Name of the Department/Centre: Physics

Course Type (Please tick appropriate box):

Major		Discipline Specific Core	X	Ability Enhancement	
Minor		Multidisciplinary		Skill Enhancement	
Value Added		Any other			

Semester - II

Course Title - Mathematical Physics I

Course Type – Discipline Specific Core

Course Code – 24-PHY-D-171

Course Level – 100

Total Credits – 3

Classes /week – 3

Prerequisite – Mathematics in class XII

Course Advisor's Name :

Course Advisor's Email :

Expected Learning Outcome - Physics is generally referred as mathematical description of nature. To understand the underlying physical laws in nature one has to be equipped with proper mathematical training. In this mathematical physics course students will be exposed to different mathematical topics which they need to understand other areas of physics which they will read in their first year. It will also help them to understand the next level courses of mathematical physics as well.

Reference Books:

1. Vector Analysis : Schaum Series
2. Advanced Engineering Mathematics : Kreyzig
3. Linear Algebra : Schaum Series
4. Complex Variable : Spiegel
5. Linear Vector Spaces : M. C. Jain

Course Syllabus -

Unit I: Matrices and Linear Vector Space :

Matrix algebra; Different types of matrices; Quotient space; Inner Product; Abstract Systems; Binary Operations; Groups; Fields; Linear Vector Spaces; Subspaces; Linear Independence and Dependence; Basis; Dimensions; Change of basis; Homomorphism, Isomorphism, Linear and Non-singular Transformations, completeness and closure properties, linear operators system of linear equations, eigen values and eigen vectors, similarity transformation and diagonalization.

Unit II: Vector and Multivariate Calculus :

Vector algebra; Fields; Directional derivatives; normal derivative; Gradient; Divergence; Curl; Laplacian, Vector identities, Ordinary Integrals of Vectors, Multiple integrals, Jacobian, Notion of infinitesimal line, surface, volume elements; Line, surface, volume integrals of vector fields. Flux of a vector field, Gauss theorem, Green's theorem and Stokes Theorems, Orthogonal curvilinear coordinates: Calculation of divergence, gradient, curl and Laplacian in spherical polar and cylindrical coordinates. Multiple Integrals, Jacobian. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Differentiation of composite functions. Implicit functions. Taylor series expansion of function of more than one variable. Maxima and minima. Integrating factor, Constrained Maximization using Lagrange Multipliers.

Unit III: Ordinary Differential Equations :

FODE homogeneous and nonhomogeneous with variable coefficients, Integrating factors, Second Order Differential equations: Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems, Second-Order homogeneous and nonhomogeneous equations with constant and variable coefficients Particular Integral.

Unit IV: Fourier Series and Dirac Delta Function:

Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function Properties and representation of Dirac delta function in 1D, 2D, 3D; integral representation; Fourier series: Periodic functions; Dirichlet Conditions; Fourier coefficients; complex form, Expansion of arbitrary period function, non-periodic function, even and odd functions; Half range expansions; Summing of infinite series; Parseval Identity.