16 MPYC-103(QUANTUM MECHANICS-I)

Marks-100

Unit-I

General principle of Quantum mechanics:

Linear Vector Space Formulation: Linear vector Space(LVS) and its generality. Vectors:Scalar product, metric space, basis vectors,linear independence, linear superposition of general quan-tum states,completeness and orthogonal relation,Schmidtsorthonormalisation procedure, Dual space, Bra and Ket vectors, Hilbert space formalism for quantum mechanics.

Operator:

Linear,Adjoint,hermitian,,unitary,,inverse,,antilinearoperators,Noncommutativity and uncertainty relation, complete set of compatible operators, simultaneous Measurement, Projection operator,eigen value and Eigen vector of linear,hermitian,unitary operators, Matrix representation of vectors and operators, matrix elements,eigen value equation and expectation value, algebraic result on Eigen values, transformation of basis vectors, similarity transformation of vectors and operators,diagonalisation. Vectors of LVS and wave function in co-ordinate, momentum and energy representations .

Unit-II

Quantum Dynamics

Time evolution of quantum states, time evoluation of operators and its properties, Schrodinger picture, Heisenberg picture, Dirac/Interaction picture, Equation of motion, Operator method of solution of 1D Harmonic oscillator, time evolution and matrix representation of creation and annihilation operators, Density matrix.

Rotation and orbital angular momentum:

Rotation matrix, Angular momentum operators as the generation of rotation, components of angular momentum Lx; Ly; Lz and L2 and their commutator relations, Raising and lowering operators (L+ and L), Lx; Ly; Lz and L2 in spherical polar co-ordinates, Eigen value and eigen function of Lz; L2(operator method), Spherical harmonics, matrix representation of L+; L and L2, Spin angular momentum: Spin 1/2 particle,Pauli spin matrices and their prop-erties Eigen values and Eigen function, Spinor transformation under rotation.

UNIT-III

Addition of angular momentum:

Total angular momentum J. Eigen value problem of Jz and J2, Angular momentum matrices, Addition of angular momenta and C.G.Coeffcients, Angular momentum states for composite system in the angular momenta(1/2,1/2) and (1,1/2).

Motion in Spherical symmetric Field:

Hydrogen atom, Reduction to one dimensional one body problem, radial equation, Energy eigen value and Eigen function, degeneracy, radial probability distribution.

Free particle problem:

Incoming and outgoing spherical waves, expansion of plane waves in terms of spherical waves. Bound states of a 3-D square well, particle in a sphere.

Books:

1. Quantum Mechanics S. Gasiorowicz
2. Quantum Mechanics J. Sukurai
3. Quantum Mechanics R. Shankar
4. Quantum Mechanics S.N. Biswas
5. Quantum Mechanics A. Das
6. Quantum Mechanics A. Ghatak and S. Lokanathan
7. Advanced Quantum Mechanics P.Roman
8. Quantum Mechanics (Non Relativistic theory) L.D. Landau and E.M. Lifshitz
9. Elementary Theory of Angular Momentum M.E. Rose
10. Principles of Quantum Mechanics P.A.M. Dirac
11. Quantum Mechanics, concepts and application, N Zettili