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

SEMESTER - II

QUANTUM MECHANICS .II

Unit - I

Approxmination method for bound states : Rayleigh- Schrodinger Perturbation theory of non-degenrate and degenrate levels and their application to perturbation of an oscillator, normal helium atom and first order stark effect in hydrogen. Variation method and its application to ground state helium, W K B Approximation method, connection formulae, ideas on potential barrier with applications to theory of alpha decay.

Unit - II

Time dependant perturbation theory: Methods of variation of constants and transition probability, adiabatic and sudden approximation, wave equation for a system of charged particles under the influence of external electromagnetic field, absorption and induced emission, Einstein's A and B coefficients and transition probability.

Unit- III

Theory of Scattering, Physical concepts, scattering amplitude, scattering cross section. Born Approximation and partial waves, scattering by perfectly rigid sphere, complex potential and absorption, scattering by spherically symmetric potential, identical particles with spin, Pauli's spin matrices.

Unit- IV

Schrödinger.s relativistic equation (Klein-Gordon equation), Probability and current density, Klein - Gordon equation in presence of electromagnetic field, hydrogen atom, short comings of Klein-Gordon equation, Dirac.s relativistic equation for free electron, Dirac.s Matrices. Dirac.s relativistic equation in electromagnetic field, negative energy states and their interpretation hydrogen atom, hyperfine splitting.

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 book:

1. LI Schiff Quantum Mechanics
2. S Gasiorowicz Quantum Physics
3. B Craseman and J J Powell Quantum Mechanics (Addison Wessley)
4. A .Messiah Quantum Mechanics
5. J.J. Sakurai Modern Quantum Mechanics
6. Mathews and Venkatessan Quantum Mechanics
7. A .K.Ghatak and Loknathan Quantum Mechanics

Academic session 2017-19

7.2.17

7/7/2017

CLASS - M.Sc. SUBJECT - PHYSICS

SEMESTER - II PAPER - II

STATISTICAL MECHANICS

Unit - I

Foundation of statistical mechanics, specification of states of a system contact between statistics and thermodynamics, classical ideal gas entropy of mixing and Gibb.s paradox. Microcanonical ensemble, phase space, trajectories and density of states, Liouville theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

Unit-II

Statistics of ensembles, statistics of indistinguishable particles, density matrix, Maxwell -- Boltzmann, Fermi Dirac and Bose- Einstein statistics, properties of ideal Bose gases, Bose . Einstein condensation, properties of ideal Fermi gas, electron gas in metals, Boltzman transport equation.

Unit-III

Cluster expansion for a classical gas, virial equation of state, mean field theory of Ising model in 3,2 and 1 dimension. Exact solution in one-dimension.

Unit .V

Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations

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 book:

1. F Reif Statistical and thermal Physics
2. K Huang Statistical Mechanics
3. R K Pathria Statistical Mechanics
4. R Kubo Statistical Mechanics
5. Tandan Statistical Physics

Academic Sessim 2012+13

CLASS - M.Sc. SUBJECT - PHYSICS

SEMESTER - II PAPER - III

ELECTRODYNAMICS AND PLASMA PHYSICS

Unit . I

Review of Basics of electrostatics, and magnetostatics (electric field, Gauss.s law, Laplaces and Poisson equations, method of images, Biot-Sawart law, Ampere law, Maxwell's equations, scalar and vector potentials, gauge transformation, Lorentz gauge, Coulomb Gauge, Solution of Maxwell equations in conducting media radiations by moving charges, retarded potentials, Lienard Wiechrt potentials, fields of charged particles in uniform motion, fields of arbitrarily moving charge particle.

Unit-II

Fields of accelerated charged particles at low velocity and high velocity, angular distribution of power radiated, Review of four vector and Lorentz transformation in 4-dimensional spaces, Invariance of electric charge, relativistic transformation properties of E and H fields. Electromagnetic fields tensor in 4-dimensional Maxwell equation, Four Vector current and potential and their invariance under Lorentz transformation, covariance of electrodynamics. Langragian and Hamiltonian for a relativistic charged particle jn External EM field; motion of charged particles in electromagnetic fields, uniform and nonuniform E and B fields.

Unit -III

Elementary concept of occurrence of plasma. Gaseous and solid state plasma. Production of gaseous and solid state plasma. Plasma parameters. Plasma confinement pinch effect instability in a pinched-plasma column. Electrical neutrality in a plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.

Unit . IV

Domain of Magnetohydrodynamics and plasma Physics : Magnetohydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in a plasmas, Experimental study of Plasma, the theory of single and double probes.

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 book:

1. Bitteneerort Plasma Physics
2. Chen Plasma Physics
3. Gupta, Kumar, Singh Electrodynamics
4. Sen Plasma state and matter
5. Jackson Classical electrodynamics
6. Pamolsky & Philips Classical electricity and Magnetism

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7.7.17

7/7/2017

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

SEMESTER
ATOMIC AND MOLECULAR PHYSICS

UNIT -
Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Pauli's principle, Spectra of alkali elements, Spin orbit interaction and line structure of alkali Spectra . Methods of molecular quantum mechanics, Thomas Fermi statistical model, Hartree and Hartree fock method, Two electron system. Interaction energy in L-S and J-J coupling, hyperfine structure (qualitative), line broadening mechanisms(general ideas).

UNIT - II
Types of molecules. Diatomic linear. Symmetric top, asymmetric top and spherical top molecules. Rotational spectra of diatomic molecules as a rigid rotator, Energy level and Spectra of non-rigid rotator, intensity of rotational lines,

UNIT- III
Vibrational energy of diatomic molecule, diatomic molecule as a simple harmonic oscillator, Energy levels and spectrum, Morse potential energy curve, Molecules as vibrating rotator, Vibration spectrum of diatomic molecule PQR branches, IR spectrometer(qualitative)

UNIT-IV
Introduction to ultraviolet, visible and infra-red spectroscopy, Raman spectroscopy: Introduction, pure rotational and vibrational spectra, Techniques and instrumentation, Photo electron spectroscopy, elementary idea about photoacoustic spectroscopy and Mossbauer spectroscopy(principle).

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 and reference Books:

1. H.E. White Introduction to atomic spectra
2. C.B. Banwell Fundamental of molecular spectroscopy
3. Walker and Strnghem Spectroscopy vol. I, II and 111
4. G.M.Barrow Introduction to molecular spectroscopy
5. Herzberg Spectra of diatomic molecules
6. Jeanne L and McHale Molecular Spectroscopy
7. J.M.Brown Molecular Spectroscopy
8. P.F.Bemath Spectra of atoms and molecules
9. J.M. Halian Modern Spectroscopy

Academic Session 2017-19

Subject : Physics

List of Experiments for M.Sc. (2nd Sem) 2014-15

Lab A : General

1. Study of calcite prism.
2. Study of Characteristics of Thermistor.
3. Wavelength of light using grating.
4. Four Probe methods.
5. Study of Ionization potential of given gas.

List : Lab B (Electronics)

1. Study of characteristics of FET
2. Study of RPS using Transistor.
3. Study of Filter circuits.
4. Study of Negative resistance diode (Tunnel / LDR)
5. Study of Photocell / solar cell.

Note :

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

Academic session 2017-19