MA2002D MATHEMATICS IV

Pre-requisites: MA1001D Mathematics I & MA1002D Mathematics II

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Total hours: 39

Course Outcomes:

Students will be able to:

CO1: Find solutions of linear differential equations using power series method and Frobenius series method.

CO2: Formulate various engineering problems as partial differential equations and hence solve them. CO3: Identify analytic functions and find harmonic conjugates.

CO4: Find images of regions under complex transformations. CO5: Evaluate line integrals in the complex plane

CO6: Use techniques of complex analysis to evaluate integrals of real valued functions.

Module 1: (11 Hours)

Series Solutions and Special Functions

Power series solutions of differential equations, Theory of power series method, Legendre Equation, Legendre Polynomials, Frobenius Method, Bessel's Equation, Bessel functions, Bessel functions of the second kind, Sturm- Liouville's Problems, Orthogonal eigenfunction expansions.

Module 2: (10 Hours)

Partial differential Equations

Basic Concepts, Cauchy's problem for first order equations, Linear Equations of the first order, Nonlinear Partial Differential Equations of the first order, Charpit's Method, Special Types of first order equations, Classification of second order partial differential equations, Modeling: Vibrating String, Wave equation, Separation of variables, Use of Fourier Series, D'Alembert's Solution of the wave equation, Heat equation: Solution by Fourier series, Heat equation: solution by Fourier Integrals and transforms, Laplace equation, Solution of a Partial Differential Equations by Laplace transforms.

Module 3: (9 Hours)

Complex Numbers and Functions

Complex functions, Derivative , Analytic function, Cauchy- Reimann equations, Laplace's equation, Geometry of Analytic functions: Conformal mapping, Linear fractional Transformations, Schwarz - Christoffel transformation, Transformation by other functions.

Module 4: (9 Hours)

Complex Integration

Line integral in the Complex plane, Cauchy's Integral Theorem, Cauchy's Integral formula, Derivatives of analytic functions.Power series, Functions given by power series, Taylor series and Maclaurin's series. Laurent's series, Singularities and Zeros, Residue integration method, Evaluation of real Integrals.

References:

1. Kreyszig E, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, New York, 1999
2. I.N. Sneddon, Elements of Partial Differential Equations, Dover Publications, 2006.
3. Wylie C. R. & Barret L. C., Advanced Engineering Mathematics, 6th Edition, Mc Graw Hill, NewYork,1995.
4. Donald W. Trim, Applied Partial Differential Equations, PWS – KENT publishing company, 1994.