S. S. Jain Subodh PG (Autonomous) College, Jaipur
Department of Physics

Bachelor of Science (B.Sc. Honors)
Subject – Physics

Examination Scheme:

Semester - I		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER -I	MECHANICS – I	75 Marks
PAPER – II	ELECTROMAGNETISM – I	75 Marks
PAPER – III	OSCILLATIONS AND WAVES –I	75Marks
PAPER – IV	ELECTRICAL AND DIGITAL ELECTRONICS -I	75Marks
Physics Practical – I		150 Marks
Semester - II		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER -I	MECHANICS – II	75 Marks
PAPER – II	ELECTROMAGNETISM – II	75 Marks
PAPER – III	OSCILLATIONS AND WAVES –II	75Marks
PAPER – IV	ELECTRICAL AND DIGITAL ELECTRONICS -II	75Marks
Physics Practical – II		150 Marks

Examination Scheme for each Paper

Part A 7 QUESTIONS (very short answer Questions) 7X 2 MARK EACH = 14 Marks

Part B 4 QUESTIONS (1 question from each unit with Internal choice) 4X10 MARK EACH = 40 Marks

Total of End semester exam (duration of exam 3 hours) = 54 Marks

Internal assessment = 21 Marks

Maximum Marks (Each theory paper) = 75Marks

Max. Practical Marks = 150 Marks

(Internal Marks 60+ External marks 90)

Total of Theory Papers : 4 X 75 Marks Each = 300 Marks (Min. Pass Marks 40%)

Total of Practical Marks = 150 Marks

Grand Total of Subject per Semester = 450 Marks

Note:- Syllabus for Subsidiary Subject (Chemistry/ Mathematics) is same as the syllabus for B.Sc. (Pass Course).

Semester - I

PAPER I: MECHANICS – I

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT-I Physical Laws and Frames of Reference:

Inertial and non-inertial frames, examples. Transformation of displacement, velocity and acceleration between different frames of reference involving translation. Galilean transformation and invariance of Newton's law. Non-inertial frames, fictitous or pseudo forces, Transformation of displacement, velocity and acceleration between rotating co-ordinate systems, centrifugal acceleration, Coriolis force and its applications, Motion relative to earth. Foucault's pendulum

UNIT-II Special Theory of Relativity:

Postulates of special theory of relativity. Lorentz transformations, Addition of velocities and acceleration, Time dilation and length contraction. Variation of mass with velocity, Relativistic energy and mass energy relation.

UNIT-III Conservation Laws:

Conservative forces. Potential energy. Potential energy in gravitational and electrostatic field. Rectilinear motion under conservation forces. Discussion of potential energy curves and motion of a particle. Conservation of angular momentum about an arbitrary point, Precessional motion of Spinning top, Spin precession in constant magnetic field.

UNIT-IV Rigid Body Dynamics:

Equation of motion of a rotating body, inertial coefficients, case of J not parallel to w, kinetic energy of rotation and idea of principle axis. Calculation of moment of inertia of a disc, spherical shell, hollow and solid spheres and cylindrical objects (cylindrical shell, solid cylinder) about their symmetric axis through centre of mass.

Semester - I

Paper – II ELECTROMAGNETISM – I

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT -I Vector Fields :

Partial derivative. Gradient of a scalar function. Line integral of a vector field. Divergence of a vector field. Divergence in the Cartesian coordinates, Concept of solid angle. Gauss divergence theorem, Gauss law in differential form, Gauss law from inverse square law, physical meaning of divergence of a vector, The Laplacian operator. Possion's and Laplace equations.

UNIT -II Curl and the Field of Stationary Charge:

Curl of a vector field, curl in Cartesian coordinates, Stoke's theorem, physical meaning of curl. Potential difference and potential function. Potential energy of a system. Application : energy required to build a uniformly charged sphere. Classical radius of the electron, potential and field due to a short dipole, torque and force on a dipole in a Z external field.

UNIT -III The Field of Moving Charge:

Magnetic force, Measurement of charge in motion, Invariance of charge. Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Force on a moving charge, Interaction between a moving charge and other moving charges.

UNIT – IV The Magnetic Field:

The definition of magnetic field, properties of the magnetic field. Ampere's circuital law with applications. Ampere's Law in the differential form. Vector potential. Poissions equation for vector potential. Field of any current carrying wire and deduction of Bio-Savart law.

Semester – I

Paper – III OSCILLATIONS AND WAVES –I

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT -I Oscillations:

Oscillations in an arbitrary potential well, Simple harmonic motion, examples-spring mass system, mass on a spring, torsional oscillator, LC circuit, energy of the oscillator,

UNIT -II Damped Oscillator:

Damping of oscillator, viscous and solid friction damping. Power dissipation. Anharmonic oscillator, simple pendulum as an example.

UNIT -III Driven Oscillator:

Driven harmonic oscillator with viscous damping. Frequency response, phase relations. Quality factor, Resonance. Introduction of j operator concept in Electrical oscillations, series and parallel LCR circuit. Electro-mechanical system-Ballistic Galvanometer Effect of damping.

UNIT – IV Coupled Oscillator:

Equation of motion of two coupled S.H Oscillators. Normal modes, motion in mixed modes. Transient behaviour. Effect of coupling in mechanical systems. Electrically coupled circuits, frequency response. Reflected impedance. Effect of coupling and resistive load.

Semester – I

Paper IV- Electrical and Digital Electronics-I

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

Unit-I:- Quantization of Charge, Current, Measurement of Electric Field and electric Intensity, Kirchoff's Law, Digital Electronics : Signals: Digital & Analog Signals, Positive & Negative Logics, Basic Digital Circuits and operations: AND, OR, NOT, NAND , NOR, Exclusive OR & Exclusive NOR. Boolean Algebra, De Morgan's Theorem.

UNIT-II:- Number system and codes number system, Binary number system, binary arithmetic, Octal number system, Hexadecimal number system, codes: Straight Binary code, Natural BCD codes, Exces-3 codes, Grey code, Hexadecimal code.

UNIT-III:- Standard forms for logical expression: Sum of products (SOP), Conversion into SOP forms, Products of sum (POS), Conversion into POS forms. Advantage of SOP & POS forms, Standard SOP & POS forms, Minterm & Maxterm, Interrelation between Minterm & Maxterm.

UNIT-IV:- Karnaugh Map, Representation of logical functions, K-map with two, three & four variables: Mapping of standard SOP & POS expressions, Minimization of the expression, Mapping of K- map from truth table, Don't care combination, Quine Mc- Clusky algorithms.

Physics Practical : I

Max. Practical Marks	**= 150 Marks**
Internal Marks	**= 60 Marks**
External Practical Exam.	**= 90 Marks**

Semester - II

Paper I MECHANICS – II

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT-I Centre of mass frame:

Centre of mass, Two particle System, motion of centre of mass and concept of reduced mass, Conservation of energy and linear momentum, Collision of two particles in one and two dimensions (elastic and inelastic), Analysis of collision in centre of mass frame. Slowing down of neutrons in moderator. System with varying mass. Angular momentum and charged particle scattering by a nucleus as an example.

UNIT-II Motion under central forces :

Motion under central force, Gravitational interaction, Inertial and gravitational mass. General solution under gravitational interaction. Rutherford scattering. Discussion of trajectories. Cases of elliptical and circular orbits. Kepler's laws,

UNIT-III Elasticity-I :

Elasticity, Small deformations, Young's modulus, Bulk modulus and Modulus of rigidity for an isotropic solid, Poisson's ratio, relation between elastic constants. Elastic theorems.

UNIT-IV Elasticity-II :

Theory of bending of beams and Cantilever, Torsion of a cylinder, Bending moments and Shearing forces. Experimental determination of elastic constants by bending of beam.

Paper – II ELECTROMAGNETISM – II

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT – I Magnetic Fields in Matter :

Electric current due to orbital electron, the field of current loop, Bohr magneton. Orbital gyro magnetic ratio Electron spin and magnetic moment. Magnetic susceptibility, magnetic field caused by magnetized matter. Magnetization current. Free current and the field H.

UNIT –II Electric Field in Matter :

The moment of a charge distribution. Atomic and molecular dipoles. Atomic polarizability. Permanent dipole moment, dielectrics. The Capacitor filled with a dielectric. The potential and field due to a polarized sphere.

UNIT –III Dielectric :

Dielectric.. Dielectric sphere placed in a uniform field. The field of charge in dielectric medium and Gauss's law. The connection between electric susceptibility and atomic polarizability. Polarization in changing field. The bound charge (polarization) current.

UNIT -IV Transient behavior and Maxwell's Equations:

Transient behaviour of an R-C circuit. Electromagnetic Induction and Maxwell's Equations, Faraday's law in differential form. Mutual inductance, Self inductance Transient behaviour of an L-R circuit, the displacement current, Maxwell's equations in differential and integral forms.

Paper – III OSCILLATIONS AND WAVES –II

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT -I Lattice dynamics:

Dynamics of a number of oscillators with near-neighbour interactions. Equation of motion for one dimensional mono-atomic and diatomic lattices, acoustic and optical modes, dispersion relations. Concept of group and phase velocities.

UNIT – II Electrical Transmission Line:

Electrical transmission line, propagation velocity, losses, characteristic impedance, standing waves, effect of termination.

UNIT –III Wave Motion:

Wave motion – Elastic waves in a solid rod. Pressure waves in a gas column. Transverse waves in a string, waves in three dimensions, spherical waves, Fourier series and Fourier analysis.

UNIT – IV Electromagnetic Wave:

Plane electromagnetic (EM) wave. Energy and momentum of EM wave. Radiation pressure. Radiation resistance of free space. EM waves in dispersive media (normal case). Spectrum of electromagnetic radiations.

Paper IV-Electrical & Digital Electronics –II

Duration : 3 hrs. **Max. Marks : 54**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

Unit-I:- Semi Conductor and Transistor Characteristics, Field Effect Transistor, Digital Logic Families: **(a)** Bipolar Logic Families, Characteristics of Digital IC's. Register Transistor Logic (RTL), DCTL, DTL, ECL, TTL- Circuits. **(b)** Unipolar Logic Families, MOS-Logic: MOSFET Inverter, MOSFET NAND and NOR Gates, CMOS-Logic: CMOS Inverter, CMOS NAND and NOR Gate.

Unit-II:- Combinational Circuits: Multiplexers, Basic four input one output Multiplexer, IC-74151- 8 to 1 Multiplexer, IC- 74150-16 to 1 Multiplexer,De-Multiplexer-1 to 4 De-Multiplexer, 1 to 8 De-Multiplexer, IC-74154-1 to 16 De- Multiplexer, Decoder: Basic Binary Decoder, 3 to 8 Decoder, IC 74154- 4 to 16 Decoder, BCD to Seven Segment Decoder, Parity generators and Checkers.

Unit-III:- Sequential Circuits(Latch): Flip Flops: Flip Flops, Basic Flip Flops (the latch), R-S Flip Flop, D-type Flip Flop, J-K Flip Flop, T-type Flip Flop, Master Salve J-K Flip Flop, Applications of Flip Flops,.

Unit–IV:- Digital Counters: Introduction, Modulus of Counter, Asynchronous Mod-16 Ripple Counter, Synchronous Mod and Counter, Up/Down Counter, Ring Counter, Left and Right Shift Register Operations, Applications of Digital Counters and Shift Registers.

Physics Practical : II

Max. Practical Marks	**= 150 Marks**
Internal Marks	**= 60 Marks**
External Practical Exam.	**= 90 Marks**

S.S. JAIN SUBODH PG (Autonomous) COLLEGE, JAIPUR

B.Sc. Hons. Physics
SEMESTER – III

Paper –I -STATISTICAL AND THERMODYNAMICAL PHYSICS-I

UNIT I General Thermo-dynamical Interaction:
Thermal interaction ; Zeroth law of thermodynamics Helmholtz free energy; Adiabatic interaction and enthalpy ;General interaction and first law of thermodynamics; Infinitesimal general interaction; Gibb's free energy and Phase transitions. Clausius-Clapeyron equation; Vapor pressure curve.

UNIT II Carnot's Engine and Maxwell Relation:
Heat engine and efficiency of engine, Carnot,s Cycle; Thermodynamic scale as an absolute scale; Maxwell relations and their applications.

UNIT III Production of Low Temperature:
Joule Thomson expansion and J.T. coefficients for ideal as well as Vander Waal's gas. Porous plug experiment, Temperature inversions. Regenerative cooling and cooling by adiabatic expansion and demagnetization.

UNIT IV Application of Low Temperature:
Liquid Helium, He I and He II, super fluidity, quest for absolute zero. Nernst heat theorem. Qualitative Discussion of Superconductivity.

Reference books:

1. Berkeley series Vol. V, Statistical Physics
2. Reif-Thermodynamics and Statistical Physics
3. Lokanathan and Khandelwal-Thermodynamics and Statistical Physics
4. Sears- Thermodynamics, Kinetic theory of gases and Statistical Physics
5. Kittle - Thermal Physics

Paper – II -OPTICS –I

UNIT-I Geometrical Optics:
Fermat's principle, Laws of reflection and refraction from Fermat's principle, refraction at a spherical surface. Axial, lateral, angular magnification and their interrelationship; Abbe's Sine condition for spherical surfaces;

UNIT-II Lenses:
Refraction through a thick and thin lenses and its Focal length , Focal length of two thin lenses separated by a distance, Cardinal points of a co-axial lens system, properties of cardinal points; construction of image using cardinal points.

UNIT-III Interference:
Young's double slit experiment, temporal and spatial coherence, coherence length, Division of amplitude, Interference in thin films, colour in thin films. Wedge shaped film, Newton rings and determination of wavelength and refractive index by Newton ring. Michelson Interferometer, Measurement of wavelength and refractive index by Michelson Interferometer.

Unit-IV Polarization:
Polarization states of electromagnetic (EM) waves, reflection and refraction of plane EM wave at plane dielectric surface, boundary conditions, derivation of Fresnel's relations. Huygen's theory, Theory of double refraction using Fresnal's ellipsoidal surface (no mathematical derivation). Production and analysis of plane, circularly and elliptically polarized light, quarter and half wave plates.

Reference Books :

1. Principles of Optics by B.K. Mathur

2. Optics by D.P. Khandelwal
3. Introduction to Modern Optics by A.K. Ghatak (Tata McGraw Hill)
4. Optics by Brij Lal and Subramanium.
5. An Introduction to Modern Optics by G.R. Fowels.
6. Optical Physics by Lipson and Lipson
7. Essentials of Lasers by Allen.

Paper – III -ELECTRONICS & SOLID STATE DEVICES –I

UNIT-I Circuit Analysis:

Network-some important definitions, loop and nodal equation based on DC and AC circuits (Kirchhoff's Laws), Four terminal network parameters; Current volt conventions, Open circuit, short circuit and hybrid parameters of any four terminals network. Input, Output and mutual impendence for an active four terminal network.

UNIT – II Network Theorems:

Superposition, Thevenin, Norton, Reciprocity, Compensation and maximum power transfer and miller theorems.

UNIT – III Semiconductors:

Intrinsic and extrinsic semiconductors, charge densities in N and P materials, conduction by drift and diffusion of charge carriers. PN diode equation, capacitance effects. Nature of charge carriers by Hall effect and Hall coefficient. Zener Diode, tunnel diode, photovoltaic effect.

UNIT – IV Rectifiers and Voltage Regulation:

Half-wave, full wave and Bridge rectifiers, Calculation of ripple factor, efficiency and regulation. Filters: shunt inductors, shunt capacitor, L sections and π sections filters. Voltage regulation and voltage stabilization by Zener diode, Voltage multiplier circuits.

Reference books :

1. John D. Ryder, Electronic Fundamentals and Applications, Prentice Hall of India Pvt. Ltd., New Delhi.
2. John D. Ryder, Engineering Electronics, McGraw Hill Book Company, New Delhi.
3. Jacob Millman and Christos C. Halkias, Integrated Electronics. Analog and Digital Circuits and systems: McGraw-Hill Ltd. (1972)
4. Albert Paul Malvino, Digital Computer Electronics, Tata McGraw- Hill Pub. Co. Ltd., New Delhi (1983).
5. Kumar & Gupta, Hand book of Electronics.
6. G.K. Mithal, Hand Book of Electronics.

PAPER-IV- PHYSICS OF MATERIALS-I

Unit-I

Materials: Crystalline and non-crystalline (amorphous) materials, crystal structure and its description in seven systems, lattice, space lattice, bravis lattice, polymers, classification of polymers, carbon nanostructures, nanotubes and nanofibers, 2D materials, magnetic materials, dielectric and ferroelectrics.

Unit-II

Synthesis of materials: Physical and chemical synthesis, Sol-gel, thermal evaporation and chemical vapor deposition(CVD) method, solid state diffusion method, laser ablation and pulsed laser deposition (PLD) method.

Unit-III

Bonding in materials: Bonds, types of bonds, bond energy, bond length, ionic bonding, and calculation of lattice energy of ionic crystals, madelung constant, covalent bonding, metallic bonding, secondary bonding, vibration in bonding and their properties.

Unit-IV

Defects in materials: Defects, types of defects, point defects intrinsic and extrinsic defects, roles of defects in materials characteristics, line defects, dislocations, screw dislocations, mixed dislocations, columnar defects, volume defects, Frenckel & Shottky defects.

Physics Practical: III

1. Using Platinum resistance thermometers find the melting point of a given substance.
2. Using Newton's rings method find out the wave length of a monochromatic source and find the refractive index of liquid .
3. Using Michelson's interferometer finds out the wavelength of given monochromatic source (Sodium light).
4. To determine dispersive power of prism.
5. To determine wave length by grating.
6. To determine wave length by biprism.
7. Determine the thermodynamic constant using Clements & Desorment's method.
8. To determine thermal conductivity of a bad conductor by Lee's method.
9. Study of variation of total thermal radiation with temperature.
10. To study the Specific rotation of sugar solution by polarimeter.

S.S. JAIN SUBODH PG (Autonomous) COLLEGE, JAIPUR

B.Sc. Hons. Physics

SEMESTER – IV

Paper –I STATISTICAL AND THERMODYNAMICAL PHYSICS-II

UNIT I Kinetic Theory of Gases:

Distribution law of molecular velocities, most probable, average and RMS velocities, Energy distribution function; Experimental verification of the Maxwell velocity distribution the principle of equipartition of energy.

UNIT II Transport Phenomenon of Gases:

Transport Phenomenon: Mean free path, distribution of free paths, coefficients of viscosity, thermal conductivity, diffusion and their interrelation.

UNIT III Classical Statistics:

Validity of classical approximation, Phase space, micro and macro states; Thermo dynamical probability, entropy and thermodynamic probability; Monoatomic ideal gas; Barometric equation ; Specific heat capacity of diatomic gas; Heat capacity of solids.

UNIT IV Quantum Statistics:

Black body radiation and failure of classical statistics, Postulates of quantum statistics, indistingushability, wave function and exchange degeneracy, a priori-probability; Bose Einstein statistics and its distribution function ;Plank distribution function and radiation formula ;Fermi Dirac statistics and its distribution function ,contact potential ,thermionic emission ;Specific heat anomaly of metals ;Nuclear spin statistics (para and ortho hydrogen)

Reference books:

1. Berkeley series Vol. V, Statistical Physics
2. Reif-Thermodynamics and Statistical Physics
3. Lokanathan and Khandelwal-Thermodynamics and Statistical Physics
4. Sears- Thermodynamics, Kinetic theory of gases and Statistical Physics
5. Kittle - Thermal Physics

Paper – II OPTICS –II

UNIT-I Fraunhoffer Diffraction:

Fraunhofer diffraction at single slit and a circular aperture, intensity distribution and width of central maxima, and determination of slit size, two slit diffraction and its intensity distribution with missing orders. Diffraction due to N slits with intensity distributions. Plane transmission grating its formation and intensity distribution.

UNIT-II Fresnel class of Diffraction & Resolving Power:

Fresnel class of diffraction, half period zones, zone plate, diffraction due to circular aperture. Diffraction at straight edge, thin and thick wire, rectangular slit. Rayleigh's criterion, resolving power of prism, telescope, microscope and plane transmission grating.

Unit-III Optical Activity and Holography :

Optical activity, Specific rotation, biquartz and half shade polarimeters. Basic concepts of holography, construction of a hologram and reconstruction of the image, important features of hologram and uses of holography.

Unit-IV Lasers:

Difference between ordinary and laser source, stimulated and spontaneous emission, stimulated absorption. Einstein's A and B coefficients, population inversion, conditions for laser action, meta-stable states, pumping. Types of lasers, construction, working and energy level schemes of He-Ne and Ruby laser. Properties and uses of lasers.

Reference Books :

1. ***Principles of optics by B.K. Mathur***
2. Optics by D.P. Khandelwal
3. Introduction to Modern Optics by A.K. Ghatak (Tata McGraw Hill)
4. Optics by Brij Lal and Subramanium.
5. An Introduction to Modern Optics by G.R. Fowels.
6. Optical Physics by Lipson and Lipson
7. Essentials of Lasers by Allen.

PAPER – III -ELECTRONICS & SOLID STATE DEVICES –II

UNIT-I Transistor:

Notations and volt -ampere characteristics for bipolar junction transistor, concept of load line and operating point, hybrid parameters. Transistor as Amplifiers: CB, CE, CC configurations, its characteristic curves and their equivalent circuits. Analysis of transistor amplifiers using hybrid parameters and its frequency response. Fixed and emitter biasing, bias stability in transistor circuits.

UNIT-II Amplifiers with Feedback:

Concept of feedback, positive and negative feedback, voltage and current feedback circuits, Advantages of negative feedback- stabilization of gain by negative feedback, Effect of feedback on output and input resistance. Reduction of nonlinear distortion by negative feedback. Effect on gain- frequency response.

UNIT-III Operational Amplifier & Oscillators:

Differential amplifier, DC levels shifter, operational amplifier, input and Output impedances, input offset current. Application: Unity gain buffer, Adder, Subtractor, Integrator and Differentiator. Feedback requirements for oscillations, circuit requirement for oscillation, basic oscillator analysis. Colpitt and Hartley oscillators. R-C oscillators, Piezoelectric frequency control.

UNIT-IV Field Effect Transistor and Digital Circuits:

Field Effect Transistor (FET) and its characteristic biasing JFET, ac operation of JFET and MOSFET.Binary, Hexadecimal and Octal number systems. Binary arithmetic. Logic fundamentals AND, OR, NOT, NOR., NAND, XOR gates, Boolean theorems, transistor as a switch, logic gates: circuit realization of logic functions. Analog to digital and digital to analog analysis. DDL, RTL, TTL circuits.

Reference books :

1. John D. Ryder, Electronic Fundamentals and Applications, Prentice Hall of India Pvt. Ltd., New Delhi.
2. John D. Ryder, Engineering Electronics, McGraw Hill Book Company, New Delhi.
3. Jacob Millman and Christosc Hailkias, Integrated Electronics. Analog and Digital Circuits and systems: McGraw-Hill Ltd.

PAPER-IV- PHYSICS OF MATERIALS

Unit-I

Modification of materials: Heating, doping, cooling, quenching, solidification and crystallization, glass transition, light induced modification, irradiation by swift heavy ions and electron irradiation.

Unit-II

Analysis of materials: X-ray diffraction (XRD), Microwave diffraction, X-ray Fluorescence (XRF), X-ray Photoelectron Spectroscopy (XPS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Raman Spectroscopy, Positron Annihilation Spectroscopy (PAS).

Unit-III

Applications of materials: Nanodevices, Solar cell & fuel cell fabrications, Energy & Charge storage, Memory storage, Microwave (Radiation) shielding. Fire retardancy, Reflectors & absorbers.

Unit-IV

Energy Materials: Memory and resistive switching. Solar Energy collectors, solid state hydrogen storage in carbon nanotubes, Oxides, sulfides, carbon nanostructures and ferroelectrics for high energy storage.

References:

1. Handbook of Science and Technology in India published in 2002
2. Materials Science and Engineering, V.S. Raghvan TMH.
3. J.A.Duffie, Solar materials and thermal process, John Wiley and Sons, New York.

Physics Practical-IV

1. Plot thermo emf versus temperature graph and find the neutral temperature (Use sand bath)
2. Study of power supply using two diodes/bridge rectifiers with various filter circuits.
3. Study of half wave rectifier using single diode and application of L and π section filters.
4. To study characteristics of a given transistor PNP/NPN (Common emitter, common base and common collector configurations
5. Determination of band gap using a junction diode.
6. Determination of power factor (cos δ) of a given coil using CRO.
7. Study of single stage transistor audio amplifier (Variation of gain with frequency).
8. To determine e/m by Thomson's method.
9. Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO
10. Measurement of inductance of a coil by Anderson's bridge.
11. Measurement of capacitance and dielectric constant of a liquid and gang condenser by de-Sauty Bridge.
12. Any experiment according to theory paper

Syllabus for B.Sc. (Hons.) Physics
SEMESTER-V

PAPER-IV - Atomic and Molecular Physics –I

Unit-I

Atoms in Electric and Magnetic Fields :- Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

Atoms in External Magnetic Fields :- Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only).

Unit-II

Many electron atoms :- Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum. Vector Model. L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and Alkali Atoms (Na etc.).

Unit-III

Molecular Spectra :- Rotational Energy levels, Selection Rules and Pure Rotational Spectra of a Molecule. Vibrational Energy Levels, Selection Rules and Vibration Spectra. Rotation- Vibration Energy Levels, Selection Rules and Rotation-Vibration Spectra. Determination of Internuclear Distance.

Raman Effect :- Quantum Theory of Raman Effect. Characteristics of Raman Lines. Stoke's and Anti-Stoke's Lines. Complimentary Character of Raman and infrared Spectra.

Unit-IV

Lasers :- Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.

Reference Books:

1. Concepts of Modern Physics by Arthur Beiser (McGraw-Hill Book Company, 1987)
2. Atomic physics by J.B.Rajam & foreword by Louis De Broglie.(S.Chand & Co., 2007).
3. Atomic Physics by J.H.Fewkes & John Yarwood. Vol. II (Oxford Univ. Press, 1991).
4. Physics of Atoms and Molecules, Bransden and Joachein.
5. Molecular Spectroscopy, Banwell.
6. Optoelectronics by Ghatak and Thyagarajan
7. Principles of Lasers by Svelto

Syllabus for B.Sc. (Hons.) Physics

SEMESTER –VI

Paper **IV- Atomic and molecular Physics-II**

Unit-I

Background from quantum theory: The four quantum numbers (n,l,m,s), spectrum terms arising from L-S coupling, Matrix elements of dipole moment, selection rules, emission and absorption probabilities, spectra of mono and divalent atoms, Fine structure of hydrogen lines, doublet structure of alkali spectrum, spectra of helium and alkaline earth atoms, singlet and triplet series, isotope effect and deduction of m/M from hydrogen and deuterium spectra

Unit-II

Magnetic field effects and x-ray spectroscopy: Effect of magnetic fields on energy levels, Gyromagnetic ratio for orbtal and spen moments, vector model, J-J coupling, Lande g factor strong and weak field effects, x-ray spectra, Continuous x-ray spectra, characteristics of x-rays, Mosley's law, doublet fine structure, H-like character of x-ray energy states, x-ray absorption spectra, absorption edges, qualitative discussion of nuclear edge and extended fine structure, determination of atomic number of atoms

Unit-III

Diatomic & Triatomic molecules: The structure of H_2O, CO_2 and N_2O molecules from IR and Raman spectra. Sharing of electrons, formation of molecular orbital's, and qualitative discussion of H_2 ion, H_2 molecules, electronic levels and quantum numbers for electronic states of diatomic molecules: singlet and triplet characters, rotational energy levels, intermolecular distance, vibrational energy levels, spectra of diatomic molecules, pure rotational spectra, selection rules, vibration rotation spectra, electronic band system, Franck-Condon principle.

Unit-IV

Experimental Techniques:

Emission spectroscopy: Emission sources, prism, grating and crystal spectrographs, Concave grating, different types of mountings, monochromators, resolution and dispersion in various spectrographs, high resolution spectroscopy, Fenbry –Perot and lummer plate in high resolution.

Absorption spectroscopy: Continuous sources for absorption studies in x-ray, UV-Vis and IR region, single beam and double beam instruments, photographic plate, photomultiplier tube and bolometer, Laser imaging of objects, burnable lasers for high resolution spectroscopy, pulsed laser for time resolved spectroscopy.

Reference books:

1. G. Herzberg Atomic spectra and atomic structure
2. H. Kuhn, Atomic spectra
3. Walker and straugha, spectroscopy Vol, I,II, III
4. H. Barrow, Theory of atomic spectra
5. R C Johnson, Introduction to molecular spectra
6. White, Atomic spectra
7. B K Agarwal, X-ray spectroscopy
8. D P Khandelwal Optics and atomic Physics
9. C L Arora, Atomic and molecular Physics
10. Raj Kumar, Atomic and molecular Physics