2009