16 MPYC-102 (MATHEMATICAL METHOD IN PHYSICS-I)

Full Marks-100

Unit-I

Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables.Analyticity and Cauchy-Riemann Conditions.Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable.Cauchy's Inequality.Cauchy's Integral formula.Simply and multiply connected region.Laurent and Taylor's expansion.Residues and Residue Theorem.Application in solving Definite Integrals.**(10lectures)**

UNIT-II

Integrals Transforms:

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples.Fourier transform of trigonometric, Gaussian, finite wave train & other functions.Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations. **(10 Lectures)**

UNIT-III

Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits.

Groups and Group representation: Definition of groups,Finitegroups,example from solid state physics,sub groups and classes,Group Representation, Characters,Infinite groups and Lie groups,Liealgebra,application, Irreducible representation of SU(2),SU(3)and O(3). Beta, gamma functions, Greens function and its application . Partial differential equations.(20)

BOOKS:

1. Mathematical methods of physics J. Mathews & R.L. Walker.
2. Mathematical methods of physics Arfken and Weber.
3. Mathematical methods for physicists Dennery&Krzywicki.
4. Mathematical methods of physics H. K. Das
5. Mathematical methods of physics Dr. Rama verma (s. Chand)
6. Mathematical methods of physics Satyaprakash (S. Chand)
7. Mathematical methods of physics Binoy Bhattacharya. (NCBA Publication)
8. Introduction to Tensor calculus - Goreux S. J.
9. Mathematical methods of physics Dettman J.W.
10. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence,3rd ed., 2006, Cambridge University Press
11. Advanced Engineering Mathematics, E. Kreyszig (New Age Publication) 2011.
12. Complex Variables, A. S. Fokas& M. J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
13. Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw•
14. First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett.
15. Mathematical Physics –C. Harper, (Prentice Hall India) 2006.
16. Mathematical Physics-Goswami (Cengage Learning) 2014
17. Mathematical Method for Physical Sciences -- M. L. Boas (Wiley India) 2006
18. Introduction to the theory of functions of a complex variable- E.T.Copson (Oxford) Univ.Press.