

Course 1: Mathematical methods of physics

Course code: MSCPH501

Credit: 3

BLOCK – 1 vector, matrix, tensor, and complex Analysis

UNIT 1: **Vector Algebra:** vector algebra and calculus, curvilinear coordinates, spherical and cylindrical coordinate systems, linear algebra.

UNIT 2: **Matrix:** Introduction, properties, types of matrix, Determinant of matrix, cofactor, minors of matrix, Adjoin of matrix, Rank, Cayley- Hamilton theorem, applications of matrix in Physics.

UNIT 3: **Complex Analysis:** Element of complex Analysis, Analytic Function Cauchy integral formula, Taylor and Laurent series Pole, Residue, Cauchy residues theorem, singularity, evolution of residues and integrals.

UNIT 4: **Tensor:** Tensor and tensor classification, Rank of a tensor, covariant and contra-variant tensors, symmetric and anti-symmetric tensor, Kronecker delta symbol, contraction of tensor, metric tensor and tensor densities, Covariant differentiation and Geodesic equation

BLOCK – 2 Differential equations and Special functions

UNIT 5: **Differential equations:** Linear ordinary differential equations of first and second order

UNIT 6: **Partial differential equation:** Partial differential equation, Laplace Equation, Wave Equation, Heat equation in two and three dimension.

UNIT 7: **Legendre's differential equation and Bessel differential equation:**

Legendre's differential equation and related polynomials, orthogonality relation, generating function, recurrence relation, Bessel differential equation and related polynomials, orthogonality relation, generating function, recurrence relation.

UNIT 8: **Hermite differential equation and Laguerre differential equation:**

Hermite differential equation and related polynomials, orthogonality relation, generating function, recurrence relation, Laguerre differential equation and related polynomials, orthogonality relation, generating function, recurrence relation

BLOCK – 3 : INTEGRAL TRANSFORMS

UNIT 9: **Fourier integral and transforms:** Fourier integral, Fourier transforms and Application

UNIT 10: **Laplace Transform:** Laplace Transforms and Applications

Reference Books:

1. H.K. Das, Mathematical Physics, S. Chand, Delhi
2. Mathematical Methods for Physics: Wyle.
3. P.K. Chakrabarti and S.N. Kundu, A Text Book of Mathematical Physics, New Central Book Agency, Kolkata.
4. A.K. Ghatak, I.C. Goyal and S.H. Chua, Mathematical Physics Macmillan India, New Delhi.
5. Mathematical Methods for Physicists: Arfken.
6. Satya Prakash, Mathematical Physics, Sultan chand Publication