

Course Title: Advance Mathematics- VII (Methods of Mathematical Physics)
Course Rating: 4 Cr. Hours

Sturm Liouville Systems

- Some properties of Sturm-Liouville equations
- Regular, Periodic and singular Sturm-Liouville systems and its applications

Series Solutions of Second Order Linear Differential Equations

- Series solution near an ordinary point
- Series solution near regular singular points

Series Solution of Some Special Differential Equations

- Hypergeometric function $F(a, b, c; x)$ and its evaluation
- Series solution of Bessel equation
- Expression for $J_n(X)$ when n is half odd integer, Recurrence formulas for $J_n(X)$
- Orthogonality of Bessel functions
- Series solution of Legendre equation

Introduction to PDEs

- Review of ordinary differential equation in more than one variables
- Linear partial differential equations (PDEs) of the first order
- Cauchy's problem for quasi-linear first order PDEs

PDEs of Second Order

- PDEs of second order in two independent variables with variable coefficients
- Cauchy's problem for second order PDEs in two independent variables

Boundary Value Problems

- Laplace equation and its solution in Cartesian, Cylindrical and spherical polar coordinates
- Dirichlet problem for a circle
- Poisson's integral for a circle
- Wave equation
- Heat equation

Fourier Methods

- The Fourier transform
- Fourier analysis of generalized functions
- The Laplace transform

Green's Functions and Transform Methods

- Expansion for Green's functions
- Transform methods
- Closed form of Green's functions

Variational Methods

- Euler-Lagrange equations
- Integrand involving one, two, three and n variables
- Necessary conditions for existence of an extremum of a functional
- Constrained maxima and minima

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Recommended Books

1. D.G. Zill and M.R. Cullen, *Advanced Engineering Mathematics*, (Jones and Bartlett Publishers, 2006)
2. W.E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, (John Wiley & Sons, 2005)
3. E.T. Whittaker, and G. N. Watson, *A Course of Modern Analysis*, (Cambridge University Press, 1962)
4. I.N. Sneddon, *Elements of Partial Differential Equations*, (Dover Publishing, Inc., 2006)
5. R. Dennemyer, *Introduction to Partial Differential Equations and Boundary Value Problems*, (McGraw Hill Book Company, 1968)
6. D.L. Powers, *Boundary Value Problems and Partial Differential Equations*, (Academic Press, 2005)
7. W.E. Boyce, *Elementary Differential Equations*, (John Wiley & Sons, 2008)
8. M.L. Krasnov, G.I. Makarenko and A.I. Kiselev, *Problems and Exercises in the Calculus of Variations*, (Imported Publications, Inc., 1985)
9. J. Brown and R. Churchill, *Fourier Series and Boundary Value Problems*, (McGraw Hill, 2006)