**PH 401: Mathematical Physics-I (3-1-0:4)**

**Transformation and Vector Calculus**

Vectors in 3-D space, Coordinate Transformations, Rotations in 3D, Differential vector operators, Vector integration, Curvilinear coordinates. **[6L+2T]**

**Vector Spaces**

Vectors in function spaces - Scalar product, Hilbert space, Schwarz Inequality, Orthogonal expansions, Bessel’s inequality, Dirac notation, Gram-Schmidt orthogonalisation, Operators, Basis expansion of operators, Self-adjoint operators, unitary operators, transformation of operators, Invariants. **[9L+3T**]

**Ordinary Differential Equations**

Introduction, First-Order Equations, ODEs with Constant Coefficients, Second-Order Linear ODEs, Series Solutions - Frobenius’ method. **[6L+2T]**

**Special Functions**

Bessel, Legendre, Hermite and Laguerre functions, Orthogonality, Generating functions, Recurrence relations. **[9L+3T]**

**Probability and Statistics**

Probability: Definitions, Simple properties,Random variables, Binomial distribution, Poisson distribution, Normal distribution, central limit theorem.**[6L+2T]**

**Textbooks and References**

1. Arfken, Weber and Harris, “Mathematical Methods for Physicists”, 7thedition, Academic Press, 2012.
2. Riley, Hobson and Bence, “Mathematical Methods for Physics and Engineering’’, 3rdedition, Cambridge University Press, 2018.
3. M. L. Boas, “Mathematical methods in the Physical Sciences”, 3rdedition, Wiley India Pvt. Ltd, 2006.
4. S. D. Joglekar, “Mathematical Physics-The Basics”, 1st edition, Universities Press, 2002.
5. V. Balakrishnan, “Mathematical Physics with Applications”, Ane Books, 2017.
6. R. Courant and D. Hilbert, “Methods of Mathematical Physics, Vol. 1”, 1stedition, Wiley VCH, 1989.
7. P. Dennery and A. Krzywicki, “Mathematics for Physicists”, Dover Publications, 2012.
8. R. Beals and R. Wong, “Special Functions: A Graduate Text”, Cambridge University Press, 2010.
9. E.Kreyszig, “Advanced Engineering Mathematics”, 10thedition, John Wiley & Sons Inc, 2015.