

B. Sc. Part-I : PHYSICS HONOURS

The course shall consist of two theory papers of 75 marks each paper—I (theory) and paper-II (theory). The pass marks in the theories papers taken together will be 46 and the examination in each paper will be of 3 hrs. duration.

There will be also one practical paper of 50 marks. The pass marks will be 20 and the examination will be of 6 hrs. duration in this paper.

The following will be the detailed course.

Time : 3 Hours] PAPER-I (Theory) [Marks : 75

(12 questions to be set, 6 to be answered, one from Group-A and 4 from Group-B)

GROUP-A : Special Theory of Relativity-2 Questions

Gelilean Transformation, Inertial form of reference. Michelson, Morley experiment, Lorentz, Pityerald contractions. Einstein postulates, Lorentz, Transformations and its consequences. Length contraction and time dilation, Addition of velocities, Dragging of light by moving medium Relativistic Dopler effect for propagation of light waves. Abberation of light, variation of mass with velocity, Mass energy relation.

GROUP-B : Mechanics and Properties of Matter-8 Questions

Inertial frame of reference and non-inertial frame Corioli's & centrifugal forces and their simple applications. Generalised co-ordinates, Constraints (holonomic nonholonomic) D'Alembert's principle and Lagrange's equations of motion, Ramilton's equation of motion and their simple applications.

Gravitational potential and field due to bodies of regular geometrical shape. Motion in central field, Keppler's laws, two particle motion in central field.

Elasticity and elastic constants, Relation between elastic constants, Bending of beams and cantilivers, Torsion of cylinder and rigidity modulus by flat spring. Non spring effect of temperature and pressure on elasticity.

Surfare tension and Surface energy. Principle of virtual work and its application to surface tension. Ripples and gravity waves. Surface tension by the method of apples, Effect of temperature and pressure on surface tension.

Time : 3 Hours] PAPER-II (Theory) [Marks : 75

(10 questions to be set 6 to be answered 2 from Group-A and 4 from Group-B)

Derivation of Maxwell's law of distribution of velocities and its experimental varification. Equipartition of energy. Mean free path.

Transport phenomen viscosity, condition and diffusion, Brownian motion, Langevin and Einstein's theories and experimental determination of Avogardo's number.

Rectilinear flow of heat in a metal rod conductivity of periodic flow method. Relation of thermal and electrical conductivities van der Waal equation of state.

GROUP-B : Thermodynamics-8 Questions

Zereth law of thermodynamics, Definition of temperature, First and second law of thermodynamics, Carnot's engine and Carnot's theorem Absolute scale of temperature, Classiu's inequality entropy. E changes in reversible and irreversible processes, Enthalpy, Helmholtz and Gibb's function Gibb's Helmholtz equations. Maxwell's equations and its application to simple physical problems.

Thermodynamics description of phase, transition Chemical potential, Latent heat of transition, Claperon equation, Ehruest scheme of phase transition.

Joule Thompson effect Liquification of gasses with special reference to hydrogen and helium. Production and measurement of low temperature.

Black body radiation, Kirchoff's law, Stefan's law, Wiens law, Plack's law and its experimental verification.

Einstein and Debye theories of specific heat of solids.

Time : 6 Hours]

PRACTICAL PAPER

The courses shall include the following experiments :

[Marks : 50

1. 'g' by Kaders Pendulum.

2. Young Modulus by Flexure of beam.
3. Elastic constants by Searle's method.
4. Rigidity modulus by (i) Barlow's apparatus (ii) Maxwell's model.
5. Moment of inertia by Fly-wheel.
6. Surface tension by Laguerre's method.
7. Surface tension by method of Ripples.
8. Surface tension by soap bubble.
9. Viscosity of water by capillary flow method.
10. Viscosity of air by Rankine's method.
11. Viscosity by Stokes method.
12. Laws of transverse Vibration by Sonometer.
13. Frequency of tuning fork by Melde's experiment.
14. Velocity of ultrasonic wave in a liquid.
15. 'Gamma' of gas by constant pressure thermometer.
16. Gamma of liquid by Sinker method.
17. Specific heat of solid by radiation correction.
18. Specific heat of liquid by cooling method.
19. Thermal conductivity of copper.
20. Thermal conductivity of asbestos by Lee's disc method.
21. 'J' by Joules calorimeter.

PAPER-III ✓

(12 questions to be set, 6 to be answered 4 from Group A & 2 from Group B).

GROUP-A (Optics)

8 Questions

Format's principles and mirror and lens formula, Cardinal points of a thick lens and thick lens formula.

Interference phenomena by division of wave form and division of amplitude, Michelson Interferometer, Fabry-perot Interferometer L.G. plate, achelon Grating.

Diffraction : Fresnel's & Fraunhofer's diffraction. Half period zones Zone plate. Fresnel's diffraction at straight edge and single narrow wise Fraunhofer's diffraction at slits and circular aperture. Plane diffraction grating concave grating and Engle's mounting Resolving power of prism, telescope and microscope, Cornu's spiral and its use diffraction problems.

Production of plane, circularly and elliptically polarized light. Nicol's Quarter wave plate, Babinet's compensator analysis of elliptically polarised light Rotatory polarisation and polarimeter. Principle of Laser action, Ruby Laser, He, Ne Laser.

GROUP-B**8 Questions****(Electromagnetic theory)**

Maxwell's field equation pointing vector electro-magnetic momentum, Maxwell's stress tension, Pressure of radiation, Plane electromagnetic waves, Reflection and total internal reflection of polarised light, Double reflection in crystal. Theory of dispersion optical properties of metal and dispersion in metals scattering by free and bound charges.

PAPER-IV

(12 questions to be set, 6 to be answered selecting at least two from Group A, Group B and Group C)

GROUP-A**Electrostatics Magnetism (1, 1 questions)**

Boundary condition at the surface of separation of two dielectrics and refraction of lines force.

Solar potentials in Electrostatics. The potential of a system of charges. Dipole and Quadrupole moment Energy stored in an electrostatic field Poisson's and Laplace's equation in Cartesian, Polar and cylindrical co-ordinates and their solutions for simple geometries dielectric polarisation Relation between D, E, & P.

Properties of ferromagnetic material. Hysteresis curve method for obtaining B. H. curve. Energy loss per cycle of magnetisation, Magnetic circuit and application to electromagnet. Measurement of Magnetic flux density (B) by (a) B. C. and search coil (b) Grassot fluxmeter, Energy stored in a magnetic field Measurement of susceptibility of liquid by Quink's method Langevin's and Weiss theories of dia, para and ferromagnetism.

GROUP-B**Current electricity****5 Questions**

Thermodynamic treatment of seeback, Peltier and Thompson effect and their application, self Inductance and Mutual Inductance. Growth and decay of current in circuits containing L, C, and R. Simple applications of these circuits. Moving coil galvanometer, a periodic and ballistic galvanometers. A.C. and A. C. circuit : Use of vectors and complex number in A. C. circuit theory Series and parallel resonant circuit. Power in A. C. circuits, Watt meter A. C. Bridges (i) De Sauty's bridge (ii) Anderson bridge (iii) Carey Foster bridge (iv) Schering bridge. Three phase A. C. Systems, Mutually coupled circuits Rotating magnetic fields polyphase and single phase induction motors. The transformer equipment circuit and vector diagram, Iron and Copper losses in transformer.

GROUP-C**Modern Physics****5 Questions**

Measurement of charge by Millikan's method and specific charge of an electron by Thomson's method, Natural radioactivity Rutherford's theory of radio active decay Geiger, Muller counters, Discovery of Neutron isotopes, Artificial Radioactivity, Elementary idea about nucleus and its structure, Nuclear fission Reactors, Aston's mass spectrograph Cyclotron and Betatron.

Photoelectric emission, Einstein, Photoelectric equation, photo conductive and Photo-Voltain cells.

Compton effect, Bragg's law and determination of X-ray wave length.

Cathod ray Oscilloscope and its uses in amplitude frequency and phase measurement solid state rectifier and one stage R. C. amplifier.

Primary and secondary cosmic rays, Penetrating components of cosmic rays, Altitude and latitude variation of cosmic ray, intensity E. W. Asymetary cosmic ray showers Fossi curve outline of cascade origin of cosmic rays.

B. Sc. Part-II : PHYSICS (Gen./Sub. Course)

The course shall consist of one theory paper (Paper II theory) of 70 marks. The pass marks will be 21 and the examination will be of 3 Hours duration in this paper. There will be also one practical paper (paper II practical) of 30

marks. The pass marks will be 12 and the examination will be 6 hours duration in this paper.

The following will be the detailed course :

Time : 3 Hours]

PAPER-II

[Full Marks : 70

12 questions to be set; 6 to be answered, one from Group A, 3 from Group B and 2 from Group C.

GROUP-A

Electrostatics and Magnetism

2 (1+1) Questions

Boundary conditions at the surface of operation of two dielectrics. Electric dipoles, Dipole moment, Dielectric polarisation. Electrical Image—problems involving infinite conducting plane and thin conducting spherical shell only.

Magnetic shell, Langevin's and Weiss theory of dia, para and Ferro magnetism, Curie Law, Production and measurement of strong magnetic fields, Magnetic circuit and Electromagnets.

GROUP-B

Current electricity, Modern Physics (6 Questions)

Thermodynamic treatment of Seebeck, Peltier and Thomson effects and the application. Moving cell, a periodic and ballistic galvanometers, Growth and decay of currents in electric circuit. Oscillatory, discharge of condenser.

AC and DC circuits : Use of Vectors and complex quantities in AC. Circuit theory (LR, CR, AND LCR, circuits) De. Sautys bridge, Anderson bridge, Carey Foster's bridge.

Measurement of charge by Milliken's method and specific charge of an electron by Thompson method, Natural radioactivity, Rutherford Soddy's theory of radio active decay, Geiger, Muller, counter. Discovery of Neutron Isotopes, Artificial radioactivity. Elementary ideas about nucleus and structure, Nuclear fission Reactors, Aston's mass spectrograph. Photoelectric emission, Einstein's photoelectric, equation photoelectric, Photo-conductive and photo-voltaic cells.

Compton effect, Bragg's law and determination of X-ray's wave length.

Cathode ray oscilloscope and its uses in amplitude, frequency and phase measurements, Solid state rectifier. One stage R-C amplifier, Principle of amplitude modulation and demodulation, Radio receiver through block diagram.

GROUP-C

OPTICS

(4 Questions)

Fermat's principle, Newton's ring, Michelson's interferometer Fresnel's diffraction at straight edge, Fraunhofer's diffraction, single slit, double slit, plane transmission, grating Resolving power of microscope and telescope, Polarization, production of plane circularly and elliptically polarized lights, Nicol's prism. Quarter waveplate Half shade polarimeter Babinet's compensator.

Bohr's theory of hydrogen spectra, principle of laser action, Ruby laser. Maxwell equations, Equation of plane electromagnetic waves and its solution.

PRACTICAL

PAPER-II

[Full Marks : 30

Time : 6 Hours]

The course shall include following experiments :

1. Refractive index by Spectrometer.
2. Wavelength by Newton's ring.
3. Wavelength by plane transmission grating.
4. Magnifying power of telescope.
5. Magnifying power of microscope.
6. Resolving power of telescope.
7. Dip by (i) Dip circle (ii) Earth's inductor.
8. Figure of merit of moving Galvanometer.
9. B. G. Constant and Long decrement.
10. Measurements of low and high resistance.
11. Temperature variation of electrical resistance.
12. Characteristics of value and Semiconductor diodes.

B. Sc. Part-III : PHYSICS (Hons.)

The course shall consists of three theory papers V, VI and VII, each of 100 marks. The examination in each theory paper will be of 3 hours duration. There will be also two practical papers (Paper VIIIA and Paper VIIIB) each of 50 marks and 3 hours duration. The following will be the detailed course

PHYSICS PAPER - V

Time : 3 hours]

[Full Marks : 100

(12 questions to be set, 6 to be answered selection 2 from each group.)

GROUP-A: Methods of Mathematical Physics (4 Questions)

Curvilinear co-ordinates. Cartesian spherical pollar and cylindrical co-ordinates. Orthogonal transformation of co-ordinates, scalar, vector scalar and vector fields, divergence and curl, line surface and volume integrals. Theorem of Gauss, Stoke and Green, Tensor and its elementary properties.

Partial differential equations and its solution by separation of variables, Laplace equation an its solution, wave equation and its solution. Poisson's equation and its solution.

Functions of a complex variable, Coughy-Rieman equations. Zeros and poles, Tylor and Laurentz theorems. Cauchy's integral theorem, residue theorem. Integration of complex functions.

GROUP-B**Classical Mechanics (4 Questions)**

Hamilton's principle, and Euler-Lagrange's equation. Principle of least action. Conservation theorems and symmetry properties. Application of Hamiltonian dynamics to simple problems-Charged particle in an electromagnetic field (non-relativistic cases). Laws of motion of rigid bodies. Moments of inertia and products of Inertia. Eulerian angles. Euler's equation of motion of a rigid body. Gyroscopic motion, Motion of symmetrical top. Canonical transformation. Examples of Canonical transformation. Contact transformations. Hamilton-Jacobi equation, Action angle variations.

GROUP-C**Quantum Mechanics (4 Questions)**

Indequacy classical mechanics. Dual nature of matter and radiation. De Broglie's relation, concept of state. The correspondence principle postulates of quantum mechanics. Eigen functions and eigen values of Hamilton Operators uncertainly relations.

Schrodinger wave equation and its physical meaning, its application to problem of free particle, transmission it particle through potential step, one dimensional Square well particle in a box. Linear harmonic oscillator, Rigid rotator, Hydrogen atom.

Commutation rules of orbital angular momentum, their eigen functions, eigen values, spin half angular momentum, Pauli's spin matrices Pauli's spinors. Symmetric and antisymmetric wave function, Pauli's exclusive principle.

PHYSICS PAPER - VI

(12 questions to be set, 6 to be answered selecting 3 from each group).

GROUP-A**Statistical Physics (6 Questions)**

The fundamental assumption of statistical mechanics, probability distribution and entropy. Partition function and its conversion to thermodynamic functions, Sackur -Tetrode equation and Gibb's paradox, Elements of ensemble theory and Liouville's theorem. Canonical ensemble and thermodynamics, Energy fluctuations in the canonical ensemble. Grand canonical ensemble and thermodynamics, Density and energy fluctuations in the grand canonical ensemble, simple application of ensemble theories to perfect gas.

Boltzmann distribution, Fermi-Dirac distribution. Bose-Einstein distribution and their simple application, Radial distribution function and its relation to thermodynamic functions, A brief introduction to first and second order phase transformation, Critical exponent. Ising model in zeroth approximation, Introduction to Fluctuations. The probability of thermodynamic fluctuation.

GROUP-B**Electronics (6 Questions)**

Thermionics-Richardson's equation and its experimental verification. Child-Langmuir equation Schottk'y Effect. Semiconductor Derives. p-n junction and Zener diodes, BJT and FET transistor, photo-electrical devices, photo-devices, LDR Photovaltaic cell, photo transistor.

CIRCUIT THEORY

Coupled LCR circuits, Superposition theorem, Thevenin and Rediprocity theorems, Maximum power transfer theorem, One part and two port networks (Only h-parameter), T and pi equivalence of two port network, Ladder network* and constant K filters (low, high and band pass) Attenuators.

SOLID STATE ELECTRONIC CIRCUITS

Equivalent circuit of BJT and FET, Half-wave and Full-wave rectifiers, Power supply with specific reference to smoothing circuits and voltage stabilization by cold cathode valve and Zener diode. A.F. amplifiers (R.C. coupled amplifier) Feedback amplifiers, Push-pull power amplifier, Simple circuits for oscillation L. C. (Harley and Colpitt's) Oscillator, R.C. Oscillator. As able Multivibrator. Principle of amplitude modulation, amplitude modulator, average and envelop detection, radio receivers, Super heterodyne receivers, Simple idea of transmitter (with block diagram). CRO and its applications. Logic circuits, AND OR, NAND, NOR operation with the help of simple logic gates.

Types of computers and three basic components. Input out-put devices, concept of hardware and software. BITS and BYTES Computer programming of some simple mathematical problem mathematical problem in BASIC and FORTRAN Languages.

PHYSICS PAPER - VII

(12 questions to be set, 6 to be answered selection 2 from each group.) Plasma and

Classical electrodynamics (4 Questions)

Microscopic and macroscopic properties of Plasma Plasma oscillations. Debye's potential, Wave propagation in isotropic plasma. Ionospheric reflection pitch effect. Alven wave, Shaha's theory of ionisation.

Retarded and advanced potential, Field due to an oscillating current element oscillating dipole Linear-Wich hart potentials. Potential and field due to units formly moving charge.

Covariance of Maxwell equations under Lorentz transformation. Transformation equations electromagnetic fields.

GROUP-B

Solid State Physics (4 Questions)

Element of crystallography, Bravais lattice, Miller indices, seven crystal system, simple crystal structure of NaCl, CaCl_2 and diamond.

Interaction of X-rays, Neutrons and electrons with matter, Diffraction of X-rays from a perfect crystal, Bragg's law Reciprocal Lattice, Ewald construction and Brillouin zones.

Crystal binding ionic, metallic covalent and Vanderwall's binding Vanderwall's- London interaction and cohesive energy of inert gas crystals. Madelung energy and Madelung constant.

Free electron theory of metals. Heat capacity of electron gas. Electrical conductivity of metals, Boltzmann-Transport equation, Sommerfield theory of electrical conductivity, band theory of solid, Bloch's Theorem, Kronig-Penny model. Distinction between metal, semiconductor and Insulator, Intrinsic and Extrinsic semiconductors Transistors, p-n-junction rectifier, Hall-Effect.

GROUP-C**Physics of Atoms, Molecules Nuclei (4 Questions)**

Origin of atomic spectra, Bohr's theory and Bohr-Sommerfield theory of hydrogen atom, spectra of alkali and alkaline earths metals, selection rules, Excitation potential, Fine structure, Stern Gerlach Experiment, vector model of atom, Zeeman Effect and Paschen Back effect of single valence atom. Mosely's Law, origin of X-ray spectra.

Rotational vibrational spectra of diatomic molecules Rotation, vibration and electronic bands, Introduction to NMTR, ESR Laser spectroscopy.

General properties of nuclear mass, charge, spin, static magnetic moment, size and stability, Nuclear models, liquid drops model and mass formula. The shell model, Classical theory of Rutherford scattering.

PHYSICS PAPER - VIII**Time : 3 hours]****[Full Marks : 50****The course shall include the following experiments :**

- ✓ 1. Junction diode and Zener diode characteristics.
- ✓ 2. BJT characteristics.
- ✓ 3. FET characteristics.
4. Static Characteristic of tetrode.
5. Verification of Child-Langmuir law.
6. Frequency response of R-C amplifier.
7. Effect of negative feedback in R-C amplifier.
8. Properties of Hartley oscillator.
9. Study of a plate modulated amplifier.
10. Frequency study of a tuned I-F amplifier.
11. Sensitivity study of a grid leak detector.
12. Study of load characteristic of a rectifier.
13. Multi-vibrator and study of its wave forms.
- ✓ 14. Study of logic gates (AND, NAND, OR, NOR).

PHYSICS PAPER - VIIIB**Time: 3 hours]****[Full Marks: 50****The courses shall include the following experiments**

- ✓ 1. Verification of Brewster's law.
2. Verification of Fresnel's laws of reflection and refraction of polarised light.
3. Analysis of elliptical polarised light.
- ✓ 4. Inductance by Anderson bridge.
5. Mutual inductance by Carey-Foster bridge.
6. Frequency characteristic of Low pass filter.
7. E/m by Braun's tube.
8. e/m by Helical method.
9. Measurement of Hall co-efficient.
10. Band gap of semiconductor.
11. Planck's constant by photo-cell method.
12. Power factor of A.C. fan by (i) three ammeter method (ii) three voltmeter method.
13. Copper loss and iron loss of a transformer.
14. Insertion loss variation load of the T-section of an attenuator.
15. Battery absorption coefficient of a metal by G.M. counter.