

MT-538

Partial Differential Equations

Review of ordinary differential equations and their solutions, simultaneous, total (or Pfaffian) and Riccati's equations. Formation of Partial differential equations (PDE), Partial differential equations (PDE) of the first order. Lagrange's equations, method of multiplier, Nonlinear PDE of first order, Charpit's method, linear homogeneous and nonhomogeneous PDE with constant coefficients, PDE of order two with variable coefficients, Monge's method, applications of 1st order partial differential equations. Some special and hypergeometric functions arising in the solutions of PDE.

Partial differential equations of second order: Fundamental concepts, Classification of second order PDE, Boundary and initial conditions, Reduction to canonical form and the solution of 2nd order PDE. Technique of separation of variable for the solution of PDE, Elliptic PDE and related BVP's, Laplace and Poisson equations, Parabolic PDE and related BVP's, Diffusion equation. Hyperbolic PDE and related BVP's, Wave equation. Dirichlet and Neumann Problems for different geometries. Mathematical modeling of heat, Laplace, wave and transmission line equations. Separation of variable method with special emphasis on Heat, Laplace, wave transmission line equations. Separation of variable method in polar, cylindrical and spherical coordinate system. Green's function, the method of images, the eigenfunction method, Laplace, Fourier and Hankel transforms for the solution of PDE and their application to boundary value problems. Traveling wave solutions PDE, Similarly and Lie group methods for PDE, Perturbation techniques for PDE. Techniques for solving non-linear partial differential equations.

Reference Books

1. Applied Partial Differential Equations, David Logan, Springer, 2014.
2. Advanced differential equations, M.D. Raisinghania, S. Chand & Company, 2014.
3. Partial Differential Equations for Scientists and Engineers, Stanley J. Farlow, Dover Publisher, 2012.
4. Introduction to Partial Differential Equations, K. Sankara Rao, PHI limited, Latest available.
5. Chester, C.R., Techniques in Partial Differential Equations, McGraw-Hill Book Company, Latest available.
6. Haberman, R., Elementary Applied Partial Differential Equations, Prentice Hall, Inc. New Jersey, Latest available.