Modified Syllabus for Sixth Semester PHYSICS Major
(Ref: F. No. F/COE/07/(UG-S)/2021 dated19.07.2021)
Paper H7
Full Marks-100 (Internal Assessment: 20, Semester Exam: 80)

UNIT-I: Nuclear Physics: (20 + 5 internal)

Characteristics of nucleus : mass, charge, size, binding energy, spin, magnetic moment, packing fraction, atomic mass unit, isobars, isotopes, isotones.

Nuclear structure: Nature of nuclear force, nuclear stability and nuclear binding, binding energy curve and its significance, description of liquid drop model and Bethe- Weizsacker mass formula.

Radioactivity: Successive disintegration, secular and transient equilibrium.

α-decay: Rutherford α-scattering experiment and formula (deduction not necessary) and its significance, range of α-particle, Geiger-Nuttal law, α-ray spectrum, fine structure in α-ray spectrum, theory of α-disintegration.

β-decay: Different types of β ray spectrum and their natures, neutrino hypothesis, β-disintegration energy, internal conversion, Curie plot, β-ray absorption (qualitative discussion).

 γ-decay: γ-ray spectra and nuclear energy levels, qualitative discussion on γ-ray absorption in matter - photoelectric process, Compton Scattering and pair production, electron-positron annihilation (qualitative).

Unit – II Quantum mechanics: (20 + 5 internal)

Matter wave, wave function, Physical significance of ψ, concept of wave packet associated with free particle. Schrödinger time independent equation from the classical differential equation in one and three dimension, one and three dimensional representation of position , momentum and energy by quantum mechanical operators, Schrödinger equation using idea of quantum mechanical operator and separation of one and three dimensional space part and time part, expectation value of an observable, probability current density, equation of continuity, Ehrenfest theorem, Eigen function and Eigen values, stationary states , orthogonality of Eigen functions and normalization, fundamental postulates of quantum mechanics.

Free particles in one dimensional box, three dimensional box normalization, energy level diagram, explanation of continuous energy ocean as a limiting case of discontinuous energy

Eigen value, degeneracy, zero point energy, momentum and wave function for a free particle in one dimensional box, particle in a finite one dimensional potential barrier.

UNIT – III Condensed Matter Physics: (20 + 5 internal)

Crystal physics: Distinction between crystalline and amorphous solids, Characteristics of a crystal: Face, Form, Edges and Interfacial angles. Lattice, Basis and Crystal structure, translational and angular parameters, Unit cell and primitive cell, fundamental types of lattices, Different features of simple cubic , b.c.c and f.c.c lattices, namely lattice point density, number of nearest neighbour, nearest neighbour distance, number of second nearest neighbour, second nearest neighbor distance , packing fraction. Miller indices, Laue and Bragg's equations.

Lattice vibration (only monoatomic lattice), concept of phonon (basic ideas only), theory of specific heat of solid: Einstein model.

Classical Free electron theory of metal: drift velocity, mobility and conductivity, calculation of thermal and electrical conductivities of metals, Wiedmann Franz law.

Semiconductors: Qualitative discussion on n and p-type semi conductors, Hall Effect in both conductor and semi conductors.

Magnetic properties of materials: dia, para and ferromagnetic properties of solid, Langevin's theory of diamagnetism, classical theory of paramagnetism, Curie's law, spontaneous magnetization and domain structure, temperature dependence of magnetic property, Curie-Wiess law and explanation of hysteresis.

UNIT -IV Digital Electronics and computer: (20 + 5 internal)

Digital Electronics: Binary system, conversion of binary to decimal and vice versa, binary addition and subtraction, Boolean expression, Logic gates (AND ,OR , NOT), DDL, DTL, digital electronics combinational circuits, circuit adder & subtractor, multiplexer, sequential circuits – Flip – Flop: RS, D & J-K.

Operating system: Familiarity with different operating system in common use. Simple MS DOS command. Simple Windows command.

Algorithm and Flow chart for solving simple problems.

Elementary idea about machine, assembly and high-level languages, assembler, compiler, characteristics & field of application of high-level languages such as BASIC, FORTRAN, C.

Sixth semester: practical paper =H8 (Total marks: 100)

Marks division: 40 marks =Two hour written examination of 40short practical based questions (to be supplied by Head Examiner) 20 marks = Internal assessment including Laboratory note book 40 marks =performance of the experiment.

Electronics Practical:

1. To draw the dynamic characteristics of a triode and to determine the voltage gain of a triode amplifier.

2. To draw the input and the output characteristics of a transistor amplifier in CE mode and calculation of alpha and hybrid parameters.

3. To draw the characteristics of zener diode and study of line and load regulation.

4. To draw the static, dynamic and transfer characteristics of FET and calculation of voltage gain in FET amplifier.

5. Construction and study of half wave and full wave rectifier without and with R-C FILTER.

6. Study of operational amplifier (IC-741).

7. A. Construction and study of OR, AND & NOT circuits using diode, transistor, resistance etc.

   B. Boolean expression and realization of relevant truth table using digital **IC 74 ****.

N.B. Out of seven Experiments, minimum of **three** experiments have to be set up in the laboratory by the concerned Department and must be completed by the students subject to offline practical class feasibility in Covid- pandemic situation by obeying the Government Covid protocol.