TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar-799022

Syllabus

OF

Physics (Major)
Semester – VI

2014

Sixth Semester:

Sub: PHYSICS (Honours)

Total Marks = 200 = 100 (Theory) + 100 (Practical)
Paper Name : H7 (Theory) and H8 (Practical)
H7 (Theory paper) = 100 marks = 80 + 20 internal)

Four units :

UNIT-I: NUCLEAR PHYSICS: (20 + 5 internal)
UNIT-II : Quantum Mechanics: (20 + 5 internal)
UNIT-III-:Condensed Matter Physics: (20 + 5 internal)
UNIT-IV: Digital Electronics and Computer: (20 + 5 internal)

H8 (Practical paper) = 100 marks

Sixth Semester: Paper = H7

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 particles, 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).

Nuclear reaction: conservation principles in nuclear reactions, Q-value and thresholds, exoergic and endoergic reactions, artificial radioactivity, nuclear reactions induced by α-particle, proton, deuteron, γ-rays, neutron, Bohr's postulates of compound nuclear reaction.

Spontaneous and induced fission, nuclear chain reaction and basic principle of nuclear reactor.

Four basic interactions in nature and their relative strengths, examples of different types of interactions.

Accelerators and detectors: Betatron, Synchrotron (principle only), Ionization chamber, Proportional counter, G.M. counter.

Sixth Semester: Paper = H7

UNIT-II
Quantum Mechanics: (20 + 5 internal)

Black body radiation and discussion of the failure of classical theory with special mentioning of Wien's and Rayleigh – Jeans formula, Plank's hypothesis and Planck's energy distribution law in black body radiation (Deduction Required).

Matter wave, wave function, physical significance of ψ, concept of wave packet associated with free particle. Schrödinger time independent equation from the classical differential wave 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 functions and eigen values, stationary states, orthogonality of eigenfunctions, 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, one dimensional harmonic oscillator, the hydrogen atom problem (see appendix).

Sixth Semester: Paper = H7

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. anf f.c.c. lattices, namely lattice point density, number of nearest neighbour, nearest neighbour distance, number of second nearest neighbour, second nearest neighbour distance, packing fraction. Miller indices, Laue and Bragg's equations, powder diffraction method, study of Nacl & KCl structure.

Different types and natures of bonding: ionic, covalent, molecular, metallic and Van der walls.

Lattice vibration (**only monatomic lattice**), concept of phonon (basic idea only), theory of specific heat of solid : Einstein & Debye model.

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

Band Theory and semiconductor: Modification of electronic energy levels of atoms in a crystalline solid, band structure of electronic states: Bloch Theorem, Kronig-Penny model, distinction between metals, insulators and semi conductors, qualitative discussion on n and p–type semi conductors, Hall effect in both conductor and in semi conductors.

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

Sixth Semester: Paper = H7

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

Digital Electronics: Binary system, conversion of binary to decimal and vice versa, binary addition and substraction, 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 systems 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. Development of simple programs BASIC language using commands listed : CLS, REM, INPUT, PRINT, assignment statement (LET), READ- DATA, arithmetic logic, DEFFN, GOSUB, IF – THEN, GOTO, FOR – NEXT, FILES (INPUT, OUTPUT, FILE open), DIM, PRINT USING, LPRINT, TAB, LOCATE, END, RUN, SAVE.

Sixth Semester: Practical Paper = H8
(Total marks: 100)

Marks division:

40 marks = Two hour written examination of 40 short practical based questions (to be supplied by the Head Examiner)

20 marks = Internal assessment including Laboratory note book

40 marks = performance of the experiment.

Electronics Practical

Expt. No.	Name of Experiment
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 output characteristics of a transistor amplifier in CE mode and calculation of α 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, resistances etc.
	(b) Boolean expressions and realization of relevant truth tables using digital IC 74**.

N.B. Out of seven experiments, a minimum of six experiments have to be set up in the laboratory by the concerned Department and must be completed by the students. **Otherwise no practical marks will be given.**