


ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS

PROF. P. N. AGARWAL
Department of Mathematics
IIT Roorkee
PROF. D.N. PANDEY
Department of Mathematics
IIT Roorkee

INTENDED AUDIENCE :UG and PG students of technical institutions/ universities/colleges.

COURSE OUTLINE :

This course is a basic course offered to UG/PG students of Engineering/Science background. It contains existence and uniqueness of solutions of an ODE, homogeneous and non-homogeneous linear systems of differential equations, power series solution of second order homogeneous differential equations. Frobenius method, boundary value problems for second order ODE, Greens function, autonomous systems, phase plane, critical points and stability for linear and non-linear systems, eigen value problems, Sturm-Liouville problem. Classification of first order PDE, existence and uniqueness of solutions, Nonlinear PDE of first order, Cauchy method of characteristics, Charpits method, PDE with variable coefficients, canonical forms, characteristic curves, Laplace equation, Poisson equation, wave equation, homogeneous and nonhomogeneous diffusion equation, Duhamels principle. This course has tremendous applications in diverse fields of Engineering and Sciences such as control theory, numerical analysis and dynamical systems etc.

ABOUT INSTRUCTOR :

Prof. P. N. Agarwal is a Professor in the Department of Mathematics, IIT Roorkee. His area of research includes approximation Theory and Complex Analysis. He delivered 13 video lectures on Engineering Mathematics in NPTEL Phase I and recently completed Pedagogy project on Engineering Mathematics jointly with Dr. Uaday Singh in the same Department. Further he has completed online certification course “Mathematical methods and its applications” jointly with Dr. S.K. Gupta of the same department. He taught the course on “Integral equations and calculus of variations” several times to MSc (Industrial Mathematics and Informatics) students. He has supervised nine Ph.D. theses and has published more than 187 research papers in reputed international journals of the world. Currently, he is supervising eight research students.

Prof. D. N. Pandey is an Associate Professor in the Department of Mathematics, IIT Roorkee. Before joining IIT Roorkee, he worked as a faculty member in BITS-Pilani Goa campus and LNMIIT Jaipur. His area of expertise includes semigroup theory and functional differential equations of fractional and integral orders. He has already prepared e-notes for the course titled “Ordinary Differential Equations and Special Functions” under e-Pathshala funded by UGC. Also, he has published a book titled “Nonlocal Functional Evolution Equations: Integral and fractional orders, LAP LAMBERT Academic Publishing AG Germany”. He has delivered several invited talks at reputed institutions in India and abroad. He has guided three PhD theses and has published more than 60 papers in various international journals of repute. Currently, he is supervising five research students.

COURSE PLAN :

Week 1: Existence and uniqueness of solutions of ODE

Week 2: Linear system

Week 3: Power Series solution

Week 4: Fronius Series solution

Week 5: Stability of systems

Week 6: Boundary Value Problems

Week 7: Introduction to First order PDE

Week 8: Nonlinear PDE of 1st Order

Week 9: Classification and Canonical forms of Second order PDE

Week 10: Laplace equation

Week 11: Wave equation

Week 12: Heat equation