



Bhartiya Skill Development University

Syllabus for Ph.D. Entrance Test

Mathematics

Fluid Dynamics:

Governing equations of fluid motion; stream line; velocity potential, path line, equation of continuity, Motion in two dimensions; stream function; complex potential; source; sink and doublet; image circle theorem, Viscous fluid, Stokes-Navier equations; Plane Poiseuille and Couette flows between two parallel plates. Theory of Lubrication. Flow through tubes of uniform cross section in form of circle, annulus, ellipse and equilateral triangle under constant pressure gradient. Unsteady flow over a flat plate. Dynamical similarity. Buckingham π -theorem. Reynolds number. Prandtl's boundary layer. Boundary layer equations in two dimensions. Blasius solution. Boundary-layer thickness. Displacement thickness. Karman integral conditions. Separations of boundary layer flow.

Analysis:

Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem.

Linear Programming Problem:

The Linear programming problem. Mathematical Formulation of the Problem, Types of solutions, Linear programming in matrix notation. Some Exceptional Cases, General Linear Programming Problem Slack and Surplus Variables, Theory and application of the simplex method of solution of a linear programming problem, Charne's M-technique, The two phase method, Duality, Transportation & Assignment Problems.

Ordinary Differential Equations (ODEs):

Existence and Uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.



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Partial Differential Equations (PDEs):

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis:

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

References:

- Fluid Dynamics, MD Raisinghania, 11th Edition, S Chand Publications, New Delhi.
- Numerical Methods, RK Jain, SRK Iyengar, 6th Edition, New Age Int. Pvt. Ltd., New Delhi.
- Ordinary and Partial Differential Equations, MD Raisinghania, S Chand Publications, New Delhi.
- Operations Research: theory and application, J.K. Sharma, Macmillan Publishers.
- Real Analysis, Robert G Bartle, Wiley Publication.