# MATHEMATICS - III

## UNIT I -LINEAR ODE WITH VARIABLE COEFFICIENTS AND SERIES SOLUTIONS(SECOND ORDER ONLY)

**Cauchy's differential equations -** Cauchy euler homogeneous linear equation, Example problems. **Legendre differential equations -** Legendre differential equations, Example problems. **Motivation For Series Solutions -** Motivation for power series solutions of Differential Equation, Power Series, Analytic Function, Ordinary Point, Singular Point, Power Series Solution of the Differential equation when $x = 0$ is an ordinary point i.e., when P does not vanish for $x = 0$", Example problems. **Extended power series method-indicial equation -** Extended power series method-indicial equation, Series solution about regular point x - Frobenius method, Example problems.

## UNIT II -SPECIAL FUNCTIONS

**Lengendre polynomials -**Lengendre polynomials, Rodrique's Formula, Express Legendre's polynomial in terms of algebraic polynomial, Express algebraic polynomials in terms of legendre polynomials, Example problems, Rodrigue's formula, Example problems, Generating function for pn(x), Example problems, Orthogonal Properties of Legendre's polynomial, Laplace's first and second integral of Pn(x).**Recurrence Relations -** Recurrence Relations, Recurrence Relation I to VI, Example problems, Beltrami's result, Example problems, Fourier – Legendre expansion of f(x), Example. **Bessel's Functions -** Bessel's Functions, Solution of Bessel's Equations, Expansions for J0 and J1, Recurrence formulae for Jn(x), Formula Two, Formula Three, Formula Four, Formula five, Formula six, Example problems. **Generating Function ForJn(x) -** Generating Function For Jn(x), Example problems, Orthogonality of Bessel functions.

## UNIT III -COMPLEX FUNCTIONS – DIFFERENTIATION AND INTEGRATION

**Function of complex variable -** Complex numbers, Function of a complex variable, Exponential functions, Limit of a function, Continuity, Example problems, Derivative, Example problems, Theorem.**Analytic function -** Analytic function, Cauchy-Riemann(C-R) Equations in cartesian coordinates, Cauchy-Riemann equations IN polar coordinates,Properties of analytic functions, Example problems. **Properties of Analytic function-** Harmonic function - laplace equation, Harmonic functions, Example problems, Orthogonal system, Example problems. **Construction of analytic function -** Construction of analytic function, Example problems. **Milne Thompson Method -** Milne Thompson Method (To construct an Analytic function), Working Rule: To construct an Analytic Function by Milne Thompson Method, Example problems. **Line Integral of a Complex Function -** Introduction, Line Integral of a Complex Function, Example problems. **Cauchy's integral theorem -** Introduction, The cauchy's theorem, Cauchy's integral formula, Generalized cauchy's integral formula, Some useful theorems, Example problems.

## UNIT IV-POWER SERIES EXPANSIONS OF COMPLEX FUNCTIONS AND CONTOUR INTEGRATION

**Taylor's theorem of complex valued function -** Introduction of complex power series, Taylor's series, Example problems. **Laurant's theorem complex valued function -** Laurent's series, Example problems. **Classification of singularities -** Singularities and poles, Example problems. **Cauchy's Residue theorem –** Introduction, Residues, Cauchy's residue theorem, Example problems. **Integration around the unit circle -** Contour integration type I, Example problems. **Integration around the semi – circle -** Contour integration type II, Example problems.

## UNIT V-CONFORMAL MAPPING

**Mapping or Transformation -** Conformal mapping, Translation, Example problems, Magnification, Magnification and Rotation, Example, Magnification, Rotation and Translation, Inversion and Reflection, Example problems. **Some standard transformation -** Mapping by elementary transformation, Transformation w = ez, Transformation w = log z, Transformation w = sin z, Transformation w = cos z, Transformation w = sinh z, Transformation w = cosh z, The conformal mapping w = tan z, The transformation w = z + 1/z(Joukowski's transformation), Transformation w = z + a/2, Example problems. **Bilinear transformation -** Bilinear transformation, Fixed points (or) Invariant points, Cross Ratio, Example problems.