RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous Degree College with P.G. Section under University of Calcutta)

B.A./B.SC. SECOND SEMESTER EXAMINATION, MAY 2011

FIRST YEAR

Date : 28/05/2011 **PHYSICS (General)**

Time : 11 am – 1 pm Paper : II Full Marks : 50

Group – A

Answer <u>any two</u> questions :

1. a) Define Young's modulus (Y), Bulk modulus (K) and Poisson's ratio (σ) of an elastic body. From the relation $Y = 3K(1-2\sigma)$ discuss the limiting values of σ. [4]

   b) Show that the moment of torsional couple per unit twist of a solid cylinder is given by $\frac{\eta\pi r^4}{2\ell}$, where symbols have usual meaning. [5]

   c) Find the dimension of Poisson ratio. [1]

2. a) Deduce Poiseuille's equation for flow of a liquid through a narrow tube. [5]

   b) Obtain an expression for critical velocity of a fluid from dimensional homogeneity. [3]

   c) A flat plate of area 20 sq cm is separated from a large plate by a layer of glycerine 2 mm thick. If the coefficient of viscosity of glycerine be 20 poise, what force is required to keep the plate moving with a velocity of 1·5 cm/s. [2]

3. a) Define surface tension of a liquid. Show how it is related to surface energy. [4]

   b) One thousand droplets (each of radius 0·1 mm) of water merge to a single drop. Calculate the energy loss. Given the surface tension of water is 72×1^{-3} Nm^{-1}. [3]

   c) Find an expression for the excess pressure of a spherical soap bubble. [3]

4. a) Define coefficient of viscosity of a liquid. What are the effects of pressure and temperature on the coefficient of viscosity of a liquid? [4]

   b) State the Bernoulli's theorem in hydrodynamics. Write down the relevant mathematical relation. [4]

   c) Why do two ships moving side by side and parallel to each other tend to come closure together? [2]

Group – B

Answer <u>any three</u> questions :

5. Two thin lenses of focal lengths f_1 and f_2 are separated by a distance 'd'. Obtain the expression for equivalent focal length of the combination. [5]

6. State Fermat's principle and establish the laws of refraction in a plane surface separating two transparent media. [5]

7. Find the condition of achromatism of two thin lenses separated by a distance. [5]

8. Mention different types of Seidal aberration. What is spherical aberration? Mention any one condition for minimising this defect. [5]

9. Draw a labelled diagram of Huygen's eyepiece. State the disadvantages of Ramsden eyepiece? [5]

Group – C

Answer any three questions :

10. When two S.H.M of same frequency but of different amplitudes and phases are acting on a particle in two perpendicular directions, show that the path of the resultant motion is elliptic. When will it be a straight line? [5]

11. Derive a general expression for the velocity of longitudinal waves in a gaseous medium. [5]

12. What is Doppler effect? Deduce the expression for the Doppler shift in frequency when both the source of sound and the listener are in motion with different velocities along the same direction in a straight line. [5]

13. What are beats? Show analytically that the number of beats produced per second is equal to the difference of frequencies of the two sounding bodies. [5]

14. What is forced vibration? Write down its differential equation when a periodic external force is applied and explain each term clearly.
    Draw the graph of velocity verses displacement of a particle executing S.H.M. [5]