

**MJD Govt College Taranagar (Churu)**  
**BSC III YEAR**  
**Paper-I**

Unit I

Origin of Quantum theory : Failure of classical Physics to explain the phenomenon such as black body spectrum. Planck's radiation law. photoelectric effect and Einstein explanation. Compton effect, "de-Broglie" hypothesis, evidence for diffraction and interference of particles. Uncertainty principle and its consequences: diffraction at a single slit, particle in a box and its applications (i) Non existence of electron in nucleus, (ii) Ground state energy of H-atom (iii) Ground state energy of harmonic oscillator. Energy-time uncertainty.

Unit II

Schrodinger equation- Time dependent and time independent form. Physical significance of the wave function & its interpretation. Probability current density, Operators in quantum mechanics, linear and Hermitian operators. Expectation values of dynamical variables, the position, momentum, energy, fundamental postulates of quantum mechanics, eigen function and eigen value, degeneracy. orthogonality of eigen functions' commutation relations. Ehrenfest theorem, concept of group and phase velocities, wave packet.

Unit III

Simple Solutions of Schrodinger equation : Time independent Schrodinger equation and stationary state solution. Boundary and continuity conditions on the wave function, particle in one dimensional box. eigen function and eigen values . discrete energy levels, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barrier. Calculation of reflection and transmission coefficient. Qualitative discussion of the application to alpha decay (tunnel effect), square well potential problem, calculation of transmission coefficient.

Unit IV

Bound State Problems : Particle in one dimensional infinite potential well and finite depth potential well energy value and eigen functions, simple harmonic oscillator (one dimensional) eigen function energy eigen values zero point energy. Schrodinger equation for a spherically symmetric potential. Separation of variables. Orbital angular momentum and its quantisation spherical harmonics, energy levels of H-atom shape of  $n=1$ ,  $n=2$  wave functions, comparison with Bohr model and Correspondence principle,

Unit V

Atomic and Molecular Physics : Frank-Hertz experiment spectra of hydrogen, spectral terms, fine structure, screening constant for alkali spectra for s, p, d, f states, selection rules. Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance pure rotational and rotation vibration spectra, transition rules for pure vibration and electronic vibration spectra. Raman effect.

## Paper-II

### Nuclear and Solid State Physics

#### Unit I

Rutherford theory of alpha particle scattering, properties of nucleus quadrupole moment and nuclear ellipticity. Quadrupole moment and nuclear spin. parity and orbital angular momentum. Nuclear potential and properties of nuclear forces. Semi-empirical mass formula.

#### Unit II

Theory of nuclear fission and liquid drop model, Barrier penetration theory of spontaneous fission. Nuclear fission as a source of energy, chain reaction and condition of controlled chain reaction, the principle of nuclear reactor, uses of atomic energy.

#### Unit III

Nuclear fusion. energy production in stars by p.p and carbon cycle. Interaction of charged particles and neutrons with matter and regions of multiplicative operation, working of nuclear detectors G.M. counter, proportional counter, scintillation counter cloud and spark chamber, Linear accelerator. cyclotron, synchrocyclotron. Betatron. Electron synchrotron.

#### Unit IV

Space lattice and crystal structure, Bravais lattice. Miller Indices, spacing of planes in crystal lattice. unit cell, wigner-seitz cell Atomic packing. common crystal structures. Laue's theory of X-ray diffraction. Bragg's law. Laue pattern., Concept of phonon, classical view of lattice specific heat of solid, the Einstein model, Debye model, thermal conductivity.

#### Unit V

Band Structure :Formation of bands .periodic potential of a solid, Bloch theorem. Kronig Penny model, Drude-Lorentz theory of electrical conductivity, Boltzmann transport equation Sommerfeld theory of electrical conductivity thermal conductivity & Wiedemann Frenzel law, Hall Effect.

## Paper-III

### Electronics and Solid State Devices

#### Unit I

Network some definitions loop, nodal equations Driving point and transfer impedance four terminal networks parameters. Open circuit short circuit and hybrid network theorems super position, Thevenin, Norton, Reciprocity, Compensation and Maximum power transfer theorem. Tand  $\delta$  Networks

#### Unit II

Intrinsic semiconductor, extrinsic semiconductor, Fermi level calculation of electron and hole concentration along with their temperature dependence, law of mass action. Semiconductor devices, p-n junction, majority and minority carriers, diode. zener and tunnel diodes. Light emitting diode, solar cell. Rectification : halfwave and full wave rectifiers, bridge rectifier ripple factor. different types of filters (shunt capacitor, inductor filter, L section and  $\delta$  filters), voltage stabilization, voltage multiplier circuits.

#### Unit III

Transistors :Notations and volt-ampere relation for bipolar junction transistor concept of load line and operating point, hybrid parameters.CB.CE.CC configuration. their characteristics curves and their equivalent circuits, Analysis of a transistor amplifier using h-parameter ( $A_i$ ,  $A_v$ ,  $Z_{in}$ ,  $Z_o$ ), fixed and emitter bias, bias stability in transistor circuit. FET, its characteristics and constants, biasing JFET and operation of JFET.

#### Unit IV

Small signal amplifiers : General principles of operation, classification, distortion, RC coupled amplifier, gain frequency response. Operational Amplifiers : Differential amplifier DC level shifter input & output impedance . input offset current application unity gain buffer adder, subtractor integrator differentiator. Numbers systems, Binary arithmetic, fundamental Logic gates, Boolean theorems and circuit realization of logic functions using diodes (DL).

#### Unit V

Amplifiers with feedback : Concept of feedback, Effect of negative feedback on stabilization of gain, output and input impedance, reduction of nonlinear distortion, voltage & current feedback circuits.

Oscillators Feedback requirement for oscillator, basic oscillator analysis. Colpitt and Hartley Oscillators.

## PHYSICS PRACTICALS

### Section: A

1. Determination of Planck's constant.
2. Determination of  $e/m$  using Thomson's Tube.
3. Determination of  $e/m$  using magnetron method.
4. Determination of  $e/m$  using helical method.
5. Absorption spectrum of Iodine vapour.
6. Study of spectra of Hydrogen and Deuteron (Rydberg constant and ratio of masses of electron to proton).
7. Study of Zeeman effect for determination of Lande g-factor.
8. Study of absorption of alpha and beta rays.
9. Study of statistics in radioactive measurement.
10. Hysteresis Curve of transformer core.
11. Study of L and  $\bar{\delta}$  filter in Half wave rectifier
12. Study the characteristic of an R-C transmission line.
13. Study the characteristic of an L-C transmission line.
14. Study the characteristic of F.E.T. and determine  $r_p$ ,  $g_m$ , and  $\mu$
15. Study the frequency response of LCR series/ parallel resonance circuit with and without damping.

### Section - B

1. Characteristics of a transistor.
2. Characteristics of a tunnel diode.
3. Study of voltage regulation system.
4. Study of Lissajous figures using a CRO.
5. Study of VTVM.
6. Study of RC coupled amplifier.
7. Study of AF and RF oscillators.
8. Determination of a energy gap of a semiconductor.
9. Determination of dielectric constant.
10. Analysis of a given band spectrum.
11. Hall-probe method for measurement of magnetic field.
12. Study the application of an operational amplifier as inverting and non- inverting amplifier.
13. Determine the value of Stefan constant.
14. Study of voltage multiplier as a doublers, tripler and quadrupole.
15. Construct OR, AND, NOT, XOR gate from NAND gate and verify their truth table
16. Study the recovery time of the given diodes.

