

**M.G. KASHI VIDYAPITH, VARANASI**  
Three Years Degree Course Syllabus for  
**PHYSICS**

**(BASED ON UNIFORM SYLLABUS FOR U.P. STATE UNIVERSITIES)**

**B.Sc. (FIRST YEAR)**

		<b>Max. Marks</b>
PAPER I	MECHANICS AND WAVE MOTION	50
PAPER II	KINETIC THEORY AND THERMODYNAMICS	50
PAPER III	CIRCUIT FUNDAMENTALS AND BASIC ELECTRONICS	50
PRACTICAL	PRACTICAL EXAMINATION*	50
TOTAL		200

Candidate must obtain minimum pass marks in Theory and Practical Examinations separately.

\*PRACTICAL (30 MARKS) + VIVA (10 MARKS) + RECORD (10 MARKS)

## **PAPER I - MECHANICS AND WAVE MOTION**

### **UNIT-I**

Inertial reference frame, Newton's laws of motion, Dynamics of particle in rectilinear and circular motion, Conservative and Non-conservative forces, Conservation of energy, linear momentum and angular momentum, Collision in one and two dimensions, cross section.

### **UNIT –II**

Rotational energy and rotational inertia for simple bodies, the combined translation and rotational motion of a rigid body on horizontal and inclined planes, Simple treatment of the motions of a top. Relations between elastic constants, bending of Beams and Torsion of Cylinder.

### **UNIT – III**

Central forces, Two particle central force problem, reduced mass, relative and centre of mass motion, Law of gravitation, Kepler's laws, motions of planets and satellites, geo-stationary satellites.

### **UNIT IV**

Simple harmonic motion, differential equation of S. H. M. and its solution, uses of complex notation, damped and forced vibrations, composition of simple harmonic motion.

Differential equation of wave motion, plane progressive waves in fluid media, reflection of waves, phase change on reflection, superposition, stationary waves, pressure and energy distribution, phase and group velocity.

### **Text and Reference Books**

- 1-EM Purcell, Ed: "Berkeley Physics Course, Vol. 1, Mechanics" (McGraw-Hill).
- 2-RP Feynman, RB Lighton and M Sands; "The Feynman Lectures in Physics", Vol. 1 (BI Publications, Bombay, Delhi, Calcutta, Madras).
- 3-J.C. Upadhyay: 'Mechanics'.
- 4-D.S, Mathur "Mechanics",
- 5-P.K. Srivastava: "Mechanics" (New Age International).

## PAPER II- KINETIC THEORY AND THERMODYNAMICS

### UNIT-I

**Ideal Gas:** Kinetic model, Deduction of Boyle's law, interpretation of temperature, estimation of r.m.s. speeds of molecules. Brownian motion, estimate of the Avogadro number. Equipartition of energy, specific heat of monatomic gas, extension to di- and triatomic gases, Behaviour at low temperatures. Adiabatic expansion of an ideal gas, applications to atmospheric physics.

**Real Gas:** Vander Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joule expansion of ideal gas, and of a Vander Waals gas, Joule coefficient, estimates of J-T cooling.

### UNIT –II

**Liquefaction of gases:** Boyle temperature and inversion temperature. Principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium. Refrigeration cycles, meaning of efficiency.

**Transport phenomena in gases:** Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path.

Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

### UNIT – III

**The laws of thermodynamics:** The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function and other applications. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics. Different versions of the second law, practical cycles used in internal combustion engines. Entropy, principle of increase of entropy. The thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero; third law of thermodynamics. Thermodynamic relationships: Thermodynamic variables; extensive and intensive, Maxwell's general relationships, application to Joule-Thomson cooling and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

### UNIT –IV

Blackbody radiation: Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, spectral distribution of Black body radiation, Wien's displacement law, Rayleigh-Jean's law, Plank's law the ultraviolet catastrophe.

#### Text and Reference Books

- 1- G.G. Agarwal and H.P. Sinha "Thermal Physics"
- 2- S.K. Agarwal and B.K. Agarwal "Thermal Physics"

## **PAPER III - CIRCUIT FUNDAMENTALS AND BASIC ELECTRONICS**

### **UNIT-I**

Growth and decay of currents through inductive resistances, charging and discharging in R.C. and R.L.C. circuits, Time constant, Measurement of high resistance. A.C. Bridges, Maxwell's and Scherings Bridges, Wien Bridge. THINLY, NORTON and Superposition theorems and their applications.

### **UNIT –II**

Semiconductors, intrinsic and extrinsic semiconductors, n-type and p-type semiconductors, unbiased diode forward bias and reverse bias diodes, diode as a rectifier, diode characteristics, zener diode, avalanche and zener breakdown, power supplies, rectifier, bridge rectifier, capacitor input filter, voltage regulation, zener regulator.

Bipolar transistors, three doped regions, forward and reverse bias, DC alpha, DC beta transistor curves.

### **UNIT – III**

Transistor biasing circuits: base bias, emitter bias and voltage divider bias, DC load line.

Basic AC equivalent circuits, low frequency model, small signal amplifiers, common emitter amplifier, common collector amplifiers, and common base amplifiers, current and voltage gain, R.C. coupled amplifier, gain, frequency response, equivalent circuit at low, medium and high frequencies, feedback principles.

### **UNIT-IV**

Input and output impedance, transistor as an oscillator, general discussion and theory of Hartley oscillator only.

Elements of transmission and reception, basic principles of amplitude modulation and demodulation. Principle and design of linear multimeters and their application, cathode ray oscilloscope and its simple applications.

#### **Text and Reference Books**

1-B.G. Streetman; "Solid State Electronic Devices", 11th Edition (Prentice Hall of India, New Delhi, 1986).

2-W.D. Stanley: "Electronic Devices, Circuits and Applications" (Prentice-Hall, New York, 1980).

3-J.D. Ryder, "Electronics Fundamentals and Applications", 11th Edition (Prentice-Hall of India, New Delhi, 1986).

4-J Millman and A Grabel, "Microelectronics", International Edition (McGraw Hill Book Company, New York, 1988).

## PRACTICALS

Every institution may add any experiment of the same standard in the subject.

### **Mechanics**

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. Study of conservation of momentum in two dimensional oscillations.

### **Oscillations**

1. Study of a compound pendulum.
2. Study of damping of a bar pendulum under various mechanics.
3. Study of oscillations under a bifilar suspension.
4. Potential energy curves of a 1-Dimensional system and oscillations in it for various amplitudes.
5. Study of oscillations of a mass under different combinations of springs.

### **Properties of matter**

1. Study of bending of a cantilever or a beam.
2. Study of torsion of a wire (static and dynamic methods)

### **Kinetic theory of matter**

1. Study of Brownian motion.
2. Study of adiabatic expansion of a gas.
3. Study of conversion of mechanical energy into heat.
4. Heating efficiency of electrical kettle with varying voltages.

### **Thermodynamics**

1. Study of temperature dependence of total radiation.
2. Study of temperature dependence of spectral density of radiation.
3. Resistance thermometry.
4. Thermo-emf thermometry
5. Conduction of heat through poor conductors of different geometries.

### **Circuit fundamentals**

1. Charging and discharging in R.C. and R.C.L. circuits.
2. High resistance by leakage.
3. A.C. Bridges.
4. Half wave and full wave rectifiers.
5. Characteristics of a transistor in CE, CB and CC configurations
6. Frequency response of R.C. coupled amplifier.

### **Waves**

1. Speed of waves on a stretched string.
2. Studies on torsional waves in a lumped system.
3. Study of interference with two coherent sources of sound.

### **Text and reference books**

- 1-D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).
- 2-S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
- Worsnop and Flint- Advanced Practical physics for students.

**M.G. KASHI VIDYAPITH, VARANASI**

Three Years Degree Course Syllabus for  
**PHYSICS**

**(BASED ON UNIFORM SYLLABUS FOR U.P. STATE UNIVERSITIES)**

**B.Sc.(SECOND YEAR)**

		<b>Max. Marks</b>
PAPER I	PHYSICAL OPTICS AND LASERS	50
PAPER II	ELECTROMAGNETICS	50
PAPER III	ELEMENTS OF QUANTUM MECHANICS, ATOMIC AND MOLECULARS SPECTRA	50
PRACTICAL	PRACTICAL EXAMINATION*	50
TOTAL		200

Candidate must obtain minimum pass marks in Theory and Practical Examinations separately.

\*PRACTICAL (30 MARKS) + VIVA (10 MARKS) + RECORD (10 MARKS)

## PAPER I - PHYSICAL OPTICS AND LASERS

### UNIT-I

**Interference of a light:** The principle of superposition, two-slit interference, coherence requirement for the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer and other applications. Localised fringes; thin films, applications for precision measurements for displacements.

**Haidinger fringes:** Fringes of equal inclination. Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines. Twyman Green interferometer and its uses. Intensity distribution in multiple beam interference, Tolansky fringes, Fabry-Perrot interferometer and etalon.

### UNIT –II

**Fresnel diffraction:** Fresnel half-period zones, plates, straight edge, rectilinear propagation.

**Fraunhofer diffraction:** Diffraction at a slit, half-period zones, phasor diagram and integral calculus methods, the intensity distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope and microscopic systems, outline of phase contrast microscopy.

**Diffraction gratings:** Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perrot etalon.

### UNIT - III

Polarization, Double refraction in uniaxial crystals, Nicol prism, polaroids and retardation plates, Babinet's compensator. Analysis of polarised light.

Optical activity and Fresnel's explanation, Half shade and Biquartz polarimeters.

Matrix representation of plane polarized waves, matrices for polarizers, retardation plates and rotators, Application to simple systems.

### UNIT-IV

**Laser system:** Purity of a special line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, spontaneous and induced emissions, conditions for laser action, population inversion.

**Application of Lasers:** Pulsed lasers and tunable lasers, spatial coherence and directionality, estimates of beam intensity; temporal coherence and spectral energy density.

### Text and Reference Books

- 1-A K Ghatak, "Physical Optics" (Tata McGraw Hill).
- 2-D P Khandelwal; "Optics and Atomic Physics" (Himalaya, Publishing House, Bombay, 1988).
- 3-F Smith and JH Thomson; "Manchester Physics series; Optics" (English Language Book Society and John Wiley, 1977).
- 4-Born and Wolf; "Optics"
- 5-KD Moltey; "Optics" (Oxford University Press).
- 6-Sears; "Optics".
- 7-Jenkins and White; "Fundamental of Optics" (McGraw-Hill).
- 8-Smith and Thomson; "Optics" (John Wiley and Sons).
- 9-B.K; Mathur; "Optics".
- 10-P.K. Srivastava; "Optics" (CBS).
- 11-B.B. Laud; "Lasers" (New Age).

## PART II- ELECTROMAGNETICS

### UNIT-I

#### **Electrostatics**

Coulomb's law, Electric Field and potentials, Field due to a uniform charged sphere, Derivations of Poisson and Laplace Equations, Gauss Law and its application: The Field of a conductor. Electric dipole, Field and potential due to an electric dipole, Dipole approximation for an arbitrary charge distribution, Electric quadruple, Field due to a quadruple, Electrostatic Energy of a charged uniform sphere, Energy of a condenser.

#### **Magnetostatics**

Magnetic field, Magnetic force of a current, Magnetic Induction and Biot- Savart Law, Lorentz Force, Vector and Scalar Magnetic potentials, Magnetic Dipole, Magnetomotive force and Ampere's Circuital theorem and its applications to calculate magnetic field due to wire carrying current and solenoid.

### UNIT-II

#### **Electromagnetic Induction**

Laws of Induction, Faraday's laws and Lenz's Law. Mutual and Self Induction, Vector potential in varying Magnetic field, Induction of current in continuous media, Skin effect, Motion of electron in changing magnetic field, Betatron, Magnetic energy in field, Induced magnetic field (Time varying electric field), Displacement current, Maxwell's equations, Theory and working of moving coil ballistic galvanometer.

### UNIT-III

#### **Dielectrics**

Dielectric constant, polarization, Electronic polarization, Atomic or ionic Polarization Polarization charges, Electrostatic equation with dielectrics, Field, force and energy in Dielectrics.

#### **Magnetic Properties of Matter**

Intensity of magnetization and magnetic susceptibility, Properties of Dia, Para and Ferromagnetic materials, Curie temperature, Hysteresis and its experimental determination.

### UNIT -IV

#### **Electromagnetic Waves**

The wave, equation satisfied by E and B, plane electromagnetic waves in vacuum, Poynting's vector, reflection at a plane boundary of dielectrics, polarization by reflection and total internal reflection, Faraday effect; waves in a conducting medium, reflection and refraction by the ionosphere

#### **Text and Reference Books**

1-Berkeley Physics Course; Electricity and Magnetism, Ed. E.M. Purcell (Mc GrawHill).

2-Halliday and Resnik; "Physics", Vol 2.

3-D J Griffith; "Introduction to Electrodynamics" (Prentice-Hall of India).

4-Reitz and Milford; "Electricity and Magnetism (Addison-Wesley).

5-A S Mahajan and A A Rangwala; "Electricity and Magnetism" (Tata McGraw-Hill).

6-A M Portis; "Electromagnetic Fields".

7-Pugh and Pugh; "Principles of Electricity and Magnetism" (Addison-Wesley).

8-Panofsky and Phillips; "Classical Electricity and Magnetism" (India Book House).

9-S S Atwood; "Electricity and Magnetism" (Dover).

## **PART III - ELEMENTS OF QUANTUM MECHANICS, ATOMIC AND MOLECULAR SPECTRA**

### **UNIT-I**

#### **Matter Waves**

Inadequacies of classical mechanics, Photoelectric phenomenon, Compton effect, wave particle duality, de- Broglie matter waves and their experimental verification, Heisenberg's Uncertainty principle, Complementary principle, Principle of superposition, Motion of wave packets.

### **UNIT –II**

#### **Schrodinger Equation and its Applications**

Schrodinger wave equation Interpretation of wave function, Expectation values of dynamical variables, Ehrenfest theorem, Orthonormal properties of wave functions, One dimensional motion in step potential, Rectangular barrier, Square well potential, Particle in a box, normalization Simple Harmonic Oscillator.

### **UNIT – III**

#### **Atomic spectra**

Spectra of hydrogen, deuterium and alkali atoms, spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d, and f states, selection rules. Singlet and triplet fine structure in alkaline earth spectra, L-S and J-J couplings. Weak spectra: continuous X-ray spectrum and its dependence on voltage, Duane and Haunt's law. Characteristics X-rays, Moseley's law, doublet structure and screening parameters in X-ray spectra, X-ray absorption spectra.

### **UNIT –IV**

#### **Molecular spectra**

Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotation and rotation-vibration spectra, Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra.

#### **Text and Reference Books**

- 1-H S Mani and G K Mehta; "Introduction to Modern Physics" (Affiliated East-West Press 1989).
- 2-A Beiser, "Perspectives of Modern Physics".
- 3-H E White; "Introduction to Atomic Physics".
- 4-Barrow; "Introduction to Molecular Physics".
- 5-R P Feynmann, R B Leighton and M Sands; "The Feynmann Lectures on Physics, Vol. III (B I Publications. Bombay. Delhi, Calcutta, Madras).
- 6-T A Littlefield and N Thorley; "Atomic and Nuclear Physics" (Engineering Language Book Society).
- 7-Eisenberg and Resnik; "Quantum Physics of Atoms, 'Molecules, Solids, Nuclei and Particles" (John Wiley).
- 8-D P Khandelwal: "Optics and Atomic Physics", (Himalaya Publishing House, Bombay, 1988).

## PRACTICALS

Every institution may add any experiment of the standard in the subject.

### Physical optics

1. Study of interference of light (biprism or wedge film).
2. Study of F-P etalon fringes.
3. Study of diffraction at a straight edge or a single slit.
4. Use of diffraction grating and its resolving limit.
5. Resolving limit of a telescope system.
6. Polarization of light by reflection.
7. Study of optical rotation for any system.

### Electrostatics

1. Characteristics of a ballistic galvanometer.
2. Setting up and using an electroscope or electrometer.

### Moving charges and magnetostatics

1. Use of a vibration magnetometer to study a field.
2. Study of field due to a current.
3. Measurement of low resistance by Carey-Foster bridge or otherwise.
4. Measurement of inductance using impedance at different frequencies.
5. Measurement of capacitance using impedance at different frequencies.
6. Study of decay of currents in LR and RC circuits.
7. Response curve for LCR circuit and resonance frequency and quality factor.

### Varying fields and electromagnetic theory

1. Sensitivity of a cathode-ray oscilloscope.
2. Characteristic of a choke.
3. Measurement of inductance.
4. Study of Lorentz force.
5. Study of discrete and continuous LC transmission lines.

### Atomic Physics

1. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton).
2. Absorption spectrum of iodine vapour.
3. Study of alkali or alkaline earth spectra using a concave grating.
4. Study of Zeeman Effect for determination of Lande g-factor.

### Molecular Physics

1. Analysis of a given band spectrum.
2. Study of Raman spectrum using laser as an excitation source

### Lasers

- 1 Study of laser as a monochromatic coherent source
- 2 Study of divergence of a laser beam

### Text and Reference Books

- 1-D.P. Khandelwal, "A Laboratory Manual for Undergraduate Classes (Vani PublishingHouse, New Delhi).
- 2-S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
- 3-Worsnop and Flint- Advanced Practical physics for students.

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Three Years Degree Course Syllabus for

**PHYSICS**

**(BASED ON UNIFORM SYLLABUS FOR U.P. STATE UNIVERSITIES)**

**B.Sc. (THIRD YEAR)**

		<b>Max. Marks</b>
PAPER I	RELATIVITY AND STATISTICAL PHYSICS	65
PAPER II	SOLID STATE AND NUCLEAR PHYSICS	70
PAPER III	SOLID STATE ELECTRONICS	65
PRACTICAL	TWO PRACTICALS* : 50 Marks each	100
TOTAL		300

Candidate must obtain minimum pass marks in Theory and Practical Examinations separately.

\*PRACTICAL (30 MARKS) + VIVA (10 MARKS) + RECORD (10 MARKS)

## PAPER I - RELATIVITY AND STATISTICAL PHYSICS

### UNIT-I

#### Relativity

Reference systems, inertial frames, Galilean invariance and conservation laws, propagation of light, Michelson-Morley experiment; search for ether.

Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence, particle with a zero rest mass.

### UNIT -II

#### Statistical physics

**The statistical basis of thermodynamics:** Probability and thermodynamic probability, principle of equal a priori probabilities, probability distribution and its narrowing with increase in number of particles. . The expressions for average properties. Constraints; accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

### UNIT – III

**Some universal laws:** The  $j$ - space representation, division of  $i$ - space into energy sheets and into phase cells of arbitrary size, applications to one-dimensional harmonic oscillator and free particles. Equilibrium before two systems in thermal contact, bridge with macroscopic physics. Probability and entropy, Boltzmann entropy relation. Statistical interpretation of second law of thermodynamics. Boltzmann canonical distribution law and its applications; rigorous form of equipartition of energy.

### UNIT –IV

**Maxwellian distribution of speeds in an ideal gas:** Distribution of speeds and of velocities, experimental verification, distinction between mean, r.m.s. and most probable speed values. Doppler broadening of spectral lines.

**Transition to quantum statistics:** ‘ $h$ ’ as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator, Indistinguishability of particles and its consequences, Bose-Einstein, and Fermi-Dirac distributions, photons in black body chamber, free electrons in a metal, Fermi level and Fermi energy.

#### Text and Reference Books

- 1-A. Beiser, “Concepts of Modern Physics” (McGraw-Hill).
- 2-B B Laud, “Introduction to Statistical Mechanics” (Macmillan 1981).
- 3-F Reif, “Statistical Physics” (McGraw-Hill 1988).
- 4-K Haug, “Statistical Physics” (Wiley Eastern, 1988).

## PAPER II- SOLID STATE AND NUCLEAR PHYSICS

### UNIT-I

#### **Crystal Structure**

Lattice translation vectors and lattice, Symmetry operations, Basis and Crystal structure, Primitive Lattice cell, Two-dimensional lattice types, systems, Number of lattices, Point groups and plane groups, Three dimensional lattice types, Systems, Number of Lattices, Points groups and space groups. Index system for crystal planes Miller indices, Simple crystal structures, NaCl, hcp, diamond, Cubic ZnS; and hexagonal , Occurrence of Nonideal crystal structures, random stacking of polyprism, glasses.

#### **Crystal Diffraction and Reciprocal Lattice**

Incident beam, Bragg law, Experimental diffraction method, Laue method, Rotating crystal method, Powder method, Derivation of scattered wave amplitude, Fourier analysis, Reciprocal lattice vectors, Diffraction conditions, Ewald method, Brillion zones, Reciprocal lattice to sc, bcc and face lattices , Fourier analysis of the basis and atomic form factor.

### UNIT -II

#### **Crystal Bindings**

Crystal of inert gases, Van der Walls-London interaction, repulsive interaction, Equilibrium lattice constants, Cohesive energy, compressibility and bulk modulus, ionic crystal, Madelung energy, evaluation of Madelung constant, Covalent crystals, Hydrogen-bonded crystals, Atomic radii.

#### **Lattice Vibrations**

Lattice Heat capacity, Einstein model, Vibrations of monatomic lattice, derivation of dispersion relation, First brillouin zone, group velocity, continuum limit, Force constants, Lattice with two atoms per primitive cell, derivation of dispersion relation, Acoustic and optical modes, Phonon momentum. Free electron theory, Fermi energy, density of states, Heat capacity of electron gas, Paramagnetic susceptibility of conduction electrons, Hall effect in metals. Origin of band theory, Qualitative idea of Bloch theorem, Kronig-Penney model, Number of orbitals in a band, conductor, Semi-conductor and insulators, Effective mass, Concept of holes.

### UNIT - III

#### **Nuclear Physics**

##### **1. General Properties of Nucleus:**

Brief survey of general Properties of the Nucleus, Mass defect and binding energy, charges, Size, Spin and Magnetic moment, Bainbridge mass spectrograph.

##### **2. Nuclear Forces:**

Saturation phenomena and Exchange forces, Deuteron ground state properties.

##### **3. Nuclear Models:**

Liquid drop model and Bethe Weiszacker mass formula, Single particle shell model (only the level scheme in the context of reproduction of magic numbers).

##### **4 Natural Radioactivity:**

Fundamental laws of radioactivity, Soddy-Faj an's displacement law and law of radioactive disintegration, Basic ideas about  $\alpha$ ,  $\beta$  and  $\gamma$  decay.

## UNIT-IV

- 1. Nuclear Reactions:**  
Nuclear reactions and their conservation laws, Cross section of nuclear reactions, Theory of fission (Qualitative), Nuclear reactors and Nuclear fusion.
- 2. Accelerators and detectors:**  
Vande Graff, Cyclotron and Synchrotron, Interaction of charged particles and gamma rays with matter (qualitative), GM counter, Scintillation counter and neutron detectors.
- 3. Elementary Particles:**  
Basic classification based on rest mass, Spin and half life, particle interactions (gravitational, Electromagnetic, weak and strong Interactions).

### Text and Reference Books

- 1-Pun and Babbar, "Solid State Physics" (S. Chand).
- 2-C. Kittel, "Introduction to Solid State Physics"- Vth Edition (John Wiley & Sons).
- 3-H.S. Mani and G.K. Mehta, "Introduction to Modern Physics" (Affiliated East-West Press— 1989).
- 4-A. Beiser, "Perspectives of Modern Physics".
- 5-T.A. Littlefield and N. Thoreley, "Atomic and Nuclear Physics" (Engineering Language Book Society).
- 6-Eisenberg and Resnik, "Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and Particles" (John Wiley).
- 7-Ghoshal S.N.- Nuclear Physics - S. Chand & Co.

## **PAPER III - SOLID STATE ELECTRONICS**

### **UNIT-I**

Diffusion of minority carriers in semiconductor, work function in metals and semiconductors Junctions between metal and semiconductors, Semiconductor and semiconductor, p.n. Junction, Depletion layer, Junction Potential Width of depletion layer, Field and Capacitance of depletion layer, Forward A.C. and D.C. resistance of junction, Reverse Breakdown.

Zener and Avalanche diodes, Tunnel diodes, Point contact diode, their importance at High frequencies, LED photodiodes, Effect of temperature on Junction diode, Thermistors.

### **UNIT -II**

Transistor parameters, base width modulation, transit time and life-time of minority carriers, Base- Emitter resistance Collector conductance, Base spreading resistance, Diffusion capacitance, Reverse feedback ratio, Equivalent circuit for transistors, Basic model, hybrid model and Y parameter equivalent circuit, Input and output impedances.

### **UNIT III**

Current and Voltage gain, Biasing formulae for transistors, Base bias, emitter bias and mixed type bias and mixed type biasing for small and large signal operation. Transistor circuit application at low frequencies, their AC and DC equivalent for three different modes of operation, Large signal operation of transistors, Transistor Power amplifiers, Class A and B operation, Maximum power output Effect of temperature, heat sinks, thermal resistance Distortion in amplifiers, cascading of stages, Frequency response, Negative and positive feedback in transistor amplifiers.

### **UNIT -IV**

Field effect transistors(JFET & MOSFET) and their characteristics, biasing of FET and use in amplifiers ,UJT,SCR(Silicon controlled rectifiers and their uses . Basic Idea about integrated circuits, photodiodes, phototransistors, Solar Cells.

#### **Text and Reference Books**

1-B G Streetman; "Solid State Electronic Devices", UK Edition (Prentice-Hall of India. New Delhi, 1986).

2-W D Stanley; "Electronic Devices, Circuits and Applications" (Prentice-Hall, New Jersey, USA. 1988).

3-J D Ryder; "Electronics Fundamentals and Applications" 1<sup>st</sup> Edition\ (Prentice-Hall of India. New Delhi, 1986).

4- I Miliman and A Grabel; "Microelectronics", International. Edition (McGraw-Hill Book Company, New York, 1988).

### **PRACTICAL**

#### **NOTE:**

This is a suggested list. Every institution may add any experiment of same standard in the same subject area.

### **Statistical Physics**

1. Data from n-option systems of several relative weights to be examined and interpreted.
2. Plotting F-D distribution in the neighborhood of Fermi energy for different temperature values.
3. Solar wind as a thermal expansion of solar corona at one million Kelvin.
4. Study of dilute gas for experimental verification of Maxwell-Boltzmann statistics.
5. Number of microscopic states of perfect gas (Gibbs-paradox).

### **Solid State Physics**

1. Goniometric study of crystal faces.
2. Determination of dielectric constant.
3. Hysteresis curve of transformer core.
4. Hall-probe method for measurement of magnetic field

### **Solid State Devices**

1. Specific resistance and energy gap of a semiconductor
2. Characteristics of a transistor
3. Characteristics of a tunnel diode

### **Electronics**

1. Study of voltage regulation system
2. Study of, a regulated power supply
3. Study of Lissajous figures using a CRO
4. Study of VTVM
5. Study of RC and TC coupled amplifiers
6. Study of AF and RF oscillators

### **Nuclear Physics**

1. Study of absorption of alpha and beta rays.
2. Study of statistics in radioactive measurement.

### **Text and Reference Books**

- 1-B.G. Strechman, "Solid State Electronic Devices". II Edition (Prentice-Hall of India, New Delhi, 1986).
- 2-W.D. Stanley, "Electronic Devices, Circuits and Applications" (Prentice-Hall, New Jersey, USA, 1988).
- 3-D.P. Khandelwal, "A Laboratory Manual for Undergraduate Classes (Vani Publishing House, New Delhi).
- 4-S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).

### **Instructions for Paper Setting**

All questions carry equal marks.

**Section A:** One compulsory question with four parts. One part (numerical or short answer type) from each unit.

**Section B:** Two questions (long answer or numerical type) from each unit but only one question from each unit is to be attempted.