

Mathematical Physics - I

Assam University

FYUG · Semester 1 · Credits 3

Unit 1: Vector Algebra and Matrices

Scalar and vector products, Physical interpretation of vector product, Scalar and vector triple products and their properties, Derivation of important vector identities, Preliminary ideas of scalar and vector fields, Different types of matrices, Symmetric and antisymmetric matrices, Hermitian matrix and its properties, Inverse and transpose of matrices, Solution of simultaneous linear equations, Eigenvalues and eigenvectors, Diagonalization of a matrix

Unit 2: Ordinary Differential Equations

Order and degree of a differential equation, General form of first order differential equations, Separation of variables, Exact differential equations, Inexact differential equations and integrating factors, Linear differential equations, Second order differential equations, Homogeneous differential equations with constant coefficients, Wronskian and general solution, Complementary function, Methods for finding particular integrals

Unit 3: Vector Calculus

Directional derivative and normal derivative, Gradient of a scalar field and its geometrical interpretation, Divergence of a vector field, Curl of a vector field, Laplacian operator, Vector identities, Ordinary integrals of vectors, Line integrals of vector fields, Surface integrals of vector fields, Volume integrals of vector fields, Gauss's divergence theorem, Stokes' theorem

Unit 4: Orthogonal Curvilinear Coordinates

Definition of orthogonal curvilinear coordinates, Examples of orthogonal curvilinear coordinate systems, Transformation between curvilinear and Cartesian coordinate systems, Expressions for infinitesimal line, surface and volume elements, Gradient in curvilinear coordinate systems, Divergence in curvilinear coordinate systems, Curl in curvilinear coordinate systems, Laplacian in curvilinear coordinate systems, Spherical coordinate system, Cylindrical coordinate system

Unit 5: Beta and Gamma Functions and Numerical Techniques

Beta and Gamma functions, Relation between Beta and Gamma functions, Expression of integrals in terms of Gamma functions, Solution of algebraic and transcendental equations by bisection method, Solution of equations by Newton-Raphson method, Numerical integration using Simpson's rule, Interpolation using Newton-Gregory forward difference formula, Interpolation using Newton-Gregory backward difference formula