B. Sc. IVYear		BPH-C701		Semester-VII	
		MATHEMATICAL PHYSICS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment
60	3 Hrs	30	60	3 Hrs	30

NOTE: The question paper shall consist of two sections (Sec.-A and Sec. B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec. B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Learning Objectives

The purpose of this paper is to introduce students to different methods of mathematical physics. The course structure of this paper include the study matrices, tensors, complex variables, special functions, integral transformations and differential equations in greater detail.

MATRICES & TENSORS

Orthogonal, Hermitian, Unitary and Normal matrices, Pauli and Dirac matrices, Orthogonality conditions, Tensor analysis: Introduction and definitions (Covariant and contravariant tensors, Addition, Multiplication & rank of tensors, Contraction, Direct product, Quotient rule), Pseudo and dual tensors, Levi-Civita symbol, Metric tensor, Christoffel symbols as derivatives of the metric tensor. (12 Lectures)

COMPLEX VARIABLES

Functions of complex variables, Analytic function, Cauchy integral theorem and Cauchy integral formula, Taylor and Laurent series, Theorem of residues, Contour integrals and definite integrals. (12 Lectures)

SPECIAL FUNCTIONS

Legendre, Bessel, Hermite, Laguerre equations and their solutions & polynomials, Recurrsion relations, Orthogonality and generating functions, Associated Legendre polynomials. (12 Lectures)

INTEGRAL TRANSFORMS

First and second order shifting theorems, Fouriers series, Fourier integral, Fourier transformes (FT), Dirac delta functions and its FT, Laplace transforms (LT), Inverse LT by partial fractions, LT of derivative and integral function.

(12 Lectures)

PARTIAL DIFFERENTIAL EQUATION

Laplace equation and its solution in rectangular, cylindrical and spherical co-ordinates; Poisson equation (Green's function solution), Two dimensional wave equation, Vibrating membrane (rectangular and circular).

(12 Lectures)

Text Books / Reference Books

1. Mathematical Physics - B.S. Rajput
2. Mathematical Methods for Physics - G Arfken
3. Mathematical Methods for Physics- G.Arfken
4. Applied Mathematics for Physicists & Engineer- Pipes & Harvil
5. Matrices and Tensors for Physicists- A .W. Joshi
6. Advanced Engineering Mathematics- E. Kreyszig
7. Mathematics for Physicists- Mary L. Boas
8. Special functions - E.D. Rainville
9. Special functions W. W. Bell
10. Mathematical Methods for Physicists & Engineers- K.F. Reily, MPH Hobson & SJ Bence

Learning Outcomes: *With the methods to be taught in this course, students will acquire all the mathematical skills those are necessary to solve problems in classical mechanics, quantum mechanics, electrodynamics, solid state physics, nuclear particle physics and other fields of theoretical physics. The students will be able to work with vectors, tensors, different types of functions, transformations and series upon the successful completion of this paper.*