PPH104 MATHEMATICAL PHYSICS

L	T	P	Cr
3	1	0	3.5

Course Objectives: To impart knowledge about various mathematical tools employed to study physics problems.

Complex Variables: Introduction, Cauchy-Riemann conditions, Cauchy's Integral formula, Laurent expansion, Singularities, Calculus of residues.

Differential Equations: Ordinary Differential Equations, First order homogeneous and non-homogeneous equation with variable coefficients, Second order homogeneous and non-homogeneous equation with constant coefficients, Second order homogeneous and non-homogeneous equation with variable coefficients, Partial differential equations of theoretical physics, Separation of variables, Series solutions.

Special Function: Bessel functions of first and second kind, Generating function, orthogonality; Legendre functions: generating function, Recurrence relations and special properties, Orthogonality; Hermite functions, Laguerre functions.

Fourier series and Fourier Transforms: Fourier series, Dirichlet conditions, applications, Gibbs phenomenon, Fourier transforms, Development of the Fourier integral, and Fourier transforms of derivatives.

Tensors: Scalar, Vector and tensor quantities, Contravariant and covariant tensors, Addition, multiplication and contraction of tensors, Application of tensors in coordinate transformations.

Group Theory: Concept of group, Character tables of discrete groups, Lie groups, generators, U(1), SU(2), SU(3).

Course learningoutcomes: Students will have achieved the ability to:

1. use complex numbers and variables.
2. solve differential equations of various types.
3. describe special functions and their recurrence relations
4. do fourier expansion and use Fourier transforms to understand tensors
5. explaintensor and its basic operations
6. describe the basics of Group Theory

Recommended Books:

1. *Arfken G. and Weber H.J., Mathematical Methods for Physicists, Academic Press, (2005).*
2. *Rajput B. S., Mathematical Physics, Pragati Prakashan, (2002).*
3. *Boas M.L. Mathematical Methods in the Physical Sciences, John Wiley & Sons, New York, (1983).*
4. *Harper C. Analytical Mathematics in Physics, Prentice Hall, (1999).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25