PARTIAL DIFFRENTIAL EQUATIONS

Course No: **MM24401CR** Total Credits: **04**
Semester: **MA/M.Sc. 4th Semester** Total Marks: **100**
Continuous Assessment Marks: **20**, Theory Marks: **80** Time Duration: 2½ hrs

Course objectives: To familiarize the students with the fundamental concepts of PDE's and their solutions in the context of Laplace, Heat and Wave equations.

Course Outcomes: Course outcomes for a Partial Differential Equations (PDE) course focuses on developing students' understanding of PDEs, their classification, solution techniques, and applications in various mathematical and scientific contexts.

UNIT -I

Introduction to partial differential equations, partial differential equations of first order, linear and non-linear partial differential equations, Lagrange's method for the solution of linear partial differential equations, Charpits method and Jacobi methods for the solution of non-linear partial differential equations, initial-value problems for quasi-linear first-order equations, Cauchy's method of characteristics.

UNIT -II

Origin of second order partial differential equations, linear partial differential equations with constant coefficients, methods for solution of second order partial differential equations, classification of second order partial differential equations, canonical forms, adjoint operators, Riemann's method, Monge's method for the solution of non-linear partial differential equations.

UNIT -III

Derivation of Laplace and heat equations, boundary value problems, Drichlet's and Neumann problems for a circle and sphere; solutions by separation of variables method, cylindrical coordinates and spherical polar coordinate system, maximum-minimum principle, uniqueness theorem, Sturm-Liouville theory.

UNIT -IV

Derivation of wave equation, D' Alembert's solution of one dimensional wave equation, separation of variables method, periodic solutions; method of eigen functions, Duhamel's principle for wave equation, Laplace and Fourier transforms and their applications to partial differential equations, Green function method and its applications.

Recommended Books:

1. Robert C. Mc Owen, Partial Differential Equations-Methods and Applications, Pearson Education, Delhi, 2004.
2. L. C. Evans, Partial Differential Equations, GTM, AMS, 1998
3. Diran Basmadjian, The Art of Modelling in Science and Engineering, Chapman & Hall/CRC, 1999.
4. E. DiBenedetto, Partial Differential Equations, Birkhauser, Boston, 1995.
5. F. John, Partial Differential Equations, 3rd ed., Narosa Publ. Co., New Delhi,1979.
6. E. Zauderer, Partial Differential Equations of Applied Mathematics, 2nd Ed., John Wiley and Sons, New York, 1989.