

Core theory course (Disciplinary)

CPH-701: MATHEMATICAL PHYSICS -II AND QUANTUM MECHANICS - II

UNIT - I

Tensor analysis :

Introduction , Defination, Contravariant vector, Covariant vector, Defination of Tensors of rank two, addition & subtraction of tensor, summation convention, symmetry - anti symmetry of second rank tensor, Contraction, Direct product, Quotient rule, Pseudo tensors Dual tensor Levi-civita symbol, irreducible tensor, Non cartesian tensors, Matrc tensor christoffel symols,christoffel symbols asderivatives of matric tensor,covariant derivative, Tensor derivative operators.

Basic reference :

Mathematical Methods for Physicist by G.B. Afrken& H. J. Weber 5th Edition 2001
Harcot (India Pvt.Ltd.)

UNIT - II

Group theory :

Groups, subgroups and classes, Invariant, subgroups and factor groups, Homomorphism & Isomorphism, Group representation, Reducible & Irreducible representations, Schur's lemma, Orthogonality theorem, Character of representation,Character table, Decomposing a reducible representation into Irreducible ones, Construction of representations, Lie groups & Lie algebra, The Three dimensional rotation groups SO(3), The special unitary groups SU(2) and SU(3), The homomorphism between SU(2) & SU(3), Some application of group theory in physics, (application- 4 classification of elementy particles)

Basic reference :

Mathematical physics by P.K.Chattopahyay, 1990 New age international (P) Ltd, New Delhi.

UNIT - III

Scattering theory :

The scatteing cross-section. General considerations: Kinematics of scattering process; Differential and Totalcross-sections, Wave mechanical picture of scattering:- The scattering amplitude, Green functions : Formal expression for scattering Amplitude, The Born and Eikonal Approximations, The Born Approximation, The validity o f the Born Approximation, The Born series, The Eikonal Approximation .

Basic reference :

A textbook of Quantum mechanics by P. M. Mathews and K. Venkatesan 1976 TMH New Delhi.

UNIT – IV

Partial Wave Analysis :

Asymptotic Behaviour of partial waves : phase shift, The scattering Amplitude in terms of phaseshifts, The Differential and Total cross-sections, Optical Theorem , Phace shift: relation to the potentials, Potentials of finite range, Low energy scattering, Exac soluble problems, Scattering by a square well, scattering by a hard sphere, scattering by a coulumb potential mutual scattering of two particles , Reduction of the two body probleen : The centre of mass frame , Transfomation from centre of mass to Laboratory frame of reference , collisions between identical particles.

Basic reference :

A textbook of Quantum mechanics by P. M. Mathews and K. Venkatesan 1976 TMH New Delhi.

Other references :

- (1) Mathematical Methods in Physical Sciences by M.L. Boas, John Wiley&Sons
- (2) Mathematical Physics by H. K. Dass.
- (3) Mathematical Physics by Styaparakash, S.Chand.
- (4) Quantum Mechanics by L. I. Schiff, McGraw-Hill International student edition (1961).
- (5) Quantum Mechanics Vol I & II A. Messiah, Jhon Wiley & Sons, INC (19 68)
- (6) Introduction to Quantum Mechanics by Powell and Crasemann Addiso -Wesley (1961).
- (7) Quantum Mechanics by V.K. Thankappen, Wiely eastern Ltd.
- (8) Quantum Mechanics : Theory and applications by A. Ghatak and S. Lokanathan.