Course Objective:

The main objective of this course is to familiarize students with a range of mathematical methods that are essential for solving advanced problems in theoretical physics.

It consists of training topics in matrices, special functions, curve fitting techniques along with the supplement of fundamental numerical techniques inclined towards the physical systems. On the basis of this, students should be able to analyze and solve basic problem in science and engineering involving problem set up (or mathematical structure developing)

The second objective is to highlight applications of mathematical methods to physical systems which shed light on both the mathematics and the logic underpinning physical models. This allows students to develop valuable intuition for subsequent courses where these same methods will be applied. We will accomplish this objective primarily in the lectures.

Mathematical Physics (18BSM 604)										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
3	**1**	**--**	**4**	**4**	**25**	**50**	**25**	**--**	**--**	**100**

UNIT I **Hours 12**

Matrices & Curvilinear Co-ordinate System:

Coordinate System: 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 coordinates, Laplacian in terms of curvilinear co-ordinates.

UNIT II **Hours 8**

Fourier series: 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, Dirac delta function, definitions and different representations of delta functions.

UNIT III **Hours 8**

Second order linear PDEs, Elliptic equations, Laplace and Poisson equations, types of solution, Laplace-Fourier methods of variable separable.

UNIT IV **Hours 11**

Parabolic and hyperbolic equations in different co-ordinate system, General physical processes, Heat propagation equation, Solution of one dimensional diffusion equation when both the ends of a bar at temperature zero, Wave equation and standard conditions, Laplace-Fourier method and types of solution.

APPROXIMATE TOTAL Hours 39

Text and Reference books

1. Mathematical Methods in Physical Science Mary L Boas, Second Edition, John Wiley & Sons
2. Mathematical Physics, B D Gupta, Second Revised Edition, Vikas Publishing House Pvt.Ltd.
3. Vector Analysis, D Spellman, M Spiegel and S Lipschutz, Schaum Series.
4. Mathematical Methods for Physics, George B. Arfken and Hans J. Weber, Academic Press, INC(Forth Edition)

Course Outcomes:

On completion of this course students will be expected to

1. use matrices in solving physical problems with the set up of system of linear equations,
2. solve physical and realistic problems involving complex coordinate systems other than Cartesian Coordinate system,
3. study and contribute in heat-flow problems by means of diffusion equation
4. understand the data set and may go for generating the best curve passing through that data set by various methods and various powered polynomials