Established by Govt. of Arunachal Pradesh vide Act 9 of 2012, the Arunachal University of Studies Act, 2012 Recognized as per u/s 2(f) of University Grants Commission Act, 1956
NH-52, Namsai, Arunachal Pradesh -792103

MASTER OF SCIENCE (PHYSICS) – SECOND SEMESTER

Second Semester			
S. No.	**Name of Subject**	**Credits**	**Total Marks**
1	Quantum Mechanics - II	5	100
2	Statistical Mechanics	5	100
3	Electrodynamics and Plasma Physics	5	100
4	Atomic and Molecular Physics	5	100
5	General Laboratory-II	4	100
Total		**24**	

Subject Name: QUANTUM MECHANICS II

Unit 1: Variational method; WKB approximation; Time-dependent perturbation theory; Harmonic perturbation; Fermi's golden rule; Adiabatic and sudden approximations.

Unit 2: Collision in 3-D and scattering; Laboratory and CM reference frames; Scattering amplitude; differential scattering cross section and total scattering cross section; Scattering by spherically symmetric potentials; Partial waves and phase shifts; Scattering by a perfectly rigid sphere and by square well potential; Complex potential and absorption.

Unit 3: Identical particles; Symmetric and anti-symmetric wave functions; Collision of identical particles; Spin angular momentum; Spin functions for a many-electron system.

Unit 4: Semi-classical theory of radiation; Transition probability for absorption and induced emission; Electric dipole and forbidden transitions; Selection rules.

Recommended Texts

1. L. I. Schiff, Quantum Mechanics(McGraw-Hill)
2. S. Gasiorowicz, Quantum Physics(Wiley)
3. B.CrasemanandJ.0. Powell, Quantum Mechanics (Addison Wesley)
4. A.P.Messiah, Quantum Mechanics
5. J.J.Sakurai, Modem Quantum Mechanics
6. Mathews and Venkatesan, Quantum Mechanics

Subject Name: STATISTICAL MECHANICS

Unit 1: Foundations of statistical mechanics; specification of states of a system, contact between statistics and thermodynamics, classical ideal gas, entropy of mixing and Gibb's paradox.

Unit 2: Micro canonical ensemble, phase space, trajectories and density of states, Liouville's theorem, canonical and grand canonical ensembles; partition function, calculation of statistical quantities, Energy and density fluctuations.

Unit 3: Density matrix, statistics of ensemble's, statistics of indistinguishable particles, Maxwell-Boltzmann, Fermi-Dirac and Bose Einstein statistics, properties of ideal Bose and Fermi gases, Bose-Einstein condensation.

Unit 4: Cluster expansion for a classical gas, Virial equation of state, Ising model, mean-field theories of the Ising model in three, two and one dimensions Exact solutions in one- dimension.

Unit 5: Landau theory of phase transition, critical indices, scale transformation and dimensional analysis. Correlation of space-time dependent fluctuations, fluctuations and transport phenomena, Brownian motion, Langevin theory, fluctuation dissipation theorem. The Fokker-Planck equation.

Recommended Texts

1. Statistical and Thermal Physics, by FReif
2. Statistical Mechanics, by K Huang
3. Statistical Mechanics, RK Pathria
4. Statistical Mechanics, R.Kubo
5. Statistical Physics, Landau and Lifshitz

Subject Name: ELECTRODYNAMICS AND PLASMA PHYSICS

Unit 1: Review of Four-Vector and Lorentz Transformation in Four-Dimensional Space, Electromagnetic Field Tensor in Four Dimensions and Maxwell's Equations, Dual Field Tensor, Wave Equation for Vector and Scalar Potential and Solution Retarded Potential and Lienard-Wiechert Potential, Electric and Magnetic fields due to a Uniformly Moving Charge and an Accelerated Charge, Linear and Circular Acceleration and Angular Distribution of Power Radiated, Bremsstrahlung, Synchrotron Radiation and Cerenkov Radiation, Reaction Force of Radiation.

Unit 2: Motion of charged Particles in Electromagnetic Field: Uniform E and B Fields, Non-uniform Fields, Diffusion Across Magnetic Fields, Time Varying E and B Fields, Adiabatic Invariants: First, Second and Third Adiabatic Invariants.

Unit 3: Elementary Concepts: Derivation of moment Equations from Boltzmann Equation, Plasma Oscillations, Debye Shielding, Plasma Parameters, Magneto plasma, Plasma Confinement.

Unit 4: Hydro-dynamical Description of Plasma: Fundamental equations. Hydro-magnetic Waves: Magneto sonic and Alfven Waves.

Unit 5: Wave Phenomena in Magneto plasma: Polarization, Phase Velocity, Group Velocity, Cut- offs, Resonance for Electromagnetic Wave Propagating Parallel and Perpendicular to the Magnetic Field, Proportion at Finite Angle and CMA Diagram, Appleton-Hartee Formula and Propagation through Ionosphere and Magnetosphere: Helicon, Whistler, Faraday Rotation.

Recommended Texts

1. Panofsky & Phillips: Classical Electricity and Magnetism
2. Bittencourt: Plasma Physics
3. Chen: Plasma Physics
4. Jackson: Classical Electrodynamics

Subject Name: ATOMIC AND MOLECULAR PHYSICS

Unit 1: Quantum states of one electron atoms, Atomic orbital's, Hydrogen spectrum-Pauli's principle, Spectra of alkali elements, Spin orbit interaction and fine structure in alkali Spectra, Equivalent and non-equivalent electrons,

Unit 2: Normal and anomalous Zeeman effect, Paschen Back effect, Stark effect, Two electron systems, interaction energy in LS and JJ Coupling, Hyperfine structure (qualitative)-Line broadening mechanisms(general ideas)

Unit 3: Types of molecules, Diatomic linear symmetric top, asymmetric top and spherical top molecules, Rotational spectra of diatomic molecules as a rigid rotor, Energy levels and spectra of non-rigid rotor, intensity of rotational lines, Stark modulated microwave spectrometer (qualitative).

Unit 4: 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).

Recommended Texts

1. Introduction to Atomic spectra, H.E. white(T)
2. Fundamentals of molecular spectroscopy, C.B. Banwell (T)
3. Introduction to Molecular spectroscopy, G.M. Barrow
4. Spectra of diatomic molecules, Herzberg
5. Molecular spectroscopy, Jeanne L Mc Hale
6. Molecular spectroscopy, J.M. Brown
7. Spectra of atoms and molecules, P.F. Bemath
8. Modern spectroscopy, J.M. Holias

Subject Name: GENERAL LABORATORY- II

1. Experiment on FET and MOSFET characterization and application as an amplifier.
2. Experiment on Uni-Junction Transistor and its application.
3. Flip-Flops
4. Measurement of resistivity of a semiconductor by four probe method at different temperatures and determination of band gap.
5. Determination of Lande's factor of DPPH using Electron-Spin Resonance(E.S.R.) Spectrometer.

6. Measurement of Hall coefficient of given semiconductor: Identification of type of semiconductor and estimation of charge carrier concentration.
7. To study the fluorescence spectrum of DCM dye and to determine the quantum yield of fluorescence maxima and full width at half maxima for this dye using monochromator.
8. To study Faraday Effect using He-Ne Laser.