

Jankidevi Bajaj College of Science, Wardha (Autonomous)
Syllabus for B. Sc. I (SEM-I) w.e.f. 2017-18
Physics I (BCSPHYT101)

Dt: 17/06/2017

SEM-I (Paper-I) : Elasticity, Viscosity, Surface Tension and Laws of Motion, Mechanics.

Unit – I Elasticity :-

Elasticity and plasticity ; Stress and strain ; Hooke's law ; Definition of three elastic constants, their unit and dimensions, Poisson's ratio ; Relation between elastic constants K, η, Y, σ ; Elastic limit ; Stress and strain Curve ; Work done in stretching a wire ; Bending of beam : Definition of beam, neutral surface, neutral axis, plane of bending ; Internal & External bending moment, condition of equilibrium ; Cantilever : Definition, derive expression for depression of a light beam of rectangular cross section loaded at one end and loaded at centre and support at ends on two knife edge ; Angle of twist and angle of shear, relation between them ; Torque required to twist a cylindrical rod through angle θ , Torsional constant : Torsional Pendulum, time constant of torsional pendulum ; η by torsional pendulum.

Unit – II Viscosity :-

Viscosity : Definition of viscosity, velocity gradient, coefficient of viscosity, Unit & dimensions of η ; Streamline and turbulent flow : Definition of critical velocity, difference between streamline and turbulent flow, Reynolds number, Its physical significance ; equation of continuity $A_1V_1=A_2V_2=\text{const}$; **Bernoulli's Theorem and its application** : State and prove Bernoulli's Theorem ; Applications 1) lift of Aeroplane, 2) Atomizer or Sprayer, 3) Velocity of efflux ; Poiseuille's Equation ; Poiseuille's law, its assumptions ; derivation of Poiseuille's Equation ; corrections to Poiseuille's Equation ; Stoke's law : Derivation of Stokes law by method of dimensions ; Effect of temperature and pressure on viscosity .

Unit – III Surface Tension and Laws of Motion :-

Introduction :- Concept with examples, definition of surface tension, its unit and dimensions, its variation with temperature and impurities.

Angle of contact and wetting :- Definition of angle of contact, characteristics of angle of contact, explain wetting, applications of wetting and not wetting on surface area.

Surface energy :- Definition of surface energy, relation between surface tension and surface energy, surface tension by Jaeger's, Quinck's and capillary rise methods ; Only quantitative discussion of Jaeger's and Quinck's method, details of capillary rise method with derivation of $T = pgrh/2$.

Newton's Law of motion :- Statements of Newton's Law of motion , first law as a special case of second law , law of conservation of linear momentum from Newton's Law of motion , limitations of Newton's Law of motion.

Motion in a Plane :- Only in two dimensions ($V_x = u_x + a_x t$, $x = u_x t + \frac{1}{2} a_x t^2$, $V_x^2 = u_x^2 + 2a_x X$) and ($V_y = u_y + a_y t$, $y = u_y t + \frac{1}{2} a_y t^2$, $V_y^2 = u_y^2 + 2a_y y$)

Component of velocity and acceleration in different co-ordinate system :- Component of velocity in Cartesian co-ordinate system and in spherical polar co-ordinate system ; Components of acceleration in Cartesian co-ordinate system and in spherical polar co-ordinate system.

Centripetal acceleration and Centrifugal Acceleration:- Define and derive an expression for Centripetal acceleration in case of rotating frame of reference, what is Centripetal acceleration and its applications.

Coriolis force and its application :- Concept of Coriolis force and state its applications.

Unit – IV : Mechanics

System of particles , Centre of Mass :- Concept of system of particles and Centre of Mass ; Two particle system (Position vector of Centre of Mass , velocity of Centre of Mass , acceleration of Centre of Mass , Linear momentum of Centre of Mass) ; Many particle system (velocity of Centre of Mass , acceleration of Centre of Mass)

Equation of motion :- Expression for equation of Centre of Mass.

Conservation of linear and angular momentum :- Concept of linear and angular momentum ; Statement and proof laws of Conservation of linear and angular momentum with examples.

Conservation of energy :- Statement and proof for single particles.

Single stage and multistage rockets :- Concept , uses , principle of working , construction of single stage rocket , Limiting value of M_0/M_1 , Limiting exhaust value of jet ; construction of multi stage rocket and its advantage over single stage rocket.

Elastic and inelastic collision :- Concept of collision , type of collision ; Explain perfectly elastic collision in one dimension ; Explain perfectly inelastic collision in one dimension ; Expression for final velocities of two particles performing elastic and inelastic collision , difference cases of elastic collision.

Moment of inertia and their products :- Definition of inertia, moment of inertia , radius of gyration , their units ; Explain product of moment of inertia.

Moment of inertia of cylinder and sphere :- Expression for moment of inertia of a solid cylinder about an axis passing through its centre and perpendicular to its own axis ; Expression for moment of inertia of a hollow cylinder about its own axis ; Expression for moment of inertia of a solid sphere about its diameter.

Parallel and perpendicular axis theorem of moment of inertia :- Expression for moment of inertia about an axis parallel to axis passing through centre of mass ($I_0 = I_C + MR^2$) ; Expression for moment of inertia about an axis perpendicular to plane lamina body ($I_Z = I_X + I_Y$) .

Principle moments and axis :- Concept of principle moments .

SEM-I (Paper-II) : Electrostatics , Dielectric and capacitor , Electromagnetic Inductions, AC Circuit.

Unit – I : Electrostatics

Concept of charge , force between two charges , Coulomb's law in vacuum in vector form , limitations ; Electric potential , electric field intensity due to a point charge ; electric dipole, electric dipole moment , electric field intensity due to electric dipole ; electric field as negative gradient of potential , conservative nature of electric field.

Unit – II : Dielectric and capacitor

Introduction, Definition of polar and non polar molecules ; Polarization of charges in dielectric ; Three electric vectors D, E and P relation between them , Clausius Mossotti equation ; Concept of capacitance , parallel plate capacitor without and with dielectric, application of Gauss' law to parallel plate capacitor.

Unit – III : Electromagnetic Inductions

Electromagnetic Inductions, Faradays law , Lenz's law , self induction and mutual induction , transformer, electric currents and current density , equation of continuity, Kirchoff's laws , rise and decay of current in L-R Circuit , rise and decay of current in C-R Circuit , current in LCR Circuit.

Unit – IV : AC Circuit

Application of complex number in solving an AC circuit , j operation method , AC applied to a pure resistor , pure capacitor and pure inductor circuits , AC applied to series LCR Circuit , power in AC circuit , power factor , AC Bridges, Induction motors.

Seminar Topics :-

Earlier development in physics up to 18th century ; Contribution of Arya Bhatt, Archimedes , Nicolus Copernicus , Galileo Galilei , Huygens , Robert Hooke , Toricelli Vernier Pascal, kepler, Newton , Boyle , Young , Thompson , Coulomb , Ampheres , Gauss , Biot-Savarts, Cavendish , Galvani , Franklin and Bernoulli .

Seminar Topics :-

Bioelectricity : Electricity observed in living systems , origin of bioelectricity , sodium and potassium transport , Resting potential and action potential , Nernst's equation , Conduction velocity , Origin of compound action potential , Neuron structure and function , An axon as cable , Membrane resistance and capacitance.

References :-

1. Introduction to Electrodynamics : David J. Griffiths, 4th Edition , Printice hall.
2. Classical electrodynamics : John David Jackson , John Wiley and sons.
3. Electrodynamics : Emi Cossor & Bassin Lorraine , Asahi Shimdunsha publishing Ltd.
4. Electricity and Magnetism : B. Gosh , Books and allied publisher.
5. From Neurons to Brain : Kuffler and Nicholas , Sinauer Associates , Inc pub. Sunderland, Massschuetts.
6. Physics for Degree Students , C.L.Arora , P.S.Hmme , S. Chand publication.
7. University Physics , Pearson.

LAB – 1

1. To calculate g by compound pendulum.
2. To calculate y by cantilever
3. To calculate y by bending of beam
4. To calculate η by torsional pendulum
5. To calculate η by statical method
6. To calculate surface tension by capillary rise method
7. To study the variation of magnetic field on the axis of circular coil
8. To calculate the unknown inductance using series LR circuit
9. To study the dipole moment of magnet using vibration magnetometer
10. To calculate the magnetic susceptibility of paramagnetic material using Quinke's tube
11. To study the characteristics of a series RC circuit
12. To study the a series LCR circuit and determine its (a) Resonant frequency , (b) Quality factor

Skill Oriented session

- To use a Multimeter for Measuring (a) Resistance (b) AC and DC voltage , (c) DC current , (d) Checking electrical fuses.

► To study the errors in the observation of travelling microscope , vernier caliper , screw gauge .

► Study of graph plot using excel/origin software .

Reference Books

- Advanced Practical Physics for students , B.L.Flint & H.T.Worsnop , Asia Publication House.
 - A text book of Practical Physics , Indu prakash and Ramakrishna , 11th edition , 2011 , Kitab Mahal , New delhi.
 - Engineering Practical Physics , S. Panigrahi & B.Mallick , 2015 , Cengage Learning India Pvt. Ltd.
 - Advanced level Physics Practical , Michael Nelson and Jon M. Ogborn , 4th edition , reprinted 1985 , Heinemann Education Publishers.
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Reference Books :-

1. University Physics : Sears and Zeemansky , XI edition , Pearson education.
2. Concept of Physics : H.C. Verma , Bharati Bhavan Publishers.
3. Problems in Physics : P.K.Shrivastava , Wiley Eastern Ltd.
4. Applied Fluid Mechanics : Mott Robert , Pearson Benjamin Cummir 4th Edition , Pearson Education/Prentice Hall International , New Delhi.
5. Properties of matter : D.S.Mathur , Shamlal charitable trust , New Delhi.
6. Mechanics : D.S.Mathur , S. Chand & company , New Delhi 5.

