Devi Ahilya Vishwavidyalaya,Indore

CLASS - M.Sc. SUBJECT - PHYSICS Session 2017-18
SEMESTER - I PAPER - I

MATHEMATICAL PHYSICS

Unit -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 functions: Non-homogenous 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.problems 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 & mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued unctions(Branch points).

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. A. Pipes Mathematics of Engineers and Physicists
2. Arfken Mathematical Methods for Physicists
3. P.K. Chattopadhyay Mathematical Physics
4. H.K.Dass Mathematical Physics
5. Ghatak, Goyal & Guha Mathematical Physics
6. M.R Spiegel (Schaum Series) Complex variable & Laplace Transform

Noted & revised
Sem I 16/8/2017

CLASS - M.Sc. SUBJECT - PHYSICS
SEMESTER - I PAPER - II

CLASSICAL MECHANICS

Unit - I

Newtonin 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 equat ions 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.

Uni t - 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 co-ordinates 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

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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

SEM I 16/8/2017

CLASS - M.Sc. SUBJECT - PHYSICS
SEMESTER - I PAPER - III

QUANTUM MECHANICS- I

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).Harmonic oscillator by operator method.

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 L_z in term of spherical harmonies, commutation relation. Interpretation of wave function, coordinate and momentum, representation of wave function and operators. Spinangular momentum and Pauli spin matrices, Addition of two angular momenta with some examples. CG-coefficient and their properties, computation of CG- coefficient.

Unit -V

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Text Books and reference-book:

1. L I Schiff, Quantum Mechanics
2. S Gasiorovvicz, Quantum Physics
3. B Craseman and J D Powell Quantum Mechanics
4. A P Messiah Quantum Mechanics
5. J. J. Sakurai Modern Quantum Mechanics
6. Mathews and Venkatesan Quantum Mechanics
7.

SCMP 16/8/2017

CLASS - M.Sc. SUBJECT - PHYSICS
SEMESTER - I PAPER - IV

ELECTRONIC DEVICES

Unit . I

Transistors: JFET, BJT, MOSFET and MESFET, structure derivations of the equations for I-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 film 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-optic, Magneto-optic and Acousto-optic effects, piezoelectric, electrostrictive and magnetostrictive effects. sensors and actuator devices, piezoelectric resonators and filters.

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.

Text books and reference books:

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

16/8/2017

List of Experiments for M.Sc. (I St Sem) 2017-18

Lab A : General

1. Forbiden energy gap.
2. Dielectric Constant.
3. e/m by Thomson's/Millikan's oil drop method.
4. Fourier analysis.
5. Study of acoustical and optical modes.

Lab B : Electronics

1. Study of Semiconductors (diode/Zener diode)
2. Transistor as a Switch.
3. Study of SC Controlled rectifiers.
4. IC regulated power supply.
5. Study of RC coupled amplifier.

Note :

Other experiments depending upon availability in institution, related to theory paper in corresponding semester.

SemI 16/8/2017