



राष्ट्रीय प्रौद्योगिकी संस्थान, कुरुक्षेत्र
NATIONAL INSTITUTE OF TECHNOLOGY
(Under the Ministry of Education, Govt. of India)
KURUKSHETRA-136119

Ref.:Advt. No.:18/2023

SYLLABUS FOR SCREENING TEST

Name of the Post: Assistant Professor Grade – II (Level – 10)

Name of the Department: Mathematics

Calculus: Functions of two or more variables, continuity, directional derivatives, partial derivatives, total derivative, maxima and minima, saddle point, method of Lagrange's multipliers; Double and Triple integrals and their applications to area, volume and surface area; Vector Calculus: gradient, divergence and curl, Line integrals and Surface integrals, Green's theorem, Stokes' theorem, and Gauss divergence theorem.

Linear Algebra: Finite dimensional vector spaces, Linear transformations and their matrix representations, rank, systems of linear equations, eigen values and eigen vectors, minimal polynomial, Cayley-Hamilton Theorem. diagonalization, Hermitian. Skew-Hermitian and Unitary matrices. Finite dimensional inner product spaces.

Complex Analysis: Analytic functions. conformal mappings. bilinear transformations, complex integration. Cauchy's integral theorem and formula, Liouville's theorem, maximum modulus principle, Taylor and Laurent's series, residue theorem and applications for evaluating real integrals, transcendental functions like trigonometric, exponential and Hyperbolic.

Real Analysis: Sequences and series of functions. uniform convergence. power series. Fourier series. functions of several variables, maxima, minima. Riemann's integrations. multiple integrals. line, surface and volume integrals, Green's, Stokes and Gauss theorem, metric spaces, completeness, Weierstrass approximation theorem. compactness, Lebesgue measure. measurable functions, Lebesgue integral, Fatou's lemma dominated convergence theorem. Limit. continuity, Derivative, Partial Derivative.

Ordinary Differential Equations: First order ordinary differential equations, existence and uniqueness theorems, system of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients. linear second order ordinary differential equations with variable coefficients. method of Laplace transform for solving ordinary differential equations, series solutions, Legendre polynomial and Bessel functions with their properties.

Algebra: Normal subgroups and homomorphism theorems. automorphisms, Group actions. Sylow's theorems and their applications, Euclidean domains, Principal ideal domains and unique factorization domains Prime ideals and maximal ideals in commutative rings. Fields, finite fields.

Functional Analysis: Banach spaces, Hahn-Banach extension theorem, open mapping and closed graph theorems, principle of uniform boundedness, Hilbert spaces, orthonormal bases. Riesz representation theorem, bounded linear operators.

Numerical Analysis: Numerical solutions of algebraic and transcendental equations: bisection. secant method. Newton-Raphson method, fixed point iteration, interpolation, error of polynomial interpolations. Lagrange. Newton interpolations, numerical differentiation. numerical integration. Trapezoidal and Simpson rules. Gauss Legendre quadrature, method of undetermined parameters, least square polynomial approximation, numerical solutions of systems of linear equations, direct methods (Gauss elimination. LU decomposition), iterative methods (Jacobi and Gauss-Seidel), matrix eigen value problems, power method, numerical solution of ordinary differential equations, initial value problems. Taylor series methods. Euler's method. Runge-Kutta methods.

Partial Differential Equations: Linear and quasilinear first order partial differential equations. method of characteristics, second order linear equations in two variables and their classifications, Cauchy, Dirichlet and Neumann problems, solutions of Laplace. wave and diffusion equations in two variables. Fourier transform, Laplace transform.

Mechanics: Generalized coordinates. Lagrange's equations, Hamiltonian canonical equations. Hamilton's principle and principle of least action, Two Dimensional motion of rigid bodies, Euler's dynamical equations for the motion of rigid body about an axis, Theory of small oscillations, Virtual work and moment of inertia.

Probability and Statistics: Probability space. conditional probability, Baye's theorem, independence, Random variables, joint and conditional distributions. standard probability distributions and their properties, expectations, conditional expectation. moments. Weak and Strong law of large numbers. central limit theorem. Sampling distributions. Testing of hypotheses, standard parametric tests based on normal. chi-square, t. F-distributions. Linear regression, interval estimation.

Linear programming: Linear programming problem and its formulation, convex sets and their properties. graphical method. basic feasible solution, simplex method. big-M and two phase methods, infeasible and unbounded LPs, alternate optima. Dual problem and duality theorems. dual simplex method and its application in post optimality analysis, Balanced and unbalanced transportation problems. different methods for solving transportation problems. assignment problems. Sensitivity Analysis.