

**PAPER –III**  
**DIFFERENTIAL EQUATIONS**

**TIME: 3 hours**

**Max. Marks: 100**

**UNIT – I**

Partial differential equation: Existence and uniqueness of solutions, second order partial differential equations, boundary value problems, Green function and Cauchy problem.

**UNIT – II**

Calculus of variations: Linear functionals, Minimal functional theorem, General variation of a function, Euler – Lagrange's equation, Variational methods of boundary value problems in ordinary and partial differential equations. Variation problems in parametric forms.

**UNIT –III**

Series solutions of a second order linear differential equations near a singular point (for Frobenius method). Hyper geometric functions: Definitions of hyper geometric series and function; elementary properties of hyper geometric function; Integral formula for hyper geometric series, Linear transformations, contiguous function relation, Linear relation between the solutions of hyper geometric differential equation Kummer's confluent hyper geometric function and its simple and basic properties

**UNIT –IV**

Legendre's polynomial Functions: Legendre's differential equation and associated Legendre's differential equations, Simple properties of Legendre's functions of first and second kind and the associated Legendre's function of integral order.

**UNIT-V**

Bessel functions, Generating function, Integral formulae, Recurrence relations; Addition formula and other properties of Bessel functions. Classical Orthogonal Polynomials, Generating functions and other properties, associated with the Jacobi, Laguerre, Legendre and Hermite Polynomials.

**Books recommended:**

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| 1. Rainville, E.D.                  | : Special Functions.                          |
| 2. Sneddon, I.N.                    | : Special Functions.                          |
| 3. Sneddon, I.N.                    | : Element of Practical differential equation. |
| 4. Forsyth, A.R.                    | : A Treatise of Differential equations        |
| 5. Gupta, A.S.                      | : Calculus of variations with Applications    |
| 6. Bansal, J.L.                     | : Differential equations Vol. II              |
| 7. Gelfand, I.M.<br>and Fomin, S.V. | : Calculus of variations.                     |