Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NPHC502	METHODS OF MATHEMATICAL PHYSICS	3	1	0	4

Course Objective
To sketch the ideas and emphasize the relations which are essential to the study of physics and related fields.
Learning Outcomes
The approach incorporate contents required for the basic & advanced level of understanding and active learning on problem solving skills of physics students. The mathematical methods given herewith are not quoted under most general assumptions, but are customized to the more restricted applications required in almost all areas of physics.

Unit No.	Topics to be Covered	Lecture Hours	Tutorial hours	Learning Outcome
1	Special Functions: Generating functions; Recurrence relation; Associate Legendre, Bessel, Hermite and Laguerre equations and their solutions; Physical applications; Green's function and its applications.	10	4	This will help students to solve varieties of problems in Spectroscopy, multipole expansion, quantum mechanics, time dependent and independent problems in physics.
2	Complex Variables: Analytic functions of a complex variable, Contour integrals, Cauchy's Integral theorem and formulae, Calculus of residues, Application of complex variables.	8	2	This will help the science and engineering students as a basic tool in many mathematical theories, viz. two dimensional fluid flow, harmonic functions, computing difficult integrals, etc.
3	Tensors: Transformation properties, Metric tensor, Raising and lowering of indices, Contraction, Symmetric and antisymmetric tensors.	6	2	To understand the theory of relativity, high energy physics, non-linear optics, quantum mechanics, etc.
4	Group Theory: Definition, Properties, Transformations, Multiplication table, Examples.	6	2	This is useful in the classification of molecules and crystals, understanding unification of different forces.
5	Laplace transform: Laplace transform and its properties, Laplace inverse transform, Laplace transform of derivatives, Application of Laplace transform.	5	2	This will help in solving the differential equations and it is widely used in engineering fields namely, mechanical and electrical engineering, etc. It is also applied in statistical mechanics, area of science and technology.
6	Fourier transform: Sine, Cosine and Complex transforms with examples, Definition, Properties and Representations of Dirac Delta Function, Properties of Fourier Transforms, Transforms of derivatives, Parseval's Theorem, Convolution Theorem, Discrete Fourier transform, Introduction to Fast Fourier transform.	7	2	This will help students to understand spectroscopic outcomes, quantum mechanics, signal processing, etc.
	Total	**42**	**14**	

Text Books:

1. Mathematical Methods for Physicists; Arfkenand Weber; Academic Press; 2010.
2. Mathematical Methods for Physics and Engineering; Riley, Hobson, Bence; Cambridge University Press; 2002.
3. Group Theory and Quantum Mechanics; Tinkham; Dover Publications; 2003.
4. Elements of Group Theory for Physicists; Joshi; New Age; 1997.

Reference Books:

1. Essential Mathematical. : Methods For Physicists; Arfkenand Weber; Academic Press; 2005
2. Applied Mathematics For Engineers And Physicists; Pipes; Mcgraw-Hill Book Company; 1970
3. Introduction To Mathematical Physics; Harper; PHI Learning; 2009
4. Mathematical Physics: Advanced Topics; Joglekar; Universities Press; 2006
5. Mathematical Methods for Physics; Wyld; Westview Press; 1999
6. Mathematical Methods in Physical Sciences; Boas; Wiley India Pvt Ltd; 2006.