MATHEMATICAL PHYSICS
PHY-101

U NIT– I

Differential equations ; Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind , Hermite , Legendre, Associate Legendre and Laguerre Polynomials. Curvilinear co-ordinate system with specific cases of Cartesian, Cylindrical, and Spherical coordinate systems.

UNIT– II

Integral transforms, Fourier integral, Fourier transform and inverse Fourier transforms, Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms. Laplace transform of derivatives, Application to a damped harmonic oscillator.

UNIT – III

Green's function: non –homogeneous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transform method of constructing Green's function, Green's function for electrostatic boundary value problem and quantum – mechanical scattering problem.

UNIT – IV

Complex variables: Analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula. Taylors, Maclaurin , Laurent series and mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued functions (Branch points).

UNIT –V

This unit will have a short note question covering all the four units. 'The studens we have to answer any two questions out of the four.

Books Recommended

1. H.K. Dass — Mathematical Physics
2. Ghatak, Goyal & Guha — Mathematical Physics
3. Arfken — Mathematical Methods of Physicists
4. L.A Pipes — Mathematics of Engineers and Physicists
5. P.K Chattopadhyay — Mathematical Physics

CLASSICAL MECHANICS
PHY-102

UNIT - I.

Newtonian mechanics of one and many particles systems: Conservation laws, Constrains their classification, Principle of virtual work; D'Almbert's Principle in generalized coordinates, The Lagrange's equation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagrangian formulation of the conservation theorems, Reduction to the equivalent one body problem; the equation of motion and first integrals, the differential equation for the orbit.

UNIT-II

The equations of canonical, transformation and generating functions; The Hamilton-Jacobi Action and Angel variables. Poisson's brackets; simple algebraic properties of Poisson's brackets.The equation of motion in Poisson's Brackets notation. Poisson theorem; principle of least action. The Kepler problem, Inverse central force field, Rutherford scattering.

UNIT-III

Theory of small oscillations, Equations of motion, Eigen frequencies and general motion, normal modes and coordinates, Applications to coupled pendulum and linear bistable molecule. Rotating coordinate systems. Acceleration in rotating frames. Coriolis force and its terrestrial astronomical applications, Elementary treatment of Eulerian coordinates and transformation matrices. Angular momentum inertia tensor. Eular equations of motion for a rigid body. Torque free motion for a rigid body.

UNIT-IV

Symmetries of space and time. Invariance under galilion transformation, covariant four-dimensional formulation, 4 -Vectors and 4 - scalers. Relativistic generalization of Newton's laws, 4-momentum and 4- force, variance under Lornetz transformation relativistic mechanics. Covariant Lagrangian, covariant Hamiltonian, Examples.

UNIT –V

This unit will have a short note question covering all the tour units. The students will have to answer any two questions out of the four.

Books Recommended

1. H. Goldstein (Addison Wesley) Classical Mechanics
2. N.C. Rana &P.S Jog Classical Mechanics
3. Landu & Lifshitz(Pergamann Press) Classical Mechanics
4. A.sommarfield(Academic Press) Classical Mechanics
5. R.G.Takwale & P.S Puranik Introduction to Classical Mechanics

QUANTUM MECHANICS-I
PHY-103

Unit-I

Basic Postulates of quantum Mechanics, equation of continuity, Normality, orthogonality and closure properties of eigen functions, expectation values and Ethrentest theorems, solution of Schrodinger equation for one dimensional (a) potential well (b) potential step and (c) Potential barrier.

Unit-II

Linear vector space, concept of Hibert space, bra and ket notation for state vector, representation of state vectors and dynamical variables by matrices and unitary transformation (Translation and rotation), creation and annihilation operators, matrices for x and p. Heisenberg uncertainty relation through operators (Schwartz inequality).

Unit-III

Solution of Schrodinger equation for (a) linear harmonic oscillator (b) hydrogen -like atom (c) square well potential and their respective application to atomic spectra, molecular spectra and low energy nuclear states (deutron).

Unit-IV

Angular momentum in quantum mechanics, Eigen values and Eigen function of L^2 and 1,, in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.

Unit-V

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

Books Recommended

1. L. I. Schiff — Quantum Mechanics
2. S Gasiorovvicz — Quantum Physics
3. J. J. Sakurai — Modern Quantum Mechanics
4. A.P.Messiah — Quantum Mechanics
5. Mathews and Venkatesan — Quantum Mechanics

\

ELECTRONIC DEVICES
PHY-104

UNIT - I

Transistors: JFET, BJT, MOSFET and MESFET, structure derivations of the equations for 1-V characteristics under different condition, microwave devices, tunnel diode, transfer electron devices (Gunn diode), avalanche transits time devices, Impatt diodes and parametric devices.

UNIT - II

Photonic devices: radiative and non-radiative transitions, optical absorption, bulk and thin fin photo conductive devices (LDR), diode Photo detectors, Solar cell (open circuit voltage and short circuit current, fill factor), LED (high frequency limit, effect of surface and indirect recombination current, operation of LED), semi-conductors; diode lasers (conditions for population inversion in active region, light confinement factor, optical gain and threshold current for lasing.

UNIT - III

Memory Devices: Read Only Memory (ROM) and Random Access Memory (RAM).Types of ROM: PROM, EPROM, EEPROM and EAPROM, Static and dynamic RAMs (SRAM & DRAM), characteristics of SRAM and DRAM. Hybrid Memories: CMOS and NMOS memories, Nonvolatile RAM, Ferro-electric memories, charge coupled devices (CCD), storage devices: Geometry and organization of magnetic (FDD & HDD) and Optical (CD-ROM CD-R, CD-R/W, DVD) Storage devices.

UNIT- IV

Electro-optics, Magneto-optic and Acousto-optic effects, materials properties related to gel these effect, important ferro electric, liquid crystal and polymeric materials for these devices. piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their applications in sensors and actuator devices, acoustic delay lines, piezoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices.

UNIT -V

This unit will have a short note question covering all the four units. 'The students will have *to* answer any two questions out of the four.

Books Recommended

1. SM Sze Willey (1985) Semiconductors devices–physics technology
2. MS Tyagi Introduction to semiconductors devices
3. Ajoy Ghatak and Thyagrajan Optical Electronics
4. M Sayer and Manisingh Measurement instrumentation and experimental design in physics and engineering

SUBJECT: PHYSICS

List of Experiments for M.Sc. (I Sem)

Lab A: General

1. Dielectric Constant.
2. Fourier analysis.
3. Study of acoustical and optical modes.

Lab B: Electronics

1. Study of Semiconductors (diode/Zener diode).
2. Transistor as a switch.
3. To determine the energy band gap of a semiconductor material using P–N Junction diode.
4. To study the characteristics of the given NPN or (PNP) transistor in the common emitter (CE) mode.
5. To study the characteristic curve of Field Effect Transistor (FET).
6. To study the characteristics of MOSFET and its application
7. To determine the efficiency (η) of the solar cell.