

AFDRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
M.Sc. PHYSICS, SPACE PHYSICS & MATERIALS SCIENCE  
1 SEMESTER Effective from 2007-2008 admitted batch

P101: MATHEMATICAL METHODS OF PHYSICS

1. SEPECIAL FUNCTIONS : (Without the derivations of power series solutions) 10 Hrs.  
Legendre polynomials, Generating function, Recurrence Relations, and Orthogonality property, Associated Legendre polynomials, Spherical Harmonics. Hermite polynomials, Generating function, Recurrence relations, and orthogonality property. Laguerre polynomials, Generating function, Recurrence Relations and orthogonality property.  
ARFKEN : Chapter : 12. Sec : 1, 2, 3, 5 and 6. Chapter : 11. Sec: 1, 2, 3, 4.  
Chapter : 13. Sec : 1 & 2.
2. FOURIER SERIES AND FOURIER TRANSFORMS : 8 Hrs.  
Fourier Series, Complex Representation of Fourier Series, Applications of Fourier Series. Fourier Transforms, Fourier Transform of derivatives, Convolution theorem, Applications of Fourier Transforms.  
ARFKEN : Chapter : 14. Chapter : 15. Sec: 1 to 5.
3. FUNCTIONS OF A COMPLEX VARIABLE : 12 Hrs.  
Complex, Algebra, Cauchy – Riemann Conditions, Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor's Series, Laurent's expansion, Singularities, Calculus of Residues, Cauchy's Residue theorem, Evaluation of Residues, Evaluation of contour integrals.  
ARFKEN : Chapter : 6. Sec: 1 to 3. Chapter : 7. Sec: 1 to 2.
4. LAPLACE TRANSFORMS : 6 Hrs.  
Definition and properties of Laplace Transforms. Laplace Transforms of elementary functions. Laplace transforms of derivatives. Inverse Laplace Transform, Convolution theorem, Applications of Laplace Transforms.  
ARFKEN : Chapter : 15. Section : 8, 9, 10, 11 and 12.
5. TENSOR ANALYSIS : 6 Hrs.  
Introduction, Transformation of Co-ordinates, Contravariant, Covariant and Mixed tensors, Addition and multiplication of tensors, contraction and Quotient Law. The line element, fundamental tensors.  
BARRY SPAIN : Chapter : 1, 2 and 3.
6. GROUP THEORY : 8 Hrs.  
Definition, Subgroups, Conjugate subgroups, Isomorphism, Representation of groups, Character, Cyclic group, Symmetric Group, Unitary group, Two-and Three dimensional Rotational Groups, Dihedral Group, Crystallographic point groups.  
MARGENAU and MURTHY. Chapter : 15. ARFKEN. Chapter : 4. Sec: 7 to 12.

**TEXT BOOKS:**

"Mathematical Methods for Physicists" by George Arfken. 3<sup>rd</sup> Ed, Academic Press, New York.

**REFERENCE BOOKS:**

1. "Mathematical Physics" by Ghatak, Goyal and Chua.
2. "Mathematical Physics" by B.D. Gupta. Vikas Publishing House, New Delhi
3. "Laplace and Fourier Transforms"-by Goyal and Gupta. Pragati Prakashan Meerut