Paper – III: Differential Equations, Calculus of Variations & Special Functions:

Unit 1: Non-linear ordinary differential equations of particular forms, Riccati's equation –General solution and the solution when one, two or three particular solutions are known.

Unit 2: Total Differential equations.

Unit 3: Partial differential equations of second order with variable co-efficients-Monge's method.

Unit 4: Classification of linear partial differential equation of second order, Cauchy's problem, Method of separation of variables.

Unit 5: Laplace, Wave and Diffusion equations, Canonical forms.

Unit 6: Linear homogeneous boundary value problems. Eigen values and eigen functions. Sturm-Liouville boundary value problems, Orthogonality of eigen functions, Reality of eigen values.

Unit 7: Calculus of variation – Functionals, Variation of a functional and its properties, Variational problems with fixed boundaries, Euler's equation, Extremals, Functional dependent on several unknown functions and their first order derivatives.

Unit 8: Functionals dependent on higher order derivatives, Functionals dependent on the function of more than one independent variable, Variational problems in parametric form.

Unit9: Series solution of a second order linear differential equation near a regular/singular point (Method of Frobenius) with special reference to Gauss hypergeometric equation and Legendre's equation.

Unit 10: Gauss hypergeometric function and its properties, Integral representation.

Unit 11: Linear transformation formulas, Contiguous function relations, Differentiation formulae, Linear relation between the solutions of Gauss hypergeometric equation, Kummer's confluent hypergeometric function and its properties, Integral representation, Kummer's first transformation.

Unit 12: Legendre polynomials and functions $P_n(x)$ and $Q_n(x)$.

Unit 13: Bessel functions $J_n(x)$.

Unit 14: Hermite polynomials $H_n(x)$.

Unit 15: Laguerre and Associated Laguerre polynomials.