PHYSICS HONOURS SYLLABUS

Semester	Paper No	Paper title	Credit	Marks
I	PHY-UG-E101	Physics I	4	100
II	PHY-UG-E201	Physics II	4	100
III	PHY-UG-E301	Physics III	4	100
IV	PHY-UG-C401	Physics IV	4	100
	PHY-UG-C402	Physics V	4	100
V	PHY-UG-C501	Physics VI	4	100
	PHY-UG-C502	Physics VII	4	100
Six	PHY-UG-C601	Physics VIII	4	100
	PHY-UG-C602	Physics X	4	100

PHY-UG-E101: Physics I

Unit I: Classical Mechanics and Gravitation

1. Dimensions of Physical Quantities: System of units, Principle of dimensional homogeneity
2. Vectors: Addition and subtraction of vectors, dot product and cross product, scalar triple product and vector triple product. Scalar and vector fields - gradient, divergence and curl; divergence theorem, Stokes' theorem.
3. Mechanics of a Particle : (a) Newton's laws of motion, principle of conservation of linear momentum, conservative force field, concept of potential, conservation of total energy.

(b) Rotational motion, angular velocity, angular acceleration, angular momentum, torque, fundamental equation of rotational motion, principle of conservation of angular momentum, radial and cross-radial acceleration in plane polar coordinates.
4. Dynamics of Rigid Bodies : Moment of inertia (MI) and radius of gyration - their physical significance, theorems of parallel and perpendicular axes, rotational kinetic energy, calculation of moment of inertia for some simple symmetric systems.
5. Gravitation: Gravitational potential and intensity due to thin uniform spherical shell and solid sphere of uniform density, escape velocity. Kepler's laws.

Unit II: General Properties of Matter, Waves and Vibrations
1. Elasticity: Hooke's law, Elastic moduli and their interrelations, torsion of a cylinder, bending moment, cantilever, simply supported beam with concentrated load at the centre.
2. Viscosity: Streamline and turbulent motion, Poiseuille's formula, critical velocity, Bernoulli's theorem, Stokes' law
3. Surface Tension: Surface tension and surface energy, molecular theory, angle of contact, elevation and depression of liquid columns in a capillary tube, excess pressure in a spherical bubble and spherical drop.
4. Simple Harmonic Motion: Differential equation and its solution; Superposition of SHMs, Damped and forced vibration, resonance, sharpness of resonance.
5. Differential Equation of Wave Motion: Plane progressive wave - energy and intensity, Velocity of longitudinal wave in solid and gas, Doppler Effect, velocity of transverse wave in stretched string.

Unit III: Heat and Thermodynamics
Heat:
Kinetic Theory of Gases: Perfect gas, pressure exerted by it, Maxwell's law of distribution of molecular velocities - rms, mean and most probable velocities, degrees of freedom, principle of equipartition of energy - application in simple cases. Equation of state - defects of ideal gas equation, van der Waals equation, critical constants, law of corresponding states.
Specific heats of mono-atomic and polyatomic gases, Transport phenomena: Thermal conductivity and viscosity, Brownian motion
Thermal Conductivity: Steady state and variable state, thermal and thermometric conductivity, Fourier equation for one-dimensional heat flow and its solution.
Thermodynamics:
Thermodynamics: Basic concepts, First law of thermodynamics and its application. C_p and C_v, work done in Isothermal and adiabatic processes, indicator diagrams. Reversible and irreversible processes, second law of thermodynamics, Carnot cycle and its efficiency, entropy and its physical interpretation.
Radiation: Nature of radiant heat, emissive and absorptive power, Kirchhoff's law, black body radiation, Stefan's law, Newton's law of cooling, Planck's distribution law, Wien's displacement law, pyrometer - principle.

Unit IV: Laboratory Works - I
(One experiment is to be performed during the Practical Examination of 3hours)

1. Determination of Young's Modulus of the material of awire by Searle's method.
2. Determination of Young's Modulus of the material of abeam by the method of flexure.
3. Determination of modulus of rigidity of the material ofa wire by dynamical method.
4. Determination of modulus of rigidity of the material ofa wire by statical method.
5. Determination of moment of inertia of a metalliccylinder/rectangular bar about an axis passing

through its centre of gravity.
6. Determination of the acceleration due to gravity by Kater's pendulum.
7. Determination of surface tension of water by capillary rise method. (Capillary tubes to be supplied).
8. Determination of the co-efficient of viscosity of water by Poiseuille's method.
9. Determination of the density of the material of the sonometer wire by using a tuning fork of known frequency.
10. Determination of the co-efficient of linear expansion of a metal by optical lever.

Text Books:

1. Theoretical Mechanics - M. R. Spiegel, (Schaum's Outline Series) (McGraw-Hill).
2. Mechanics - K. R. Symon (Addison-Wesley).
3. Introduction to Classical Mechanics - R. G. Takwale and P. S. Puranik (Tata McGraw-Hill).
4. Classical Mechanics and General Properties of Matter – D. P. Roychaudhuri and S. N. Maiti (Book Syndicate).
5. Heat and thermodynamics - Zemansky and Ditman (Mc Graw Hill, Kugakusha).
6. Kinetic theory of gases - Loeb (Radha Publ. House).
7. A Treatise on Heat - Saha and Sribastava (The Indian Press Ltd).

Reference Books:

1. Classical Mechanics – N. C. Rana and P. S. Joag (Tata McGraw-Hill).
2. Padarther Dharma - D. P. Ray Chaudhuri (West Bengal State Book Board).
3. The Feynman Lectures on Physics – Vol I (Addison-Wesley).
4. An Introduction to Mechanics – D. Keppner and R.J. Kolenkow (Tata McGraw-Hill).
5. Mechanics – H. S. Hans and S. P. Puri (Tata McGraw-Hill).
6. Classical Mechanics – J. Goldstein (Narosa Publ. House).
7. Classical Mechanics – A. K. Roychaudhuri (O. U. P., Calcutta).
8. Berkeley Physics Course, Vol – I (Mechanics) (Mc Graw Hill).
9. Thermodynamics – F. Fermi (Dover)
10. Gaser Anabik Tattwa- Pratip Kumar Chaudhuri (W. B. S. B. B).
11. Thermal Physics – S. Garg, R. M. Bansal, C. K. Ghosh (Tata Mc Graw Hill).
12. Heat and Thermodynamics – H. P. Roy and A. B. Gupta (New Central Book Agency).

PHY-UG-E201: Physics II

Unit I: Optics

Geometrical Optics:

1. Reflection and refraction: Fermat's Principle, laws of reflection and refraction at a plane surface, refraction at a spherical surface, lens formula. Combination of thin lenses - equivalent focal length.
2. Aberration in lenses: Dispersion and dispersive power, chromatic aberration and its remedy, different types of monochromatic aberration sand their remedy (qualitative).
3. Optical instruments: Ramsden eyepiece, Astronomical telescope and compound microscope - their magnifying power.
4. Laser: Temporal and spatial coherence, absorption and spontaneous and induced emissions of radiation in atoms and molecules, Einstein A and B coefficients, population inversion, optical resonators, quality factor, principles of LASER and MASER, Ruby laser, He-Ne laser, basic principles of holography.

Physical Optics:

1. Light as an electromagnetic wave: Full electromagnetic spectrum, properties of electromagnetic waves, Huygens' Principle - explanation of the laws of reflection and refraction.
2. Interference of light: Young's experiment, intensity distribution, conditions of interference, interference in thin films- Newton's ring, Fresnel's biprism.
3. Diffraction: Fresnel and Fraunhofer class, Fresnel's half-period zones, zone plate. Fraunhofer diffraction due to a single slit, Elementary theory of diffraction through double slit and plane transmission grating, resolving power.
4. Polarisation: Different states of polarisation, Brewster's law, double refraction, Nicol prism, optical activity.

Unit II: Electricity

1. Electrostatics: Coulomb's law, Electric field--intensity and potential, potential and field due to an electric dipole, Gauss' theorem - simple applications.
2. Electrostatics of conductors: Field near the surface of a charged conductor ,mechanical force on the surface of a charged conductor. Capacity of parallel-plates and cylindrical capacitors, energy stored in a parallel plate capacitor.
3. Electrostatics of dielectrics: Polar and non-polar dielectrics, Dielectric medium, polarization, electric displacement. Steady Current: Kirchhoff's laws, Wheatstone bridge, potentiometer – current measurement. Thevenin's and Norton's theorem.
4. Thermoelectricity: Seebeck, Peltier, and Thomson effects, laws of thermoelectricity, thermoelectric curve - neutral and inversion temperature, thermoelectric power.

Unit III: Magnetism

1. Magnetic effect of current: Biot and Savart's law, ampere's circuital law (statement only), magnetic field due to a straight conductor, circular coil, solenoid, infinite solenoid, Magnetic field due to a small current loop - concept of magnetic dipole.
2. Lorentz force: Force on a moving charge in simultaneous electric and magnetic fields, force on a current carrying conductor in a magnetic field.
3. Magnetic materials: Magnetic susceptibility - dia, para and ferromagnetic materials, statement of Curie's law. Hysteresis in a ferromagnetic material, hysteresis loss.
4. Electromagnetic induction: Faraday's laws of Electromagnetic induction ,Self inductance of a solenoid, energy stored in inductance.
5. Varying currents: growth and decay of currents in L-R circuit; charging and discharging of capacitor in C-R circuit. discharging of a capacitor in a series LCR circuit. Alternating current : Mean and r.m.s. values of current and emf with sinusoidal wave form; LR, CR and series LCR circuits, reactance, impedance, phase-angle, power dissipation in AC circuit - power factor, resonance in a series LCR circuit, Q-factor, principle of ideal transformer.

Unit IV: Laboratory Works - II

(One experiment is to be performed during the Practical Examination of 3hours)

1. Determination of the refractive index of the material of a lens and that of a liquid using a convex lens and a plane mirror.
2.Determination of the refractive index of water bytraveling microscope.
3.Determination of the focal length of a concave lens byauxiliary lens method.
4. Determination of end corrections of a meter bridge and to measure the specific resistance of a material in the form of a wire.
5. Determination of the resistance per unit length of a Carey Foster's bridge and to measure

an unknown resistance.
6. Determination of the temperature coefficient of the material of a coil using a meter bridge.
7. Determination of the resistance of a suspended coil galvanometer by the method of half deflection and to calculate the figure of merit of the galvanometer
8.Measurement of current by potentiometer using a lowresistance.
9.To draw the resonance curve of a series LCR circuit and hence to determine the Q-factor of the circuit.
10. Determination of the horizontal component of earth' magnetic field and magnetic moment of a magnet using a deflection and an oscillation magnetometer.

Text Books:

1. Fundamentals of Optics - F. A. Jenkins and H. E. White (Mc Graw Hill, Kogakusha).
2. Geometrical and Physical Optics - B. S. Longhurst (Orient Longmans).
3. Optics – A. K. Ghatak (Tata Mc Graw Hill).
4. Optics – B. K. Mathur.
5. Introduction to Electrodynamics – D. J. Griffith, (Prentice Hall, India Pvt. Ltd).
6. Electricity and Magnetism - J. H. Fewkes and J. Yarwood (Oxford Univ. Press, Calcutta).
7. Electricity and Magnetism – Chatterjee and Rakshit.
8. Electricity and Magnetism – A. S. Mahajan and A. A. Rangwala (Tata McGraw-Hill).

Reference Books:

1. Optics – Hecht and Zajac (Addison-Wesley)
2. A Textbook of Optics- N Subrahamanyam, B Lal and M N Avadhanulu, S Chand & Co. Ltd. 2010
3. Berkeley Series Vol II (Electricity and Magnetism) E.M. Purcell (Tata McGraw-Hill).
4. The Feynman Lectures on Physics – Vol. II (Addison – Wesley).
5. Classical Electrodynamics – J.D. Jackson (Wiley India)

Phy-UG-E301: Physics III

Unit I: Electronics and Solid State Physics

1.Diodes and Transistors: P-N junction diode, half wave, full wave and bridge rectifier, filter, Zener diode, voltage regulator, Transistors - α and β and their interrelations; output characteristics in CE mode, single stage CE amplifier - approximate expressions of current and voltage gain with the help of 'Load Line'.
2. Digital circuits: binary systems, binary numbers. Decimal to binary and reverse conversions; binary addition and subtraction.
3. Logic gates: OR, AND, NOT gates - truth tables. Statement of de Morgan's theorem, NOR and NAND universal gates.
4. Solid State Physics: Crystalline nature of solid, Miller-indices, diffraction of X-ray, Bragg's law. Intrinsic and extrinsic semiconductors, doping, p and n type semiconductors, Fermi level, p-n junction diode, transistors, LED.

Unit II: Quantum Mechanics

1. Development of Quantum theory Stern Gelach experiment, Frank Hertz experiment, Planck's concept of black body radiation, Planck's formula, Qualitative discussion of photo-electric effect, Compton effect and diffraction of electrons.
2.Basic Quantum Mechanics: Matter-wave duality, Heisenberg’s uncertainty, principle–its applications, Wave function and its physical interpretation and normalization, operators,

expectation value and eigenvalue equations, Schrodinger equation—wave function and energy eigenvalue of a particle in a I-D infinite well.

Unit III: Atomic and Nuclear Physics and Special Theory of Relativity

1. Atomic Physics: Bohr's theory of hydrogen atom—explanation of different series of H-spectra, Pauli exclusion principle, Thomson's experiment and Millikan's oil drop experiment, X-rays-continuous and characteristic, Moseley's law

2. Nuclear Physics: General properties of nuclei, Binding energy of nucleus, binding energy curve and stability; Radioactivity, successive disintegration, radioactive equilibrium, radioactive dating, radioisotopes and their uses, nuclear reactions- Q-value, fission and fusion, nuclear reactor.

3. Special Theory of Relativity: Reference frames, Galilean transformation, Michelson-Morley experiment, Postulates of STR, Lorenz transformation, Length contraction; Time dilation; Velocity addition; Mass variation, and Mass-energy equivalence.

Unit IV: Laboratory Works III

(One experiment is to be performed during the Practical Examination of 3hours)

1. Determination of the width of a narrow slit using Fraunhoffer diffraction
2. Determination of the radius of curvature of a plano convex lens using Newton's rings
3. To study the voltage current characteristic of a P-N junction diode and to determine the dynamic resistance of the diode at different currents.
4. To draw the reverse characteristics of a zener diode and to study its voltage regulation characteristics using a variable load. (Breakdown region should be identified in the graph. Percentage voltage regulation has to be calculated for given load currents).
5. To study the P-N junction diode as rectifier using half wave/full wave rectifier with and without filters.
6. To draw the voltage current characteristic of a bridge rectifier with and without using a filter. (The bridge rectifier is to be fabricated by the student using four diodes. Percentage voltage regulation has to be calculated from each graph for given load currents).
7. To draw the output characteristics of a transistor in C-E configuration (for at least five base currents) and hence to determine the AC current gain from the active region of the characteristics.
8. To verify the truth tables of OR, AND, NOT, NAND, NOR gates and their simple combination using IC.
9. To use OPAMP as inverting, non-inverting, differential amplifier and as an adder.

Text Books:

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
2. Digital Principles and Applications, D. Leech and A. Malvino (McGraw Hill) 1994
3. Electronic Principles, A. Malvino and D J Bates, (McGraw Hill) 7th Edition.
4. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit (New Age International)
5. Introduction to Solid State Physics, C. Kittel (Wiley Eastern).
6. Solid State Physics – A. J. Dekker (Mc. Millan)
7. Quantum Mechanics – J. L. Powell and B. Crasemonn, (Oxford, Delhi).
8. Quantum Mechanics – F. Schwabl (Narosa).
9. Quantum Mechanics – A. K. Ghatak and S. Lokenathan (Macmillan, Delhi).

10. Laser Principles and Applications – A. K. Ghatak and K. Tyagrajan (Tata – Mc Graw Hill).

Reference Books:

1. Electronics Fundamentals and Applications – J. D. Ryder (PHI Pvt. Ltd).
2. Electronic Device and Circuit Theory – R. Boylestad and L. Nashelsky (Prentice – Hall).
3. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).
4. Electronics – R.K. Kar (Books and Allied (P) Ltd.).
5. Digital Electronics – D. Ray Chaudhuri (Platinum Publishers)
6. Basic Electronics – K. K. Ghosh (Platinum Publishers)
7. Elementary Solid State Physics – M. Ali Omar (Pearson Education)
8. Solid State Physics – S. O. Pillai (New Age International)
9. Elements of Solid State Physics – J. P. Srivastava (Prentice Hall)
10. An Introduction to Solid State Physics and Application – R.J. Elliot and A.F. Gibson (McMillan)
11. Solid State Physics – D.W. Snoke (Person Education)

PHY-UG-C401: Physics IV

Unit I: Mathematical Methods

1. Vector Analysis: Review of vector algebra, Vector identities, Scalar and vector fields. Ordinary and partial derivative of a vector. Line, surface and volume integrals. Flux of a vector field. Gauss' divergence theorem, Green's theorem and Stoke's theorem.
2. Orthogonal Curvilinear Coordinates: Orthogonal curvilinear coordinates. Derivation of gradient, divergence, curl and Laplacian in Cartesian, spherical and cylindrical coordinate systems.
3. Ordinary Differential Equations: Solution of second order linear differential equations by power series method, solution of Legendre and Hermite equations, Legendre and Hermite polynomials–orthonormality properties.
4. Fourier Series – Fourier theorem, Even and Odd Functions, Sine and Cosine Series, Applications: Square Wave, Triangular Wave; Beta and Gamma Functions.

Unit II: Classical Mechanics II

1. Newton's three laws of motion: Conservation of linear momentum, System with variable mass (rocket), Conservative force and concept of potential.
2. Mechanics of system of particles: Reduction to one body problem, centre of mass, Linear momentum, angular momentum and energy—their conservations, Equations of motion, Rotational Motion: Moment of inertia, radius of gyration; Energy and angular momentum of rotating systems of particles, Ellipsoid of inertia
3. Central force problem: Motion under central force; Nature of orbits in an attractive inverse square field; Kepler's laws of planetary motion.
4. Lagrangian formulation: Generalized coordinates, constraints and degrees of freedom; D'Alembart's principle-- Lagrange's equation for conservative systems and its application to simple cases; generalized momentum; cyclic coordinates.
5. Hamiltonian formulation: Hamilton's variational principle and derivation of Lagrange's equation from it. Definition of Hamiltonian, Hamilton's equation (derivation by Legendre transformation) and its application to simple cases.

Unit III: Special Theory of Relativity (STR)

Postulates of STR, Lorentz transformation – length contraction, time dilatation and velocity addition theorem, Four vectors. Relativistic dynamics, variation of mass with velocity, energy momentum relationship, mass-energy relation.

Proper time and light cone: Minkowski space, time like and light like four vectors, causality.

Unit IV: Laboratory Works IV

(One experiment is to be performed during the Practical Examination of 4hours)

1. To study the L-R circuit: to draw the phase diagrams, to study the current-voltage relationship across L and to study the variation of reactance of L with frequency and hence to find its value.
2. To study the C-R circuit: to draw the phase diagrams, to study the current-voltage relationship across C and to study the variation of reactance of C with frequency and hence to find its loss factor.
3. To study a series/parallel L-C-R ac circuit: to draw its response curve, to find its resonance frequency and to study the variation of Q with C (and L if possible).
4. Determination of the constant of a ballistic galvanometer and to measure the value of the capacitance by discharge and a high resistance by leakage.
5. To measure the flux of a magnetic field with a searchcoil and a ballistic galvanometer.

Text Books:

1. Introduction to Mathematical Physics - C. Harper (Prentice-Hall of India).
2. Mathematical Methods - M. C. Potter and J. Goldberg (Prentice-Hall of India).
3. Schaum's Outline of Vector Analysis - Murray Spiegel, Seymour Lipschutz (McGraw-Hill), 2009, 2nd edition.
4. Mathematical Methods for Physicist, Arfken, Weber and Harris, Elsevier, 2012
5. Schaum's Outline of Complex Variables By Murray R. Spiegel (McGraw-Hill, 1999)
6. Special Functions By George E. Andrews, Richard Askey, Ranjan Roy (Cambridge University Press, 2000)
7. Schaum's Outline of Theory and Problems of Fourier Analysis - Murray R. Spiegel (McGraw-Hill, 1974)
8. Classical Mechanics – J. Goldstein (Narosa Publ. House).
9. Theoretical Mechanics - M. R. Spiegel, (Schaum's Outline Series) (McGraw-Hill).
10. Introduction to Classical Mechanics - R. G. Takwale and P. S. Puranik (Tata McGraw-Hill).

Reference Books:

1. Mathematical Methods of Physics, J Mathews and R L Walker, Addision-Wesley
2. Mathematical Physics – P.K. Chattopadhyay (Wiley Eastern)
3. Vector Analysis and Cartesian Tensors - D. E. Bourne, P C Kendall (Chapman & Hall, 1992) 3rd Edition.
4. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Limited) 1985.
5. Higher Engineering Mathematics by B S Grewal, Khanna Publishers (2000).
6. Complex Variables: Introduction and Applications, 2ed By Mark J. Ablowitz, A. S. Fokas (Cambridge University Press, 2003)
7. Special Functions for Scientists and Engineers By W. W. Bell (Dover Publishers, 1968)
8. Classical Mechanics – N. C. Rana and P. S. Joag (Tata McGraw-Hill).
9. The Feynman Lectures on Physics – Vol I (Addison-Wesley).
10. An Introduction to Mechanics – D. Keppner and R.J. Kolenkow (Tata McGraw-Hill).
11. Mechanics – H. S. Hans and S. P. Puri (Tata McGraw-Hill).

PHY-UG-C402: Physics V

Unit I: Heat and Thermodynamics II

1. Short review of kinetic theory of gases, Derivation of Maxwell's law of distribution of molecular velocities; van der Waals equation of state – critical constants, Brownian Motion – Einstein's theory, Perrin's work.
2. Transfer of heat: Thermal and thermometric conductivity, Fourier equation for radial flow of heat and its solution, Wiedemann-Franz law; Radiation: Wien's law, Rayleigh-Jean's law, Planck's law (qualitative)
3. Zeroth law of Thermodynamics and the concept of temperature, Applications of the first law of Thermodynamics, e.g. to find (C_p -$C_{v,}$) of ideal and real gases.
4. Different statements of second law of thermodynamics and their equivalence, Clausius inequality, Impossibility of Attainability of Absolute Zero -Third Law of Thermodynamics. T-S Diagrams.
5. Thermodynamic Functions: Enthalpy, Helmholtz and Gibbs' free energies; Legendre transformations, Maxwell's relations and simple deductions using these relations; thermodynamic equilibrium and free energies.
6. Phase transitions: equilibrium between phases, triple point: Gibbs' phase rule (statement only) and simple applications. First and higher order phase transitions, Clausius-Clapeyron's equation. Cooling by adiabatic demagnetization.

Unit II: Electrostatics and Magnetostatics

1. Electrostatics: Gauss' theorem and its differential form , Poisson and Laplace's equations and its solutions, application of Laplace's equation to simple cases of symmetric spherical charge distribution; Energy and torque of an electric dipole placed in a uniform external field, dipole-dipole interactions; Boundary value problem - in uniform external field for (i) conducting spherical shell and (ii) dielectric sphere.
2. Magnetic effect of steady current: Lorentz force, force on linear current element; ∇. B and ∇ X B; magnetic vector potential A, calculation of vector potential and magnetic induction in simple cases.
3. Magnetic Field and magnetic materials: Free current and bound current; surface and volume density of current distribution; magnetization; Non-uniform magnetization of matter; boundary conditions for B and H; hysteresis and energy loss in ferromagnetic material; magnetic circuit; energy stored in magnetic field.

Unit III: Electricity

1. Transient currents: growth and decay of currents in series LCR circuit, oscillatory discharge, measurement of high resistance by leakage.
2. Electromagnetic induction: Motional e.m.f.-simple problems; calculation of self and mutual inductance in simple cases. Theory of moving coil galvanometer-ballistic and dead beat types.
3. Alternating current: Complex Reactance and Impedance, parallel LCR circuit, theory of ideal transformer, selector and rejecter circuits, Anderson bridge for measurement of L.

Unit IV: Laboratory Works V

(One experiment is to be performed during the Practical Examination of 4hours)

1. To measure the mutual inductance of two coaxial coils at various relative orientations using ballistic galvanometer.

2. Tracing the B-H loop of a ferromagnetic specimen in the form of an anchor ring using ballistic galvanometer and to determine the area under the hysteresis loop and finding the energy loss.
3.To measure the capacitance of a capacitor by an AC bridge (Wien Bridge).
4. To measure the self-inductance of two coils separately by Anderson's bridge and the total inductance of the above two coils when they are connected in series and hence estimate the coefficient of coupling between the two coils.
5. To study the Lissagous figure using CRO.

Text Books:

1. Heat and thermodynamics - Zemansky and Ditman (Mc Graw Hill, Kugakusha).
2. Kinetic theory of gases - Loeb (Radha Publ. House).
3. A Treatise on Heat - Saha and Sribastava (The Indian Press Ltd).
4. Introduction to Electrodynamics – D. J. Griffith, (Prentice Hall, India Pvt. Ltd).
5. Electricity and Magnetism - J. H. Fewkes and J. Yarwood (Oxford Univ. Press, Calcutta).
6. Electricity and Magnetism – Chatterjee and Rakshit.
7. Electricity and Magnetism – A. S. Mahajan and A. A. Rangwala (Tata McGraw-Hill).
8. Classical Electrodynamics – J.D. Jackson (Wiley India)

Reference Books:

1. Thermodynamics – F. Fermi (Dover)
2. Thermal Physics – S. Garg, R. M. Bansal, C. K. Ghosh (Tata Mc Graw Hill).
3. Heat and Thermodynamics – H. P. Roy and A. B. Gupta (New Central Book Agency).
4. Electricity and Magnetism - Edward M. Purcell (McGraw-Hill Education, 1986)
5. Fundamentals of Electricity and Magnetism - Arthur F. Kip (McGraw-Hill, 1968)
6. Berkeley Series Vol II (Electricity and Magnetism) - E.M. Purcell (Tata McGraw-Hill).
7. Electricity and Magnetism. By D C Tayal (Himalaya Publishing House,1988).
8. The Feynman Lectures on Physics – Vol. II (Addison – Wesley).

PHY-UG-C501: Physics VI

Unit I: Solid State Physics

1.Crystal structure: Crystalline and amorphous solids, translational symmetry; elementary ideas about crystal structure, lattice and basis, unit cell, reciprocal lattice, fundamental types of lattices, Miller indices, simple cubic, fcc and bcc lattices; Laue and Bragg equations, Ewald's construction. Determination of crystal structure by X-ray diffraction studies of NaCI and KCI structures; powder photograph method.
2. Structure of solids: Different types of binding ionic, covalent, metallic and van der Waals. Band theory of solids (qualitative), energy band structure from symmetry arguments, electrons and holes, conductors, semiconductors and insulators; free electron theory of metals, effective mass, drift current, mobility and conductivity (electrical and thermal), Wiedemann and Franz law, Hall effect, thermoelectricity Seebeck, Peltier and Thomson effect, thermoelectric engines, heat pumps. Thermionic emission, Richardson equation; elementary idea of photoelectric effect, secondary emission, field emission.
3.Dielectric properties of materials: Electronic, ionic and dipolar polarisability, local fields, induced and orientational polarization, molecular field in a dielectric, Clausius Mosotti relation. Electrets, Ferro electricity, piezo-electricity.
4.Magnetic properties of materials : dia, para, and ferro-magnetic properties of materials, magnetic moment of an atom due to spin and orbital motion, Langevin's theory of diamagnetism, theory of para magnetism, Curie's law; spontaneous magnetization and domain

structure; magnetization and its temperature dependence, Curie-Weiss law, explanation of hysteresis; ferri and antiferro magnetism.

Unit II: Analog Electronics

1. Semiconductor devices: Intrinsic and extrinsic semiconductors, p-type and n-type semiconductors, electron and hole densities, generation and recombination of carriers, drift and diffusion of carriers, equation of continuity, diffusion length and lifetime of minority carriers.

2.Field Effect Transistor (FET) : Junction FET (JFET) structure (source, drain, gate, channel), JFET operation, static characteristics, drain and transfer characteristics, pinch off.

MOSFET: principle of operation, drain and transfer characteristics, small signal low frequency equivalent circuit, common source FET amplification-expression for voltage gains.

3.Amplifier: BJT amplifiers: p-n-p and n-p-n transistors, majority and minority carriers, two port network analysis, biasing of transistors, common collector, common base and common emitter configurations, Y and Z parameters, hybrid model and h-parameters, equivalent circuits, transistors characteristics, load line and Q-point, basic ideas about application of transistor as amplifier, switch, emitter follower, current source.

Basic principle of operation: current, voltage and power gains, input and output impedances, effect of source resistance, frequency response, bandwidth, phase shift on amplification, operating point class A, B, AB and C amplifiers. Small signal low frequency single stage amplifiers comparison of CB, CE and CC configurations, wide band and tuned amplifiers, emitter followers. Multistage amplifiers basic principles, two-stage RC coupled amplifier gain and bandwidth. Requirements of a power amplifier push pull amplifier. Decibel unit. Bode's plots. Principle of feedback: negative and positive feedback, voltage and current feedback, advantage of negative feedback.

4.Oscillators: Barkhausen criterion for sustained oscillation, sinusoidal oscillators: Wienbridge oscillators.

Unit III: Digital Electronics

1.Logic circuits: Binary, decimal and hexadecimal number systems and conversion from one system to another, 1's complement and 2's complement of a binary number, binary addition and subtraction, Boolean algebra- fundamental postulates, basic theorems, simplification theorems and De Morgan's theorem, simplification of Boolean expression. Logic systems, AND, OR,NOT,and NAND gates, truth tables, basic construction of these gates using diodes and transistors, combination of these gates for obtaining different Boolean functions.

2.Combinational Logic: digital comparator, decoder, encoder, digital to analog conversion, analog to digital conversion, multiplexer.

3.Sequential Logic: Flip-flops RS, D, JK, JKMS; edge triggering and clocked operations, shift registers, binary ripple counter, decade ripple counter.

Unit IV: Laboratory Works VI

(One experiment is to be performed during the Practical Examination of 4hours)

1. To verify Thevenin's theorem, Norton’s theorem and maximum power transfer theorem using a resistive Wheatstone's bridge with a DC source.

2. (a) To draw the I-V characteristics of a p-n junction diode; (b) To draw the forward and reverse bias characteristics of a zener diode and to study its voltage regulation characteristics relating to the variation of load current, variation of line voltage and ripple.

3. To draw the characteristics of a bipolar junction transistor (BJT) in CE and CB modes and

to find its parameters α and β.
4. To measure the hybrid parameters and leakage current of a transistor using an AC source.
5. To construct a single stage voltage amplifier using a transistor in CE mode on a breadboard and to measure its voltage gain, bandwidth, input and output impedances form the study of frequency response curve.
6. To construct an emitter follower on a breadboard using a BJT and to study its voltage gain, bandwidth, input and output impedances.

Text Books:

1. Introduction to Solid State Physics, C. Kittel (Wiley Eastern).
2. Elementary Solid State Physics – M. Ali Omar (Pearson Education)
3. Solid State Physics – A. J. Dekker (Mc. Millan)
4. N. W. Ascroft and N. D. Mermin, Solid State Physics, (Harcourt Asia, Singapore), 2003.
5. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
6. Digital Principles and Applications, D. Leech and A. Malvino (McGraw Hill) 1994
7. Electronic Principles, A. Malvino and D J Bates, (McGraw Hill) 7th Edition.
8. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit (New Age International)
9. Electronics Fundamentals and Applications – J. D. Ryder (PHI Pvt. Ltd).
10. Digital Fundamentals, 3rd Edition by Thomas L. Floyd (Universal Book Stall, India, 1998)
11. Microprocessor Architecture, Programming, and Systems featuring the 8085 - William A. Routt, (Thomson Delmar Learning, 2006)

Reference Books:

1. Solid State Physics – S. O. Pillai (New Age International)
2. Elements of Solid State Physics – J. P. Srivastava (Prentice Hall)
3. An Introduction to Solid State Physics and Application – R.J. Elliot and A.F. Gibson (McMillan)
4. Solid State Physics – D.W. Snoke (Person Education)
5. J. S. Blackmore, Solid State Physics, Cambridge University Press, Cambridge.
6. Electronic Device and Circuit Theory – R. Boylestad and L. Nashelsky (Prentice – Hall).
7. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
8. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).
9. Electronics – R.K. Kar (Books and Allied (P) Ltd.).
10. Digital Electronics – D. Ray Chaudhuri (Platinum Publishers)
11. Basic Electronics – K. K. Ghosh (Platinum Publishers)

PHY-UG-C502: Physics VII

Unit I: Electromagnetic Theory

1. Generalisation of ampere's law: Displacement current, Maxwell's field equations, wave equation for electromagnetic field and its solution plane wave and spherical wave solutions, gauge invariance; transverse nature of field, relation between E and B; energy density of field, Poynting vector and Poynting's theorem. Boundary conditions.
2. Electromagnetic waves in isotropic dielectric medium: Wave equation, relation between E and B, energy density and energy flow; reflection and refraction at plane boundary, reflection and transmission coefficients, Fresnel's formulae; change of phase on reflection,

polarization on reflection and Brewster's law. Total internal reflection.
3. Electromagnetic waves in conducting medium: Maxwell's equations in homogeneous conducting media, general wave equation, plane wave equations harmonic wave solution, phase lag between electric and magnetic fields, exponential damping, skin depth.
4. Dispersion: Equation of motion of an electron in a radiation field, Lorentz theory of dispersion normal and anomalous. Sellmeier's and Cauchy's formulae.

Unit II: Physical Optics

1. Interference: Coherent and incoherent superposition, conditions of interference; temporal and spatial coherence. Methods of division of wave front and division of amplitude, Fresnel's biprism,
2. Diffraction: Fresnel's half period zones and explanation of rectilinear propagation of light; zone plate. Types of diffraction-Fraunhoffer and Fresnel type. Fresnel's diffraction-single slit, straight edge, circular and rectangular apertures, Fresnel's integrals and Cornu's spirals.
3. Resolving Power of Optical Instruments: Rayleigh criterion, resolving power of eye, prism, telescope, microscope and grating.
4. Polarization: Polaroids, retardation plates and Babinet's compensator. Production, detection and analysis of different types of polarization by Nicol prism, retardation plates and Babinet's compensator, Rotatory polarization and optical activity, Fresnel explanation of optical activity; polarimeters
5. Interferometers:Michelson's Interferometer description, principle of operation and uses, resolving power. Fabry-Perot Interferometer-description, principle of operation and uses, resolving power. Lummer-Gehrcke plate-description, principle of operation and uses, resolving power.

Unit III: Wave and Vibrations and Electronics II

1. Simple harmonic motion:Superposition principle, composition of harmonic vibrations with same frequency but different phases, Coupled oscillations, normal modes, energy exchange. Fourier analysis of complex vibrations.
2.Waves: Plane progressive waves- energy transport and intensity, dispersive and non-dispersive propagation in a medium, group velocity and phase velocity; wave packets, interference of waves-stationary waves.
3.Sound Waves: Vibration of strings- equation of transverse vibration of a stretched string and its solution, kinetic energy of a vibrating string and its normal modes eigen-functions and eigen-frequencies. Fourier analysis, study of plucked and struck string.
4.Communication Principles: Propagation of electromagnetic waves in atmosphere, ground wave and sky wave, microwave transmission and communication. Modulation and demodulation theory of AM, FM, PM, detection of AM wave (diode detector), detection of FM wave (slope detector).
5.Instruments: Cathode Ray Oscilloscope: cathode ray tube, deflection sensitivity, simple time base circuits; use of CRO in frequency and phase measurements.
6.Microprocessor: Architecture, register structure, interrupts, bus structure. Interfacing concepts, memory interfacing, basic concepts of programming a microprocessor, addressing data movement, arithmetic and logic instructions. (Topics to be discussed with reference to 8085 microprocessor).
7.Fiber Optics: Optical fiber core and cladding, step index and graded index fiber, communication through optical fiber, energy loss, bandwidth and channel capacity a typical system, attenuation and dispersion, splicing and couplers. Fiber sensor.

Unit IV: Laboratory Works VII
(One experiment is to be performed during the Practical Examination of 4hours)

1. To construct a regulated power supply on a breadboard using feedback and a zener diode for voltage regulation and to study its characteristics.
2. To study the input offset voltage, input bias current, input offset current of an OPAMP and use it as an (a) inverting and noninverting amplifier; (b) differential amplifier (c) integrator and (d) differentiator.
3. To construct a Wien bridge oscillator using OPAMP and to study the waveform of the oscillator and calibrate it using a CRO.
4. a To construct the OR, AND and NOT gates using discrete components and verify the truth tables using them;
b) To verify the truth tables of NOR, NAND, and Ex OR gates using IC gates
c) To verify that the NOR and NAND gates are universal gates
d) To verify De Morgan's theorem using IC gates
5. To study the Fourier spectrum of (a) a square wave, (b) a saw tooth wave and (c) a half sinusoidal wave with the help of CRO.
6. To study the 8085 microprocessor

Text Books:

1. Vibrations and Waves - A. P. French.(CBS Pub. & Dist., 1987)
2. The Physics of Waves and Oscillations - N.K. Bajaj (Tata McGraw-Hill, 1988)
3. Fundamentals of Waves & Oscillations - K. Uno Ingard (Cambridge University Press) 1988)
4. Advanced Acoustics - D. P. Ray Chaudhuri (Chayan – Kolkata).
5. Waves- J R Crawford (Tata McGraw Hill)
6. Fundamentals of Optics By Francis Arthur Jenkins and Harvey Elliott White (McGraw-Hill, 1976)
7. Optics - Ajoy Ghatak (Tata McGraw Hill, 2008)
8. Optics - Eugene Hecht and A R Ganesan (Pearson Education, 2002)
9. Introduction to Electrodynamics – D. J. Griffith, (Prentice Hall, India Pvt. Ltd).
10. Electricity and Magnetism - J. H. Fewkes and J. Yarwood (Oxford Univ. Press, Calcutta).
11. Classical Electrodynamics – J.D. Jackson (Wiley India)
12. Electronics Fundamentals and Applications – J. D. Ryder (PHI Pvt. Ltd).
13. Electronic Device and Circuit Theory – R. Boylestad and L. Nashelsky (Prentice – Hall).
14. Microprocessor Architecture, Programming, and Systems featuring the 8085 - William A. Routt, (Thomson Delmar Learning, 2006)

Reference Books:

1. Waves and Oscillations - Rathin N. Chaudhury (New Age Publ.).
2. An Introduction to Mechanics - Daniel Kleppner, Robert J. Kolenkow (McGraw-Hill, 1973)
3. Waves: Berkeley Physics Course (SIE) by Franks Crawford (Tata McGrawHill, 2007).
4. Light and Optics: Principles and Practices - Abdul Al-Azzawi (CRC Press, 2007)
5. Contemporary Optics - A. K. Ghatak & K. Thyagarajan. (Plenum Press,1978).
6. Introduction to Optics - Khanna and Gulati
7. Berkeley Series Vol II (Electricity and Magnetism) E.M. Purcell (Tata McGraw-Hill).
8. The Feynman Lectures on Physics – Vol. II (Addison – Wesley).
9. Electricity and Magnetism – Chatterjee and Rakshit.
10. Electricity and Magnetism – A. S. Mahajan and A. A. Rangwala (Tata McGraw-Hill).

PHY-UG-C601: Physics VIII

Unit I: Quantum Mechanics

1. Principle of superposition: Schroedinger's wave equation; equation of continuity; probabilistic interpretation of the wave function.
2. Dynamical variables and linear Hermitian operators; properties of eigen functions and eigen values of Hermitian operators; momentum, energy and angular momentum operators.
3. Momentum, angular momentum operators and Schroedinger equation in rectangular Cartesian, spherical polar and cylindrical coordinates.
4. Result of measurement ofdynamical observables, expectation values, Bohr's correspondence and complementarity principles; Ehrenfest's theorem; stationary and non-stationary states.
5. Commutation relation between operators, simultaneous measurements; Heisenberg's uncertainty principle with illustrations.

Unit II: Applications of Quantum Mechanics

1.One dimensional potential well and barrier:boundary conditions, bound and unbound states, reflection and transmission coefficients. (Similarities and differences with classical systems to be emphasized at each step).Tunnel effect.
2. Free particle in one dimensional box, box normalization of free particles, momentum eigen functions of a free particle.
3. Linear harmonic oscillator wave function and energy eigen values, parity of wave functions. (Detailed solution of the wave function for at least the ground state).
4. Hydrogen problem: solution of the wave function for the ground state, discrete eigen values as a consequence of boundary conditions, comparison with the Bohr Sommerfeld model.
5. Diatomic molecules: rotational and vibrational energy levels; basic ideas about molecular spectra, Raman effect and its application to molecular spectroscopy.

Unit III: Statistical Mechanics

1.Basic concepts: Phase space, macro-states and micro states, hypothesis of equal a priori probability for microstates, statistical weight, System in equilibrium with its environment-isolated, closed and open systems, statistical definitions of temperature, pressure, entropy and chemical potential.
2.Classical statistics: Maxwell-Boltzmann distribution law, law of equipartition of energy and applications, calculation of thermodynamic quantities for ideal monatomic gases.
3.Quantum statistics: Gibb's paradox, identical particles and symmetry requirements, derivation of MB, FD and BE statistics as the most probable distributions (micro-canonical ensemble), classical limit of quantum statistics.
4.Bose Einstein statistics: Application to radiation Planck's law, phonons and lattice specific heat of solids, Einstein and Debye's theory, Bose Einstein condensation.
5.Fermi Dirac statistics: Fermi distribution at zero and non-zero temperatures, Fermi energy and its expression in terms of particle density, degenerate and non-degenerate Fermi gas, electron specific heat of metals at low temperature,
6. Random Walk Problem

Unit IV: Laboratory Works VIII

(One experiment is to be performed during the Practical Examination of 4hours)

1. Adjustment of a Spectrometer by Schuster's method and to calibrate the spectrometer (D - λ

curve) and hence to determine an unknown wavelength.
2. To draw the ($\delta - \lambda$) curve for the material of a prism using a spectrometer and to find the dispersive power.
3. To determine the wavelength of a monochromatic lightby Fresnel's bi-prism.
4. To determine the wavelength of a monochromatic lightby Newton's ring method.
5. Measurement of the slit width and the separation between the slits of a double slit by observing the diffraction and interference fringes using spectrometer.
6. To find the number of lines per centimeter of a plane transmission grating and hence to measure the wavelength of an unknown spectral line and to determine the resolving power of the grating.

Text Books:

1. Introduction to Quantum Mechanics, D J Griffiths, Pearson Education, 2005
2. Principles of Quantum Mechanics, R Shankar, Springer India Pvt. Ltd. 2010
3. Quantum Mechanics – J. L. Powell and B. Crasemonn, (Oxford, Delhi).
4. Quantum Mechanics – A. K. Ghatak and S. Lokenathan (Macmillan, Delhi).
5. Modern Quantum Mechanics, J J Sakurai, Pearson Education, 1994
6. Fundamentals of Statistical and Thermal Physics, F. Reif, (Mc Graw Hill).
7. Statistical Mechanics, Pathria, Elsevier, 2011
8. Statistical Mechanics, Kerson Huang, Wiley India Limited, 2008

Reference Books:

1. Quantum Mechanics, E Merzbecher, Wiley India Pvt. Ltd. 2011
2. Quantum Mechanics – F. Schwabl (Narosa).
3. Quantum Mechanics, Leonard Schiff, Tata Mac Grawhill Education, 2010
4. Introductory Quantum Mechanics - S. N. Ghoshal (Calcutta Book House).
5. A Textbook of Quantum Mechanics – P. M. Mathews and K. Venkatesan (Tata Mc Graw Hill).
6. Advanced Quantum Mechanics – Sakurai (Pearson Education)
7. Statistical Physics: Berkeley Physics Course Volume 5 by F Reif (Tata McGraw-Hill Company Ltd, 2008)
8. Statistical and Thermal Physics: an introduction by S.Lokanathan and R.S.Gambhir, (P.H.I., 1991).
9. Statistical Mechanics and Dynamics – H. Eyring, (Wiley Blackwell), 2nd Ed., 1982.
10. Statistical Physics: Course of Theoretical Physics, Part I, Volume 5, L Landau and E M Lifshitz
11. Statistical Physics: Course of Theoretical Physics, Volume 9 , L Landau
12. Statistical Physics, F. Mandle (ELBS).

PHY-UG-C602: Physics IX

Unit I: Atomic Physics

1. Structure of the atom: isobars, isotopes and isotones; mass spectrometers Aston & Bainbridge and their uses.
2. Atomic spectra: : Predictions of classical theory, characteristics of atomic spectra, Ritz principle, Balmer's formula, different spectral series and Rydberg constant. Bohr Sommerfeld atomic model and quantum conditions, hydrogen spectrum; excitation and ionization of atoms Franck and Hertz experiment, Stern-Gerlach experiment and the intrinsic spin of the electron; fine structure; magnetic moment of the electron; Lande g-factor,

gyromagnetic ratio. Vector atom model- space quantization; alkali atom spectra existence of four series; screening, selection rules. Pauli exclusion principle; shell structure of the atoms, the periodic table. X-rays continous and characteristic X-rays; Moseley's law and its explanation from Bohr's theory. Zeeman effect normal and anomalous, explanation from vector atom model. Faraday effect; qualitative discussions of Stark effect and Kerr effect.

Unit II: Nuclear Physics

1. Properties of Nuclei: Nuclear constituents, discovery of the neutron; nuclear mass, charge, size, binding energy, isospin, nuclear spin and magnetic moment.
2. Nuclear Structure: Nature of forces betweennucleons; nuclear stability and nuclear binding, the static liquid drop model (descriptive) and Bethe Weizsacker mass formula, application of mass formula to stability considerations; nuclear shell model (qualitative discussions with emphasis on phenomenology with examples).
3. Radioactivity: discovery, identification of alpha,beta and gamma rays, radioactive decay laws, disintegration constant, half life and mean life, successive disintegrations transient and secular equilibriums; units of radioactivity; dating from radioactivity and other applications.
4. Alpha decay: Alpha particle spectra- velocity and energy of alpha particles; Geiger- Nuttal law, fine structure in alpha spectra; outlines of theory of alpha decay based on rectangular barrier penetration.
5. Beta decay: Nature of beta ray spectra; the neutrino; energy levels and decay schemes; positron emission and electron capture; selection rules; betaabsorption and range of beta particles.
6. Gamma decay: Gamma ray spectra and nuclear energy levels; isometric state; multipolarity of transitions and selection rules (no derivation);
internal conversation and bremsstrahlung (descriptive); gamma absorption in matter photo electric process; Compton scattering and pair production (no derivation of formulae qualitative discussions only)
7. Nuclear Reactions: Conservation principles in nuclear reactions; Q values and thresholds, exoergic and endoergic reactions, nuclear reaction cross-sections; examples of different types of reactions; characteristics and examples of compound nuclear and direct interactions; Bohr's hypothesis on compound nuclear reactions Ghosal's experiment.
8. Nuclear fission: discovery, characteristics fission products and energy release, spontaneous and induced fission, transuranic elements, chain reaction and basic principle of nuclear reactors. Nuclear fusion, energy release in stars.

Unit III: Elementary Particles and Experimental Techniques

1. Discovery of particles positron, muon, pion, K meson and hypersons; stable and semi stable particles lifetime and decay widths; measurement of lifetime of the neutron.
2. Four basic interactions in nature and their relative strengths, examples of different types of interactions; quantum numbers mass, spin, isotopic spin, intrinsic parity, hypercharge and charge conjugation; conservation laws.
3. Classification of elementary particles hadrons and leptons; baryons and mesons, elementary ideas about quark structure of hadrons octet and decuplet families.
d. Cosmic rays: nature and origin, primary and secondary rays; showers; Van Allen belt.
4. Accelerators: Electrostatic machines, Van de Graaf Cockroft-Walton machines, Cyclic accelerators cyclotron: focusing condition and phase stability; synchrocyclotron, synchrotron, betatron. Linear accelerators; modern accelerators with colliding beams.
5. Detectors: Passage of charged particles through matter Bohr's ionization formula; types of interaction of charged particles with matter (qualitative no derivation of any formulae). Charged particle detectors: Gas counters ionization chamber, proportional counter and

G.M. counter, Spark chambers and wire counters; cloud chamber and bubble chamber. Gamma ray detector, scintillation counters. Semi conductor detectors for charged particles and Gamma rays.

Unit IV: Laboratory Works IX
(One experiment is to be performed during the Practical Examination of 4hours)

1. To calibrate a polarimeter and hence to determine the concentration of a given sugar solution.
2. To verify the Brewster's law and Fresnel formulae for reflection of electromagnetic waves with help of a spectrometer, a prism and two Polaroid sheets
3. To study the diffraction pattern of a crossed grating with the help of a laser source.
4. To determine the band gap of Germanium crystal by four probe method.
5. Determination of Lande "g" factor.
6. To determine Fourier spectrum of (i) square (i) triangular and (i) sinosoidical waveform by CRO

Text Books:

1. Atomic physics - J.B. Rajam & foreword by Louis De Broglie.(S.Chand & Co., 2007).
2. Atomic Physics - J.H. Fewkes & John Yarwood. Vol. II (Oxford Univ. Press, 1991).
3. Physics of Atoms and Molecules – B. H. Bransden and C. J. Joachain (Pearson Education)
4. Atomic and Nuclear Physics – S. K. Sharma (Pearson Education).
5. Concepts of nuclear physics by Bernard L.Cohen. (New Delhi: Tata Mcgraw Hill, 1998).
6. Nuclear physics - Irving Kaplan. (Oxford & IBH, 1962).
7. S N Ghoshal: Nuclear Physics, S. Chand and Co. Ltd. 2010.
8. R. Roy and B.P. Nigam: Nuclear Physics (Theory & Experiment), New Age Intl., (1967).
9. D. J. Griffiths: Introduction to Elementary Particles, John Wiley & Sons (1987).
10. Francis Halzene & Alan D. Martin: Quarks & Leptons: An introductory course in modern particle physics, Wiley, 2008

Reference Books:

1. Laser Principles and Applications – A. K. Ghatak and K. Tyagrajan (Tata – Mc Graw Hill).
2. Concepts of Modern Physics - Arthur Beiser (McGraw-Hill Book Company, 1987)
3. Introductory Nuclear Physics – Kenneth S Krane, John Wiley, (1988).
4. Introduction to the physics of nuclei and particles by R.A. Dunlap.(Singapore: Thomson Asia, 2004).
5. Emilio. Segre: Nuclei and Particles: An introduction to nuclear and subnuclear physics, Dover, (2013).
6. W. E. Burcham: Elements of Nuclear Physics, Longman, (1986).
7. W. N. Cottingham and D. A. Greenwood: An Introduction to Nuclear Physics. Cambridge University Press, 2nd Edn. (2001).
8. Ta Pei Cheng & Ling-Fong: Gauge theory of elementary particle physics, Oxford University Press, 1984
9. M. K. Pal, Theory of Nuclear Structure, Affiliated East-West, 1982
10. P. Marmier and E. Sheldon: Physics of Nuclei and Particles, Vol.I & II, Academic Press, (1969).
11. Optics and Atomic Physics – B. P. Khandelwal (Siblal Agarwala).

Books for Practical Physics:

1. C.R. Das Gupta Practical Physics 3h Ed. Syndicate , Calcutta.
2.Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

3. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
4. Indu Prakash and Ramakrishna, A Text Book of Practical Physics, Kitab Mahal, New Delhi.
5. D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
6. Nelson and Jon Ogborn, Practical Physics.