Kerala University of Digital Sciences, Innovation and Technology

School of Computer Science and Engineering (SoCSE)

Syllabus for DUAT – M.Tech in Computer Science and Engineering

Test Code: DUAT07_MTECHCS

General Aptitude (20 Marks)

Verbal Aptitude-Basic English grammar: Tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech. Basic vocabulary: Words, idioms and phrases in context. Narrative sequencing.

Quantitative Aptitude-Data interpretation: Data graphs (bar graphs, pie charts, and other graphs representing data), 2- and 3-dimensional plots, maps, and tables. Numerical computation and estimation: Ratios, percentages, powers, exponents and logarithms, permutations and combinations, summations and series, Mensuration and Geometry Analytical Aptitude-Logic: Deduction and induction, analogy, numerical relations, and reasoning. Spatial Aptitude-Transformation of shapes: Translation, rotation, scaling, mirroring, assembling, grouping, paper folding, cutting, and patterns in 2 and 3 dimensions.

Mathematics (20 Marks)

Set Theory- Concept of sets–Union, Intersection, Cardinality, Elementary counting; permutations and combinations.

Probability and Statistics- Basic concepts of probability theory, Averages, Dependent and independent events, frequency distributions, measures of central tendencies and dispersions.

Algebra-Fundamental operations in algebra, expansions, factorization, simultaneous linear/quadratic equations, indices, logarithms, arithmetic, geometric and harmonic progressions, determinants and matrices.

Coordinate Geometry- Rectangular Cartesian coordinates, distance formulae, equation of a line, and intersection of lines, pair of straight lines, equations of a circle, parabola, ellipse and hyperbola.

Calculus-Limit of functions, continuous function, differentiation of function, tangents and normal, simple examples of maxima and minima. Integration of functions by parts, by substitution and by partial fraction, definite integrals, and applications of definite integrals to areas.

Vectors-Position vector, addition and subtraction of vectors, scalar and vector products and their applications to simple geometrical problems and mechanics.

Trigonometry-Simple identities, trigonometric equations, properties of triangles, solution of triangles, heights and distances, general solutions of trigonometric equations.

Computer Science (20 Marks)

Programming and Data Structures-Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Algorithms-Searching, sorting, hashing. Asymptotic worst-case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths

Operating System-System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems.

Databases-ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Computer Networks-Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

Machine Learning-(i) Supervised Learning: regression and classification problems, simple linear regression, multiple linear regression, ridge regression, logistic regression, k-nearest neighbour, naïve Bayes classifier, linear discriminant analysis, support vector machine, decision trees, bias-variance trade-off, cross-validation methods such as leave-one-out (LOO) cross-validation, k-folds cross validation, multi-layer perceptron, feed-forward neural network; (ii) Unsupervised Learning:

clustering algorithms, k-means/k-medoid, hierarchical clustering, top-down, bottom-up: single-linkage, multiple-linkage, dimensionality reduction, principal component analysis.

Artificial Intelligence-Search: informed, uninformed, adversarial; logic, propositional, predicate; reasoning under uncertainty topics - conditional independence representation, exact inference through variable elimination, and approximate inference through sampling.