B. Sc. Part - I:- PHYSICS (HONOURS)

PAPER - I(Theory)

GROUP - A :Special Theory of Relativity

Galilean Transformation, Inertial frame of reference, Michelson-Morley experiment, Lorentz, Fitzgerald contractions. Einstein postulates, Lorentz Transformations and its consequences. Length contraction and time dilation, Addition of velocities, Dragging of light by moving medium. Relativistic Doppler effect of propagation of light waves, Abbreation of light, variation of mass with velocity, Mass energy relation.

GROUP - B : Mechanics and Properties of Matter

Inertial frame of reference and non-inertial frame reference, Coriolis & Centrifugal forces and their simple applications. Generalized co-ordinates, Constraints (holonomic & nonholonomic) D'Alembeit's principle and Lagrange's equations of motion, Hamilton's equation of motion and their simple applications.

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

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

Surface tension and Surface energy. Principle of virtual works and its application to surface tension. Ripple and gravity waves. Surface tension by the method of ripples, Effect of temperature and pressure on surface tension.

PAPER - II (Theory)

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

Transport phenomenon-viscosity, conductivity and diffusion, Brownian motion, Langevin and Einstein's theories and experimental determination of Avogadro's number.

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

GROUP - B : Thermodynamics

Zeroth law of thermodynamics, Definition of temperature, first and second law of thermodynamics, Carnot's engine and Carnot's theorem, Absolute scale of temperature, Claussius inquality entropy. Energy 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, Clapeyron equation, Ehrenfest scheme of phase transition.

Joule Thompson effect, Liquefaction 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, Planck's law and its experimental verification.

Einstein and Debye theories of specific heats of solids.

PRACTICAL PAPERS.

1. 'g' by Katers Pendulum
2. Young Modulus by Flexure of beam.
3. Elastic constants by Scarle's method
4. Rigidity modulus by (Barhon's apparatus (ii) Maxwell's model
5. Moment of inertia by - Fly-wheel.
6. Surface tension by Lagger's method
7. Surface tension by method of Ripplets
8. Surface tension by Soap bubble.
9. Viscosity of water by mapillary flow method
10. Viscosity of a air by Rankin's method.
11. Viscosity by Stokes method.
12. Laws of transverse Liberation by Sonometer.
13. Frequency of tunning fork by Meldee's experiment.
14. Viscosity of ultrasonic wave in a liquid.
15. 'Gamma' of gas by constant pressure thermometer.
16. Gamma of liquid by Slinker 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 abonite by Lee's disc method.
21. 'J' hy Joules calorimeter.

B. Sc. Part - II:- PHYSICS (HONOURS)

PAPER – III (Theory)

GROUP – A: Optics

Farmat's Principles mirror and lens formula, Cardinal points of a thick lens and thick lens formula.

Inference phenomena by division of wave front and division of amplitude, Michelson Interferometer Fabry, Fabry-Perot Interferometer LG plate, Echelon Grating.

Diffraction - Fresnel's & Fraunhoffer's diffraction. Half period zones Zone plate. Fresnel's diffraction at straight edge and single narrow wire Fraunhoffer's diffraction at slits and circular aperture. Plane diffraction grating, Concave grating and mounting, Resolving power of prism, telescope and microscope, Cornu's spiral and its use in diffraction problems.

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

GROUP-B: Electromagnetic Theory

Maxwell's field equations, Poynting vector electro-magnetic momentum, Maxwell's stress tension, Pressure of radiation, Plane electromagnetic waves, Reflection and total Internal reflections of polarized light, Double refraction in crystal. Theory of Dispersion, Optical properties of metals and dispersion in metals, Scattering by free and bound charges.

PAPER - IV (Theory)

GROUP-A: Electrostatic Magnetism

Boundary conditions at the surface of separation of two dielectrics and refraction of lines of forces.

Scalar 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 polarization, Relation between D, E & P.

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

GROUP-B: Current electricity

Thermodynamic treatment of seebeck, Peltier and Thompson effect and their applications, Self Inductance and Mutual lndustance. Growth and decay of current in circuits containing L C and R. Simple applications of these circuits. Moving coil galvanometer, aperiodic and balftstic galvanometers. A. C. and A. C. Circuits: Use of vectors and complex number in A. C. circuits 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)

Scherring 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

Measurement of charge by Millkan's method and specific charge of an electron by Thompson's method, Natural radioactivity, Rutherford Soddy's theory of radioactive decay, Geiger Muiller counters, Discovery of Neutrons Isotopes, Artificial Radioactivity, Elementary idea about nucleus and its structure, Nuclear fission Reactors, Astons mass spectrograph, Cyclotron and Betatran.

Photoelectric emission, Einstein Photoelectric equation, Photo conductive and Photo-Voltaic cells.

Compton effect, Bragg's law and determination of X-ray wave length. Cathode 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, Principal components of cosmic rays, Altitude and latitude variation of Cosmic ray, intensity, E. W. Asymmetry, Cosmic ray showers, outline of cascade origin of cosmic rays.

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

PHYSICS PAPER - V

GROUP: A

METHODS OF MATHEMATICAL PHYSICS

Curvilinear co-ordinates, Cartesian spherical-Polar and cylindrical co-ordinates. Orthogonal transformations of co-ordinates, 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 and its solution, Wave equation and its solution. Poisson's equation and its solution.

Function of a complex variable, Cauchy-Rieman equations. Zeroes and poles, Taylor and Lorentz theorems, Cauchy's integral theorem, residue theorem, Integration of complex functions .

GROUP: B

CLASSICAL MECHANICS

H amilton'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, Moment 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 transformations, Contact transformations, Hamilton-Jacobi equation, Action angle variations.

GROUP: C

QUANTUM MECHANICS

Inadequacy of classical mechanics, Dual nature of matter and radiation, De Broglie's relation, Concept of state. 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 problems of free particle, Transmission of particle through potential step, one dimensional Square· and well particle in a box, Linear harmonic oscillator, Rigid rotator, Hydrogen atom.

Commutation rules of orbital angular momentum, their Eigen function Eigen valves, Spin hall angular momentum, Pauli's spin matrices, Pauli's Spinors, Symmetric and anti-symmetric wave function, Pauli's exclusive principle.

PHYSICS PAPER - VI

GROUP: A

STATISTICS PHYSICS

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 Liouvilles theorem. Canonical ensemble and thermodynamics. Energy fluctuations in the canonical ensemble, Density and energy fluctuation in the grand canonical ensemble. Simple application of ensemble theories to perfect gas.

Boltzman distribution, Fermi-Dirac distribution. Bose-Einstein distribution and their simple applications, 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

Thermionics-Richardson's equation and its experimental verification. Child-Langmuir equation. Schottky Effect. Semiconductor Devices, p-n junction and Zener diodes, BJT and FET transistor, Opto-electrical devices, photo-devices, LOR Photovoltaic cell, photo transistor.

CIRCUIT THEORY

Coupled LCR circuits, Superposition theorem, Thevenin and Reciprocity theorems : Maximum power transfer theorem, One port 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 smoothning circuits and voltages 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 LC. (Hartley and Colpitt's) Oscillator, R.C. Oscillator . As able Multivibrator. Principle of amplitude modulation, amplitude modulator, average and envelope detection, Radio receivers, Super heterodyne receivers, Simple idea of transmitter (with block diagram). CRO and its applications . Logic circuits, AND, OR, NANO, NOR operation with the help of simple logic gates.

Types of computers and three basic components. Input and Out-put devices, Concept of hardware and software. BITS and BYTES, Computer programming of some simple mathematical problems, Mathematical problems in BASIC and FORTRAN Languages.

PHYSICS PAPER - VII

GROUP: A

PLASMA AND CLASSICAL ELECTRODYNAMICS

Microscopic and macroscopic properties of Plasma. Plasma oscillations. Debye's potential. Wave propagation in isotropic plasma. Ionospheric reflection, Pinch effect. Alfven wave, Saha's theory of ionization.

Rotarded and advanced potential, Field due to an oscillating current element, Oscillating dipole, Lineard-Wichart potentials. Potential and field due to uniformly moving charge.

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

GROUP: B

SOLID STATE PHYSICS

Elements of crystallography, Bravais lattice, Miller indices, Seven crystal system, simple rystal structure of NaCl, CaCl2 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, Vanderwall's -London interaction and cohesive energy of inert gas crystals. Madelung energy and Madelung constant .

Free electron theory of metals. Heal capacity of electron gas. Electrical conductivity of metals, Boltzman-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, Trans istors, p-n junction rectifier,Half-Effect.

GROUP: C

PHYSICS OF ATOMS, MOLECULES AND NUCLEI

Origin of atomic spectra. Bohr's theory and Bohr-Sommerfield theory of hydrogen atom, spectra of alkali, alkaline and earth metals, Ice section-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 of NMR, ESR Laser spectroscopy .

General properties of nuclear mass, charge, spin, static magnetic moment, size and stability, Nuclear models, Liquid drop model and mass formulae. The Shell model. Classical theory of Rutherford scattering.

PHYSICS PAPER - VIII A

The course shall include the following experiments:

1. Junction diode and zener diode characteristic
2. BJT characteristic.
3. FET characteristic
4. Static Character istics 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 Hartly oscillator.
9. Study of a plane modulated amplifier.
10. Frequency study of a turned R-F amplifier.
11. Sensitivity study of 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 {NAO, NANO, OR, NOR).

PHYSICS PAPER – VIII B

The course shall include the following experiments:

1. Verification of Brewster's law.
2. Verification of Fresnel's laws of reflection and refraction of polarized light.
3. Analysis of elliptical polarized 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.

B. Sc. Part-I PHYSICS (General and Subsidiary Course)

Paper-1 (Theory)

The course shall consists of one theory paper (Paper-1 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-1 of 30 marks). The pass marks will be 12 and examination will be of 5 hours duration-in this paper.

The following be the detailed course.

Time: 3 Hours] PAPER-I (Theory) [Full Marks: 70

(12 question to be set, 6 to be answered, atleast 2 from group-A, one from group-B and atleast 3 from Group-C)

GROUP-A: Relativity, Mechanics, Properties of Matter

4 Questions

Galilean Transformation, Intertial frame of reference, Michelson Morly experiment Lorentz fitzerald contraction. Einstein postulates, Lorentz transformation and its consequences Lenghth contraction and time dilution. Addition of velocities, Relativistic Doppler effect for propagation of light waves, variation of mass with velocity: Mass energy Relation.

Interial and Non-inertial frames of references, Coxioli's and centrifugal forces and their simple application, Motion in central field, Kepler's laws. Generalised co-ordinates, Constraints Holomomic lagiangian co-ordinates, Constraints Holomomic + Non-holonomic lagiangian eq. of motion and their simple applications.

Elasticity and elastic constrants. Relation between elastic constants, Bending of beams and cantilevers. Forsion of vylinder and rigidity modulus by flat spiral spring. Effect of temperature and pressure on elasticity.

Surface tension and surface energy. Ripples and gravity waves, Surface tension by the method of ripples Effect of temperature and pressure of surface tension.

Perfect fluids, equation of continuity, Euler's equation for perfect fluid, Bernullis equation.

Viscosity of liquids, critical velocity, Poiseuille's formulae with correction, Flow of compressible fluid through a narrow tube, Viscosity of gases, Rankin's method. Effect of temperature and pressure on viscousity.

GROUP-B: Waves and Aconstic : 4 Questions

Differential equation of wave, Equation of Progressive waves, Stationary waves, Compression waves in fluids and in extended solids.

Free Damped and forced oscillations Fcurler analysis Vibration of strings Intensity and loundness of sound and their measurements. Accounts of buildings, Ultrasonics

GROUP-C: Thermal Physics : 5 Questions

Maxwell's law of distribution of velocities and its experimental verification. Degrees of freedom and equipartion of energy, Mean free path and its experiment determination. Perfect Gas equation and Vander Waal's Equation of State. Laws of Thermodynamics. Absolute scale of temperature, Carnot's Theorem and Comot's cycle Entropy and its calculation in simple cases, Thermodynamic Relations and their application to simple physical problem, Claussius. Blaperyon equation, Joule Thomson effect Liquification of Gasses with special reference to Helium Superfluidity in liquid Helium.

Kirchoff's laws and black-body radiation, Stefan Boltzmann Law-its equation and experimental verification.

Time: 6 Hours] **PAPER-I (Theory)** **[Full Marks: 30**

The courses shall include the following experiments:

1. Determination of 'g' by Bar pendulum.
2. Determination of Youngs modulus by Flaxure of beam.
3. Rigidity modulus by (i) statical method (ii) dynamical method.
4. Moment of inertia by inertia table and M.I. of Flywheel.
5. Surface tension by jeager's method.
6. Viscosity of liquid by capillary flow method.
7. Viscosity by Stake's method.
8. Determination of 'gamma' by constant pressure thermometer.
9. 'Gamma' of liquid Sinker method.
10. Specific heat of solid with radiation correction.
11. Specific heat of liquid by method of cooling.
12. Thermal conductivity of copper.
13. Thermal conductivity of ebonite by Lee's disc method.
14. 'J' by Joules calorimeter.
15. Frequency of tuning forks by Melee's experiment.

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B. Sc. Part-II PHYSICS (General and Subsidiary Course)

The colirse 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 doubles, Dipole Moment, Dieectric 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 Seebek, Peltier and Thomson effects and the application. Moving cell, a petiodic and ballistic galvanometes, 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 Insotospes, Artificial radioactivity. Elementary ideas about nucleus and structure, Nuclear fission Reactors, Astons mass spectrograph.

Photoelectric omission, Einstein's photoelectric, equation t ion photoelectric, Photo-conductive and photo-voltaic cells.

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

Cathodery 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)

Fermate's principfo, Newton's ring. Micheson's inteferrometer Fresnel's diffraction at straight edge, Frunhoffer's diffraction, single slit, double slit, plane transmission, grating Resolving power of microscope ad telescope, Polarization, production of plane circularly and elliptically polariod lights, Nicol's prism. Quarter waveplate Half shade polarimeter Babinets compensater.

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

PRACTICAL

Time: 6 Hours] **PAPER-II** **[Full Marks: 30**

The course shall include following experiments:

1. Refractive index by Spectometer.
2. Wavelength by Newtons ringh.
3. Wavelength by plane transmission grating.
4. Magnifying Power of microscope.
5. Magnifying power of telescope.
6. Resolivying power of telsescope.
7. Did by (i) Dip circle (ii) Earth's inductor.
8. Fiqure of merit of moving Galvanometer.
9. B.G Constant and Long deecreament.
10. Measurements of low and high resistance.
11. Temperature variation of electrical resistance.
12. Characteristics of value and semiconductor diodes