National Institute of Advanced Manufacturing Technology

Hatia, Ranchi – 834003

Department of Applied Sciences and Humanities

Attention – Eligible applicants for the post of Assistant Professor (Mathematics) contractual

Syllabus for written test for the post of Assistant Professor (Mathematics) contractual

Function of one variable: Successive Differentiation, Leibnitz Theorem, Expansion of a function into Taylors and Maclaurin's Series, Function of two or more variables: Partial derivatives; Euler's Theorem; Taylor's Expansion. Maxima & Minima of a function of two variables, Lagrange's method of undetermined multipliers.

Reduction formula for integrals. Improper integrals and its convergence; Beta and Gamma functions and their properties. Differentiation under integral sign. Applications of integrals as length, area, volume and surface area of revolution.

Matrices- Rank of a matrix (Echelon form and Normal form), System of linear equations; consistency and inconsistency, Eigen values and eigenvectors; Diagonalization of square matrices; Cayley-Hamilton Theorem.

First order ordinary Differential Equations: Exact, Linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable equations solvable for y, equations solvable for x and Clairaut's type.

Infinite Series: Convergence of series; Comparison test, P Test, Cauchy's nth Root test, D Alembert's Ratio Test, Rabies Test, Logarithmic test.

Multivariable Integral Calculus: Double and Triple integrals, Evaluation of double integrals, change of order of integration, change of variables, Evaluation of Triple integrals, Simple applications involving areas, volumes.

Vector Calculus: Scalar and Vector point functions. Directional derivative, Gradient, divergence and curl. Line integrals, Surface integrals, Volume integrals, Green's theorem, Stokes theorem and Gauss divergence theorem (without proofs).

Higher order linear differential equations with constant and variable coefficients, Method of variation of parameters, Cauchy's and Legendre's linear equations, Simultaneous linear equations, Series solutions of differential equations, Bessel and Legendre's equations and its solution(without proof).Elementary properties of Bessel function and Legendre's polynomial.

Differentiation, Cauchy-Riemann equations, Analytic functions, Harmonic functions, finding harmonic conjugate; Conformal mappings, Mobius transformations and their properties.

Contour integrals, Cauchy Integral Theorem, Cauchy Integral formula (without proof)and for derivatives also, zeros of analytic functions, singularities, Taylor's seriesLaurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

Laplace Transformation: Laplace Transformation and its properties, Periodic function, Unit step function and impulse function .Inverse Laplace Transformation, Convolution Theorem, Applications of Laplace transforms in solving certain initial value problems & simultaneous differential equations.

Numerical Method: Finite difference, Symbolic relations, Interpolation and Extrapolation, Newton - Gregory forward and backward formula, Lagrange's formula, Inverse Interpolation by Lagrange's formula. Numerical Differentiation and Numerical Integration, Newton Cotes Quadrature formula, Trapezoidal rule. Simpson's 1/3" rule, Simpson's 3/8" rule.

Z-Transform & Inverse Z-Transform- Properties - Initial and Final value theorems, Convolution theorem- Difference equations. Solution of difference equations using Z-Transformation.

Fourier Series & Fourier Transform: Expansion of - Algebraic, Exponential &Trigonometric functions in Fourier series, Change of interval, Even and odd function, half range sine and cosine series, Complex form of Fourier series.

Fourier Transformation and inverse Fourier Transformation, Fourier sine & cosine transforms. Convolution theorem for Fourier transforms with simple illustrations.

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations of first order, Lagrange's linear equation, Non-linear equations of first order, Charpit's method Solution of one dimensional Wave equation & Heat equation by the method of separation of variables and its applications.

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