Mathematical and Quantum Physics

Course Code: BED608 **Credit: 04 (L-3, T-1, P-0)**

Contact Hours: 60 **MM: 100**

Course Outline:

Vector Calculus

Introduction to vectors, Vector operations, Applications of vectors in Physics, Del operator, Gradient, Divergence, Curl and their Physical significance, Laplace and Poisson equations

Legendre equation

Solution of Legendre's equation, Rodrigue's formulae, Generating functions, Recurrence relations, Orthogonality

Fourier series

Introduction to Fourier series, Evaluation of Fourier coefficients, Even and odd functions, Sine and cosine series, Applications: square wave, saw-tooth wave, triangular wave

Particles and waves

Wave nature of matter: de-Broglie hypothesis, Wave-particle duality, Davisson-Germer experiment, Wave description of particles by wave packets, Group and phase velocities and relation between them, wave function and its physical significance

Heisenberg uncertainty principle

Introduction, Derivation from wave packets, Applications of Heisenberg's uncertainty Principle: Non-existence of electrons inside the nucleus, Bohr radius

Schrodinger Equation

Properties of wave function, Derivation of time independent and time dependent Schrodinger wave equation, Application of Schrodinger wave equation: (i) motion of particle in a one dimensional box (ii) Potential step (iii) Barrier penetration problem

Text Books:

1. L. I. Schiff, Quantum Mechanics, 3rd edition, McGraw Hill Book Co., New York 1968
2. E. Merzbacher, Quantum Mechanics, 3rd edition, John Wiley & Sons, 1997
3. R. Courant & D. Hilbert, Methods of Mathematical Physics: Partial Differential Equation, New Delhi: Wiley India, 2008
4. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Fourier Analysis, McGraw-Hill, 1974

Reference Books:

1. J. L. Powell & B.Crasemann, Quantum Mechanics, Addison-Wesley Pubs.Co., 1965
2. AjoyGhatak& S. Lokanathan, Quantum Mechanics: Theory and Applications, 5th Edition, Macmillan India, 2004
3. Erwin Kreyszig, Advanced Engineering Mathematics , Wiley Eastern Limited,1985
4. Charlie Harper, Introduction to Mathematical Physics, P.H.I., 1995
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000
6. Satya Prakash, Mathematical Physics, Pragati Prakashan, 2000

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