

Subject: Entrance Examination Syllabus for Lateral Entry to 3rd Semester of Two-Year MCA Programme

The following 16-unit syllabus, based on the courses prescribed in Semester I and Semester II of the Two-Year MCA Programme, is proposed for the Entrance Examination for lateral entry to the 3rd Semester.

Unit 1: Java Programming and Mobile Application Development: Java programming fundamentals, JVM and bytecode, data types, variables and arrays, operators and expressions, control statements, classes and objects, constructors, inheritance, polymorphism, interfaces, exception handling, packages, strings, multithreading, file handling, serialization, GUI and event handling, socket programming, mobile application platforms, native and hybrid applications, mobile application development lifecycle, Android platform and SDK, Android application structure, activities, services, intents, content providers, manifest file, permissions, Android networking, user-interface design, layouts and SQLite database.

Unit 2: Advanced Java Programming: Exception handling, try, catch, finally, throw and throws, user-defined and chained exceptions, multithreading, thread life cycle, synchronization, Java I/O, file handling, serialization, GUI and event handling, socket programming, client-server applications.

Unit 3: Data Structures and Algorithms: Fundamental data structures, arrays, linked lists, stacks, queues, trees, binary trees, tree traversals, binary search trees, AVL trees, B-trees and B+ trees, graphs, searching, sorting, algorithm design and analysis, growth of functions, asymptotic notations, time and space complexity, recurrences, divide-and-conquer, greedy algorithms, dynamic programming, backtracking, branch and bound, randomized algorithms, minimum spanning trees, shortest-path algorithms, Eulerian and Hamiltonian tours, hashing, collision resolution, heaps, binomial heaps and leftist heaps.

Unit 4: Advanced Algorithms and Computational Complexity: Minimum spanning trees, shortest-path algorithms, Eulerian tours, Hamiltonian tours, hashing, hash functions, collision resolution, rehashing, heap structures, binomial heaps, leftist heaps, lower-bound theory, reductions, P and NP problems, NP-Hard and NP-Complete problems, Cook's theorem, approximation algorithms, vertex cover problem, travelling salesman problem and subset-sum problem.

Unit 5: Database Management and Database Design: Database concepts, DBMS architecture, data models, schemas and instances, three-schema architecture, data independence, database languages and interfaces, ER modelling, relational data model, relational algebra, functional dependencies, normalization, 1NF, 2NF, 3NF

and BCNF, distributed databases, fragmentation, replication, distributed transparency, parallel databases, object-based and object-relational databases.

Unit 6: Transactions, Concurrency and Database Recovery: Transactions, ACID properties, transaction states, concurrency problems, serializability, two-phase locking, timestamp ordering, database recovery, logging and checkpointing, transaction management and recovery mechanisms.

Unit 7: Operating Systems and Linux Programming: Operating-system concepts, processes, process scheduling, inter-process communication, process synchronization, critical section, semaphores, monitors, memory management, virtual memory, paging, page replacement, segmentation, deadlocks, deadlock prevention, avoidance, detection and recovery, Linux features and architecture, file system, directories, files, users and permissions, processes, shell environment, shell commands, shell scripting, variables, operators, decision-making, loops, functions and positional parameters.

Unit 8: Computer Networks and Data Communication: Network components and topologies, LAN, MAN and WAN, OSI model, TCP/IP model, comparison of OSI and TCP/IP models, Internet architecture, transmission media, multiplexing, switching, data-link layer, error detection and correction, sliding-window protocols, Ethernet, ALOHA, CSMA, CSMA/CD and CSMA/CA, bridges, switches, routers and gateways.

Unit 9: Internetworking, Transport and Application Protocols: Network-layer concepts, routing algorithms, IPv4, IPv6, IP addressing, CIDR, subnetting, ARP, RARP, OSPF, BGP, TCP, UDP, TCP congestion control, socket programming, HTTP, DNS, e-mail and World Wide Web.

Unit 10: Software Engineering and Management Information Systems: Software engineering principles, software crisis, software development processes, Waterfall, prototyping, incremental, iterative, Spiral and Agile models, software metrics, CMMI, COCOMO, requirements engineering, functional and non-functional requirements, requirement elicitation, analysis, validation and verification, software design, abstraction, architecture, modularity, coupling and cohesion, structured and object-oriented design, UML, software testing, black-box and white-box testing, software reliability, organizations and information systems, data and information, MIS, DSS and GDSS, system analysis, DFD, context diagrams, decision tables, ERP, SCM, CRM, IT decision-making, information-system security, ethics and privacy.

Unit 11: Machine Learning and Artificial Intelligence: Introduction and applications of Machine Learning, types of learning, training and testing, feature extraction and selection, normalization, missing data, dimensionality reduction, PCA, regression, decision trees, K-means clustering, K-nearest neighbours, hierarchical



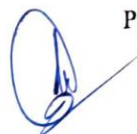
clustering, DBSCAN, fuzzy C-means, Naïve Bayes, Bayesian belief networks, SVM, Artificial Intelligence concepts and applications, knowledge representation, propositional and first-order logic, expert systems, forward and backward chaining, intelligent agents, fuzzy logic, search strategies, hill climbing, constraint satisfaction, genetic algorithms, simulated annealing, ant colony optimization, particle swarm optimization, inductive learning, uncertainty and artificial neural networks.

Unit 12: Cyber Security, Cryptography and Digital Forensics: Cyber security, CIA triad, cyber attacks and cyber crimes, cyber laws, Information Technology Act, 2000, system security, software security, web security, network security, digital evidence, chain of custody, digital forensic procedures, data acquisition and validation, computer forensic tools, timeline analysis, file-system forensics, FAT file system, anti-forensics, artifact wiping, data hiding, forensic readiness, classical encryption, symmetric encryption, DES, AES, asymmetric encryption, RSA, Diffie-Hellman, ElGamal, ECC, hash functions, MAC, digital signatures, HTTPS, TLS, SSH, firewalls and intrusion detection systems.

Unit 13: Cloud Computing and Blockchain Technologies: Cloud computing concepts and characteristics, cloud service models, deployment models, virtualization, hypervisors, multitenancy, virtual servers, cloud storage, load balancing, failover, replication, SLA monitoring, auto-scaling, cloud security, cloud architecture and scalability, blockchain concepts, distributed ledger technology, blocks and chains, consensus mechanisms, cryptographic foundations of blockchain, smart contracts, blockchain applications and security considerations.

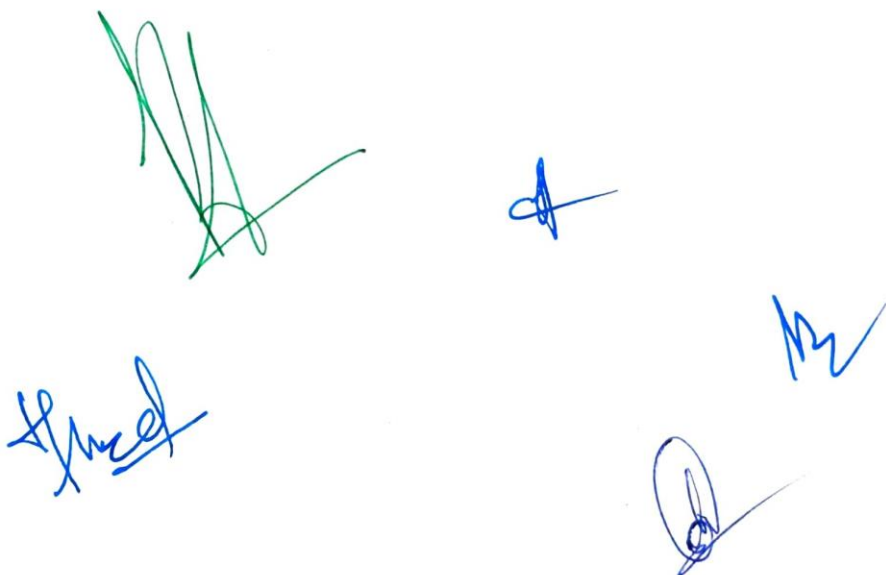
Unit 14: Computer Graphics: Introduction to Computer Graphics, applications of computer graphics, graphic display devices, raster-scan displays, random-scan displays, colour CRT monitors, double buffering, lookup tables, Cartesian and homogeneous coordinate systems, DDA line algorithm, Bresenham line algorithm, circle and ellipse drawing algorithms, two-dimensional transformations, window and viewport concepts, window-to-viewport transformation, filling techniques, clipping, Cohen-Sutherland line clipping, three-dimensional graphics, perspective and parallel projections, hidden-surface removal, Z-buffer algorithm, Bezier curves and surfaces, multimedia, virtual reality and augmented reality.

Unit 15: Theory of Computation: Introduction to computation, formal languages, regular languages, regular operations, closure properties, finite automata, DFA, NFA, ϵ -NFA, conversion of ϵ -NFA to NFA, NFA to DFA, minimization, Mealy and Moore machines, regular expressions, equivalence of DFA, NFA and regular expressions, non-regular languages, pumping lemma, context-free languages, pushdown automata, context-free grammars, parsing, ambiguity, Chomsky Normal Form, context-sensitive languages, context-sensitive grammars, linear bounded automata,



Turing machines, recursive and recursively enumerable languages, decidability and undecidability, reductions, Rice's theorem, Post Correspondence Problem, Halting Problem, P and NP, SAT, Hamiltonian Path, Clique and polynomial-time reduction.

Unit 16: Research and Publication Ethics: Research integrity, academic integrity, research ethics, responsible conduct of research, fabrication, falsification and plagiarism, authorship and contributorship, conflicts of interest, publication misconduct, ethical issues in peer review, predatory journals and publishers, open-access publishing, copyright, plagiarism detection, journal metrics, impact factor, h-index and i10-index, citation databases, reference-management tools and ethical use of research publications.

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