RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, JANUARY 2015

FIRST YEAR

Date : 10/01/2015 Time : 11 am - 1 pm

PHYSICS (General)

. Paper: I

Full Marks : 50

[2×10]

[4]

[2]

[1]

[Use a separate Answer Book for each group]

<u>Group – A</u>

(Answer	any	two	questions)
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- a) In case of bending of a beam, what do you mean by neutral plane and bending moment? [1+2]
 b) A cantilever is fixed at one end and loaded at free end. Find the depression of the loaded point. [5]
 - c) A thin wire is fixed at one end 1500 dyne-cm couple of twisting is applied at the other end by which the wire is twisted with 60° angle. Find out the torque for 1 radian twist of the wire. [2]
- 2. a) Explain the difference between streamline and turbulent flow of fluid. [2]
 - b) State and explain Bernoulli's theorem for streamline flow of incompressible and non-viscous fluid. [2]
 - c) Derive Poiseuille's equation for steamline flow of fluid through a narrow tube.
 - d) Water flows through a horizontal tube of length 20 cm and internal radius 0.081 cm under the constant pressure head of water 20 cm high. In 12 minutes 864 cc of water flows through the tube. Calculate the coefficient of viscosity of water. [2]

(Assume density of water = 1 gm/cc acceleration due to gravity $g = 980 \text{ cm/s}^2$)

3. a) Give the molecular theory of surface tension.

a) State Fermat's principle of geometrical optics.

5.

- b) Define surface energy of liquid. Prove that surface energy per unit area is numerically equal to the surface tension of any liquid. [1+3]
- c) State Stoke's law. Find the expression of the terminal velocity of a solid sphere falling under gravity in an infinite liquid. [1+3]
- 4. a) Deduce an expression for the excess pressure inside a soap bubble. [5]
 - b) Define angle of contact.
 - c) Find out the expression for work done in forming a round shaped air bubble at constant temperature. [2]
 - d) The radius of a soap bubble is increased from 1 cm to 2 cm. Find out the amount of work done for the change of the soap bubble. (Given the surface tension of soap water is 36 dyne/cm). [2]

<u>Group – B</u>

(Answer <u>any three</u> questions)

- [3×5]
- b) Establish the laws of refraction at plane surface from Fermat's principle. [4]
- 6. Find the equivalent focal length of two thin lenses separated by a distance.
- 7. a) What is 'Achromatic doublet'?b) An Achromatic converging lens of focal length 30 cm made up by two lenses. The dispersive
- power of the first lens is double of the second one. Calculate the focal length of both the lenses.[3]8. a) Define dispersive power of the material of a prism.[2]
 - b) Calculate the dispersive power of crown glass. [Given $\mu_r = 1.52$ and $\mu_v = 1.53$] [3]
- 9. Compare the working principle of 'Huygen's eye-piece' and 'Ramsden's eye-piece'. [5]

[5] [2]

Group – C (Answer any three questions) [3×5] Find an expression for the velocity of a Simple Harmonic Oscillator. 10. a) [2] A particle executes Simple Harmonic Motion (S.H.M) with a time period of 2 seconds and b) amplitude 5 cm. Find the maximum magnitude of velocity. [2] Velocity of Simple Harmonic Oscillator at any time t leads the displacement by a phase angle $\frac{\pi}{2}$ c) radian. Why? [1] Derive a relation between v (wave velocity) $\frac{dy}{dt}$ (particle velocity) and $\frac{dy}{dx}$ (volumetric 11. a) [3] strain) b) The displacement equation for a transverse plane wave at any instant is $y(x,t) = 0.03 \sin[3\pi t - 0.03\pi x].$ Calculate wavelength, frequency & phase difference between two particles 0.05 meter apart at same instant. x and y are measure in metre and t is secs. [2] Show that the velocity of longitudinal soundwave in solid medium is $\sqrt{\frac{Y}{0}}$. Y = Youngs 12. a) modulus of the material of the medium, $\rho = \text{density of the medium}$] [4] What will be the velocity in case of a gaseous medium? b) [1] 13. a) A system is operated by two Simple Harmonic Motions (S.H.M) $x = a \sin \omega t$ and $y = b \sin(\omega t + \theta)$. Under what conditions the resultant motion will be elliptic and what is the additional requirement for the circular motion? [4] Two mutually perpendicular S.H.Ms are represented by equations $x = 4 \sin \omega t$ and $y = 3 \cos \omega t$. b) Find the semi major and semi minor axis of an ellipse formed by their superpositions. [1] What are the conditions for sustained interference pattern? [2] 14. a) What do you mean by forced vibration and resonance? Give some practical applications of b) resonance. [2+1]

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