

SARDAR PATEL UNIVERSITY
Programme: B.Sc (Physics)
Semester: V
Syllabus with effect from: June-2013

Paper Code: US05CPHY02		Total Credit: 3
Title Of Paper: Mathematical Physics		
Unit	Description in detail	Weighting (%)
I	<p>Matrices & Curvilinear Co-ordinate System Matrices: Basic concept of matrix and Matrix operations, Linear and orthogonal transformations, Eigen values, Eigen vectors and diagonalizing matrices Curvilinear Coordinate System: Introduction to vector calculus and coordinate systems, Orthogonal curvilinear co-ordinates, Condition for orthogonality, Reciprocal sets of two triads of mutually orthogonal vectors, Gradient in terms of orthogonal curvilinear co-ordinates, Divergence in terms of orthogonal curvilinear co-ordinates, Curl in terms of curvilinear co-ordinates, Laplacian in terms of curvilinear co-ordinates, Equivalent expression for gradient, div and curl in rectangular co-ordinates, Cylindrical co-ordinates as a special curvilinear system, Spherical co-ordinates as a special curvilinear system, Related Numericals</p>	
II	<p>Harmonics with Special Functions Legendre differential equation(Solution in descending power), Generating function for Legendre polynomials(without corollary), Recurrence formulas for Legendre polynomials, Rodrigue's formula, Orthogonal properties of Legendre polynomials of the first kind, The associated Legendre polynomial, Bessel's differential equation, Generating functions for Bessel's function, Recurrence formula for Bessel's function, Orthogonal properties of Bessel's polynomials, Hermite differential equation, Hermite polynomials, Recurrence formula for Hermite polynomial,orthogonal properties of Hermite polynomials</p>	
III	<p>Fourier series, Diffusion and Wave Equation Definition and expansion of a function of x, Complex representation of Fourier's series, Physical application of Fourier's series, Fourier series involving phase angles, Effective values and the average of a product, Thermal state, Transverse vibration of a string, Diffusion equation or Fourier equation of heat flow, Independent derivation of one dimensional diffusion equation, Solution of one dimensional diffusion equation when both the ends of a bar at temperature zero, Two-dimensional diffusion equation, Derivation of one-dimensional wave equation, Derivation of Two-dimensional wave equation, Related Numericals</p>	
IV	<p>Numerical Techniques Curve Fitting: Introduction, The Least squares method, Fitting a straight line, Fitting a parabola, Fitting a curve of the form $y=ax^b$, Fitting an exponential curve Interpolation: Newton's forward difference interpolation formula, Newton's backward difference interpolation formula, Lagrange's interpolation formula Numerical differentiation and integration: Differentiation using difference operators, Differentiation using difference interpolation, Integration by Trapezoidal Rule, Simpson's (1/3) Rule, Eigen values and its problems, Jacobi's Method</p>	



Basic Text & Reference Books:-

- Mathematical Methods in Physical Science
Mary L Boas, Second Edition, John Wiley & Sons
- Mathematical Physics
B D Gupta, Second Revised Edition, Vikas Publishing House Pvt.Ltd.
- Numerical Methods for Scientists and Engineers
K Sankara Rao, Third Edition, Eastearn Economy Edition(PHI)
- Mathematical Methods for Physics
George B. Arfken and Hans J. Weber, Academic Press, INC(Forth Edition)
- Numerical Methods
E Balagurusamy, Tata McGraw Hill Publishers
- Numerical Mathematical Analysis
J B Scarborough, Oxford & IBH Publishing Pvt. Ltd.

