

Mathematics 2

Module 1 - Ordinary Differential Equation 1

- Ordinary differential equations of first order (linear and higher degree)
- Linear higher-order differential equations with constant coefficients
- Homogeneous linear differential equations
- Simultaneous differential equations
- Solving ordinary differential equations (ODEs) using the Laplace Transform method

Module 2 - Ordinary Differential Equation

- Second-order ordinary differential equations with variable coefficients (using one solution known)
- Removal of the first derivative
- Change of independent variable
- Method of operational factor
- Method of variation of parameters
- Solution of second-order ordinary differential equations by series method
 - Legendre polynomials
 - Bessel functions of the first kind and their properties

Module 3 - Partial Differential Equation

- Formulation of partial differential equations (PDEs)
- Solution of first-order linear partial differential equations
- Solution of first-order non-linear partial differential equations

- Homogeneous linear partial differential equations with constant coefficients (second and higher order)
- Method of separation of variables
- Applications of PDEs in solving:
 - One-dimensional heat equations
 - One-dimensional wave equations

Module 4 - Function of Complex variable

- Analytic functions
- Harmonic conjugate
- Cauchy-Riemann equations (without proof)
- Line integral
- Cauchy-Goursat theorem (without proof)
- Cauchy integral formula (without proof)
- Singular points, poles, and residues
- Residue theorem
- Application of the residue theorem for evaluation of real integrals (Unit Circle)

Module 5 - Vector Calculus

- Differentiation of vectors
- Scalar and vector point functions
- Gradient:
 - Geometrical meaning of gradient
 - Directional derivative
- Divergence and curl
- Integrals:

- Line integral
- Surface integral
- Volume integral
- Theorems:
 - Gauss divergence theorem
 - Stokes' theorem
 - Green's theorem