Name of the Faculty: Faculty of Engineering and Technology

Department : Applied Sciences and Humanities

Name of the Program : M.Tech(Computational Mathematics)

Summary of Entrance Test:

Types of Questions	Test Duration	Max. Marks	No. of Questions	Negative Marking
Multiple Choice Questions	120 Minutes	100	100	Yes (-0.25 marks for each wrong answer)

Detailed Syllabus for M. Tech Entrance Test

Sequences and Series of Real Numbers: Sequence of real numbers, convergence of sequences, bounded and monotone sequences, convergence criteria for sequences of real numbers, Cauchy sequences, subsequences, Bolzano-Weierstrass theorem ,Series of real numbers, absolute convergence, tests of convergence for series of positive terms , comparison test, ratio test, root test; Leibniz test for convergence of alternating series.

Functions of One and Several Variables: Limit, continuity, partial derivatives, differentiability, intermediate value property, Rolle's Theorem, Mean-value theorem, L'-Hospital rule, Taylor's theorem, maxima and minima.

Integral Calculus: Integration as the inverse process of differentiation, definite integrals and their properties, fundamental theorem of calculus, double and triple integrals, change of variables and change of order of integration.

Differential Equations: Ordinary differential equations of the first order, Bernoulli's equation, exact differential equations, integrating factor, orthogonal trajectories, homogeneous differential equations, linear differential equations of second order with constant coefficients, method of separation of variables, method of variation of parameters, Cauchy-Euler equation.

Vector Calculus and Linear Algebra: Scalar and vector fields, gradient, divergence, curl, line integrals, surface integrals, Green, Stokes and Gauss theorems, Rank and inverse of a matrix, determinant, solutions of systems of linear equations, consistency conditions, eigen-values and eigenvectors for matrices, Cayley-Hamilton theorem, Finite dimensional vector spaces, linear dependence and independence of vectors, basis, dimension, linear transformations, range space, null space, rank-nullity theorem.

Fundamental of Computers: Basics of Computers: generation of computers, binary, decimal numbers and conversion from binary to decimal and vice versa; Programming in C: data types, arrays, functions, pointers and structures; Data Structure: linked list, stack, queue, tree, searching and sorting algorithm.

Numerical Analysis: Numerical solution of algebraic and transcendental equations: bisection method, secant method, Newton-Raphson method, fixed point iteration method; Interpolation: Lagrange interpolation, Newton backward & forward interpolations; numerical differentiation; numerical integration: Trapezoidal and Simpson 1/3 & 3/8 rules; numerical solution of systems of linear equations: direct methods (Gauss elimination, LU decomposition); iterative methods (Jacobi and Gauss-Seidel); numerical solution of ordinary differential equations.

Probability and Statistics: Sample space, Bayes theorem, independent variable, random variables, joint and conditional probability, standard probability distributions and their properties (Binomial, Poisson, Normal, Geometric, Negative binomial, Exponential, Gamma, Continuous uniform, Bivariate normal, Multinomial), expectation, conditional expectation, moments; Weak and strong law of large numbers, central limit theorem; Testing of hypotheses, standard parametric tests based on normal, χ^2, t and F distributions; Simple linear regression.

Operation Research: Linear programming problem and its formulation, convex sets and their properties, graphical method, basic feasible solution; infeasible and unbounded LPP's, balanced and unbalanced transportation problems; Hungarian method for solving assignment problems.

Thermodynamics and Statistical Physics Laws of thermodynamics:
Macrostates and microstates; phase space; ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck's distribution law; Bose-Einstein condensation; first and second order phase transitions, phase equilibrium, critical point.

Basic Electronics: Diodes; Bipolar Junction Transistors, Field Effect Transistors, amplifier and oscillator circuits; operational amplifier, active filters and oscillators; rectifier circuits, regulated power supplies; digital logic circuits, flip-flops , combinational circuits, sequential circuits, counters, registers, A/D and D/A conversion.