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**PHYSICS REVISED CURRCULUM FOR B. Sc (PASS)**

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**B. Sc PART-I**

**PAPER-I**

**MECHANICS -1, WAVES AND OPTICS**

**MECHANIC-I**

**VICTOR OPERATION**: Victor in 3 dimensions: introduction; Direction cosines; Spherical polar coordinates; applications; divergence and curl of a vector and gradient of a scalar their physical applications of each type; Divergence and flux of a vector field and line integral (mutual relation): Divergence theorem: Divergence physical importance and applications to specific case. Converting from differential to integral forms; Stokes theorem.

**PARTICLE DYNAMICS**: Frictional forces: microscopic basis of this force; Conical pendulum; the rotor, circular the banked curve; Derivation of kinematic equations x (t), v (t) using integration. Constant and non consonant forces and special examples; derivation of time dependent forces using integration method; Effect of drag forces on motion: Applying Newton’s Laws to obtain V (t) for the case of motion with time dependent drag (various) forces; terminal velocity. Projectile motion / air resistance; non inertial forms and Pseudo forces: Qualitative discussion to develop understanding. Calculation of pseudo forces for simple cases (linearly accelerated references frame). Centrifugal force as an example of pseudo force: Carioles force: Limitation of Newton’s Laws Discussion.

**WORK AND ENERGY**: Work done by a constant force, work done by a variable force (I - dimension) (e.g. vibration of spring obeying Hooks Law); work done by a variable force (II – dimension case): obtaining general expression of force and applying to simple cases e.g. pulling mass at the end of a fixed string against gravity; Work energy Theorem: Qualitative and Derivation using integral calculus. Basis formula; and applications.

**POWER:** Reference frames: Energy changes with respect to observe & different inertial frames.

**CONSERVATION OF ENERGY**: Definitions of Conservative and non – conservative forces and examples; work done in a closed path. One dimensional Conservative system: force as the gradient of potential energy: application to the case a spring and force of gravity: Obtaining velocity on terms of U and E; stable and unstable and neutral equilibrium. Analytic solution for x (t); 2,3 dimensional conservative systems: Change in P.E. for motion in 3-d. force as the gradient of the potential. Work done in 2,3 dimensional motion; Conservation of energy in a system of particles: law of conservation of total energy of an isolated system.

**SYSTEM AND PARTICLES:** Two particles systems and generalization to many particle systems: Centre of mass; Its position velocity and equation of motion; calculation of centre of mass of solid objects using integral calculus. Calculating C.M. of (i) Uniform rod (ii) Cylinder (iii) Sphere; Momentum changes in a system of variable mass: Derivation of basic equation; application to motion of a rocket (determination of its mass as a function of time).

**COLLISION:** Elastic collisions (one dimension); conservation of momentum during collision (Two dimensions- oblique collisions); Inelastic collision in centre of mass reference frame one and two dimensions and applications: obtaining velocities in c. m. frame.

**WAVES AND OSCILLATION**

**Harmonic Oscillation**

Simple harmonic motion oscillation (SHM) obtaining and solving thew basic equations of motion x(l) v(l) energy consideration in SHM application of SHM Torisional oscillator, physical pendulum ,simple pendulum SHM and uniform circular motion , combination of harmonic motions lissajous pattern; equation of damped harmonic motion discussion of its solution equation of forced oscillation , discussion of its solution ,equation of forced oscillation ,discussion of its solution examples of resonance.

**Waves**: Phase velocity of traveling waves sinusoidal waves group speed and dispersion waves speed (Mechanical analysis) wave equation ( Discussion of its solution) Power and intensity in wave motion (derivation and discussion ) Principle of superposition (basic ideas) interference of waves ,standing waves phase changes on reflection natural frequency , resonance.

Sound: Beat phenomenon analytical treatment Doppler effects , Moving source moving observer , both object and source moving.

**Light :**

Nature of light as an electromagnetic waves speed of light in matter physical aspects , path difference ,phase difference etc interference coherence of source , double slit interference analytical treatment adding of electromagnetic waves using phasors interference from thin film Newton’s rings (analytical treatment) ; Michelsons interferometer (Michelson’s interferometer’s use in determining velocity of light ; Fresnel’s biprism and its use ; diffraction ; diffraction at single slit , intensity is single in slit diffraction using phasor treatment and analytical treatment using addition waves double.

**PAPER-II**

**PHYSICS ;312 MECHANICS -II, AND THERMODYNAMIC**

**MECHANIC-II**

**ROTATIONAL DAYANAMICS:** Overview of rotational dynamics: Relationship between linear and angular variables; scalar and vector forms; kinetic energy of rotation; moment of inertia: Parallel axis theorem: Prove and illustrate and apply to simple cases: Determination of moment of inertia of various shapes: Equation of rotational motion and effects of application of torque; Rotational dynamics of rigid bodies. Combines rotational and transitional motion (Rolling without slipping).

**ANGULAR MOMENTUM**: Angular velocity; Definition, conservation of angular momentum effects of torque. Stability of spinning object: Discussion with examples; The spinning top: Effects of torque on the angular momentum, processional motion.

**GRAVITATION:** Review of basic concepts of gravitation; Gravitational effects of spherical mass distribution: Mathematical treatment; Gravitational potential energy: Develop using integration techniques; Calculation of escape velocity; Gravitational field and potential: Develop the idea of field of force; Universal Gravitational law: Motion of planets and Kepler’s law (derivation and explanation). Motion of satellites. Energy considerations in planetary and satellite motion, Qualitative discussion on application of Gravitational law to the galaxy.

**BULK PROPERTIES OF MATTER:** Elastic properties of matter: Physical basis of elasticity. Tension, Compression & shearing Elastic Modulus; Elastic limit; Fluid statics: Variation of pressure in fluid it rest and with height in the atmosphere; Surface tension: Physical basis; role in formation of drop and bubbles; Fluid dynamics: General concepts

of fluid flow streamline and the equation of continuity; Bernoulli’s equation: Derivation and some applications such as dynamics lift thrust on a rocket; Viscosity, physical basis: obtaining the coefficient of viscosity, practical example of viscosity; fluid flow through a cylindrical pipe (Poiseuille’s law).

**SPECIAL THEORY OF RELATIVITY:** Trouble with classical mechanics: Qualitative discussion of the inadequacy of paradoxes in classical ideas of time, length, and velocity; Postulates of relativity: Statements and discussion; The Lorentz transformation inverse transformation: Derivation, Assumptions on which derived; application of the same transformation of velocities; Consequences of Lorentz transformation: Relativity of time: Relativity of length; Relativistic momentum: Derivation Relativistic energy: Derive E=mc2

**THERMODYNAMICS AND STATISTICAL MECHANICS**: Review of concepts: Temperature, Kinetic theory of the ideal gas, work done on an ideal gas; Internal energy of an ideal gas: To include the Equipartition of energy: Intermolecular forces (Qualitative discussion); Van deer Waals equation of state. Statistical Distribution of molecular speeds, distribution of energies: Maxell distribution and mean values Mean free path and microscopic calculation of mean free path; Distribution of molecular speeds, distribution of energies: Maxwell distribution; Maxell – Boltzmann energy distribution; Internal energy of an ideal gas; Brownian motion: Qualitative distribution. Diffusion, conduction and viscosity.

**HEAT**: Review of previous concepts: First law of Thermodynamics, Transfer of heat: First law of thermodynamics and its application to adiabatic, isothermal, cyclic, isothermal, cyclic and free expansion.

**ENTROPY & SECOND LAW OF THERMODYNAMICS:** Reversible and irreversible processes, Second law, Carnot cycle, Carnot engines: Definition, Discussion of heat engines, Refrigerators and second law, Calculation of efficiency of heat engines, Thermodynamic Temperature scales: Absolute zero, negative temperature,

(discussion); Entropy: Entropy in irreversible process, Entropy and second law. Entropy & probability; Low temperature physics: Liquefaction of gases: joule- Thomson Effect.

**Recommended Book:**

R. Resnick, D. Halliday and K.S Krane, Physics Volume I & II, 4th Edition, John Wiley & sons Ins, New York. (1992).

Note: -Recommended pattern of question paper

1. Numerical problems 40%
2. Theoretical questions 40%
3. Conceptual questions 20%

**B.SC PART –II**

PHYS : 410 PAPER –III

**ELECTRICITY, MAGENTISM AND ELECTRONICS**

**ELECTROSTATICS** :Electric charges : (Review of previous concepts ) Conductors . Coulomb’s Law for point charges .vector from of coulomb law. Quantization and conservation of charge (Discussion)

**ELECTRIC FIELD** : field due to a point charge :due to several point charges Electric dipole. Electric field of continuous charge distribution e.g. Ring of charge disc charge infinite line of charge :point charge in an Electric field .Dipole in electric field :Torque on and energy of dipole in uniform field Gauss’s law electric flux :

Gauss’s law (integral and different forms) Applications of Gauss’s law (Integral form ) charged isolated conductors conductor with a cavity ,field near a charged conducting sheet field of infinite line of charge: field on infinite of charge :field on infinite sheet of charge .field of spherical shell. Field of spherical charge distribution .

**ELECTRIC POTENTIAL:** Electric potential potential due to point charge potential due to collection of point charges potential due to dipole electric potential of continues charge distributions electro potential surface collecting the fieldpotential field as the gradient or derivative of potential and field inside and outside an isolated conductor capacitor dielectrics capacitance calculating the electric field in capacitor. Capacitors of various shape etc. energy stored in electric field energy per unit volume: capacitor with dielectric. Electric field of dielectric (1) atomic view (2) application of gauss’s law of capacitor with dielectric.

**ELECTRIC CURRENT: C**urrent density. resistance conductivity (microscope and microscope view of resistively) ohm’s law basic definition analog between current and heat flow. Microscope view ohm’s law energy transfer an electric current semiconductors or supper conductors descriptive giving basic idea.

**DC CURRENT:** Use of Kirchhoff’s 1st and 2nd law calculating the current in a single loop multiple lops; voltages at various elements of the loop; RC circuits: Growth and decay of current in an RC circuit analytical treatment.

**MAGNETIC FIELD EFFECTS:** Magnetic field, B (basic idea)magnetic force on a charged particle magnetic force on a current. Torque on current loop; Magnetic dipole define energy of magnetic dipole in field (discuss quantitatively)

**AMPERE’S LAW :** BIO-SAVART LAW: Analytical treatment and applications to a current loop force on two parallel current changing conductors : Ampere’s law (integral and differential forms ) applications to solenoids and toroids (Integral forms )

FARADAY’S LAW OF ELECTROMMAGETIC INDVTION : Magnetic flux consequences of analysis induced electric fields (calculation and application )E.M.F Quantitative analysis induced electric field (calculation and application) .

**ALTERNATING CURRENT CIRCUIT**: Alternating current in resistive inductive and capacitive elements single loop RLC circuit Analytical expression for the time dependence solution. Graphical analysis, phase angles :power in A.C circuits :power phase angles .RMS values power factor transformer (basic equation )

**ELECTRONICS** : Semiconductor Materials : Idea of enegery bands and energy gaps (Qualitative) P-Type , n-type Materials ; junction diode ; structure , characteristics and application as rectifies; transistor (Basic structure and operation ); Transistor biasing ; Biasing for amplifiers; characteristic of common base common emitter common collector , load line , operating point.

**PHYSICAL ELECTRONICS**:

Special diode ; Zener diode, varactor diodes, light emitting diodes, photo diodes, tunnel diodes.

**INSTRUMENT :**

Oscilloscope, Multimeter , LCR bridge , RC Generator

**Recommended Books:**

**R. Resnick, D. Halliday and K.S Krane , Physics Volume I-II 34th Edition John Wiley & sons Inc ,New York (1992).**

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**B.sc: (Pass) Part-2** **Physics Lab-111**

Electricity, Magnetism and electronics Marks:50 1. Measurement of time constant ( T = CR ) of capacitor ( RC) System and use of the same as differentiator and integrator 2. To study variation of magnetic field produced by a current carrying

( a ) straight conductor

( b ) circular loop as a function of position and current using a search coil and CRO.

3. To study magnetic force between tow current carrying coil .

4. To study the following characteristics in an Acceptor/Rejecter circuit (I ) Frequency response (II) Bandwidth (III) Phase relation ( iv ) Measurement of L.

5. To set up a half wave and full wave rectifier and study the following factors : ( i) smoothing effect of a capacitor . (ii) Ripple factor and its variation with load. (iii) study of regulation of output voltage with load .

6. To set up a single stages transistor amplifier and measure ( I )voltage again (ii) Bandwidth.

7. To set up an oscillator circuits and measure its frequency by an oscilloscope .

8. To set up and study various logic gates ( A ND.OR NAND, etc,) using diode and to develop their truth table .

9. To set up electronic switching circuit using transistor LDR and demonstrate its use as a NOT gate.

10 . Internal resistance of cell by potentiometer.

11. Cerebration of ammeter and voltmeter.

12. Investigation of parallel plate capacitance .

13. Resonance in series LCR circuit.

14. Measurement of B inside a solenoid.

15. To study the B-H curve and measuring the magnetic parameters.

**PAPER-IV Marks :100**

**MODERN PHYSICS AND NUCLEAR PHYSICS**

**QUANTUM PHYSICS :** Thermal radiations (Blackbody radiation )Stefan Boltzman , wien and planck law –consequences Quantization of energy :Quantum numbers : corresponding principle .photoelectric effect : Einstein’s photon theory .Explanation of photoelectric effect : Compton effect (Analytical treatment )line spectra (Quantitative discussion) Explanation using quantum theory .

**WAVE NATURE OF MATTER:** wave behavior of particles (De Broglie’s hypothesis) Testing De-Broglie’s hypothesis: Davisson – Germer Experiment and explanation :Waves : Wave packets and particles : Localization a wave in space and time .

Heisenberg uncertainty principle (HUP) H.U.P For momentum –position and energy –time: H.U.P applied to single slit diffraction: Wave Function: Definition, relation to probability of particle; Schrödinger equation (Without derivation) and applied specific cases e.g. step potentials, and free particle, Barrier, Tunneling (basic idea).

**STATES AND ENERGY LEVELS:** Trapped particles and probability densities particles in a wall, probability density using wave function of status discussion of particles in a well Barrier tunneling; correspondence principles discussion dual nature of matter (waves & particle ) discussion.

**THE ATOMIC STRUCTURE OF HYDROGEN** : Bohar’s Theory : derivation and quantitative discussion; Frank Hertz experiment; energy level of electrons atomic spectrum ; angular momentum of electron (Vector atom model) orbital angular momentum space quantization. orbital angular momentum and magnetism, bohr’s magneton ; electron spin : dipole in non-uniform field stern-Gerlach experiment ,Experimental results.

**ATOMIC PHYSICS:**

x-ray spectrum, continuous and discrete spectrum explanation; X –ray & atomic number development of periodic table; mosely’s law; Pauli exclusion principle and its use in developing the periodic table laser .basic concepts and working of He-Ne laser.

**Nuclear Physics:**

Discovery of nucleus of the Nucleus: Review Rutherford’s experiment and interpretation .some nuclear properties (a) nuclear systematic (Mass no. Atomic No. Isotopes) (b) Nuclear Forces (c) Nuclear magnetism ; law of radioactive decay ;half life , mean life alpha decay basic etc Natural radioactivity (Discussion) radioactive dating Nuclear reaction basic ideas e.g. reaction energy ,Q value exothermic – endothermic (some discussion of reaction energies in the contact of nuclear stationary status)

**ENERGY FROM NUCLEUS :**

Nuclear fusion ,basic process, liquid drop, model , description theory of nuclear fusion nuclear reactor basic principles thermodynamic fusion

(T.N.F) in stars; controlled thermonuclear fusion basic ideas and requirement for TN reactor

**Recommended Books**

R. Resnick, D.Halliday and K.S Krane ‘ Physics’ volume I-& II 4th edition John Wiley & sons Inc New York (1992)

**Note :** Recommended Pattern of Question Paper.

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3. Conceptual questions 20%

**Physics Lab –IV**

**MODERN PHYSICS & NUCLEAR PHYSICS** Marks : 50

1. To study of emission and determination of plank’s constant using a photocell.
2. Determination of e/m of electron.
3. Experiments with Telex meter.
4. Photoconductivity of a photo resistor.
5. Zeeman Effect experiment.
6. Hall Effect experiment.
7. Frank-Hertz experiment.
8. To find the optimum voltage for a GM-counter.
9. Statistical nature of radiation using GM-counter.
10. Determination of absorption coefficient for a B and Y particles in Al.
11. Inverse square law investigation for Y-rays.