

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. SECOND SEMESTER EXAMINATION, MAY 2012

FIRST YEAR

PHYSICS (General)

Date : 24/05/2012

Time : 11 am – 1 pm

Paper : II

Full Marks : 50

Group - A

(Answer **any two** questions)

1. a) Establish a relation between Young's modulus (Y), Bulk modulus (K) and Poisson's ratio (σ). Justify any approximation you need to make for this purpose. [3+1]
b) What is a neutral surface in a bent beam? [1]
c) A cylindrical rod of length (l) and radius (r) whose upper end is clamped and an external twist is applied at the other end. Find out an expression for the moment of the restoring couple for the rod. [5]
2. a) Two streamlines can't intersect each other. Justify. [2]
b) Define coefficient of viscosity. What is Poise? [2+1]
c) Write down Bernoulli's equation related to steady flow of an ideal incompressible fluid. Explain each term of the equation. What is the dimension of the constant term on the right hand side of the equation. Name one household article based on Bernoulli's theorem. [3+1+1]
3. a) What do you understand by Newtonian and non-Newtonian fluids? Give examples. [2+1]
b) Water is flowing (streamline) through a narrow horizontal tube of length (l) and radius (R), derive an expression for the velocity of water at any distance (x) from the axis of the tube. Hence find the maximum velocity of the water. [3+1]
c) Define terminal velocity. Write down the Stokes' law in case of falling body through the viscous liquid. [1+2]
4. a) Deduce an expression for the excess pressure over a curved liquid surface. [4]
b) Define angle of contact. [2]
c) A narrow tube of length (l) and radius (r) is dipped vertically in a water-basin. Find out an expression for rise of water in the tube in terms of angle of contact and surface tension of water. [4]

Group - B

(Answer **any three** questions)

5. Show that the resultant motion of the two SHM in same phase and having same frequency at right angles to each other is a straight line.
The velocity of sound in air is 340 m/sec and the density of air is 0.00122 gm/cc, determine the height of mercury column in a barometer if $\gamma = 1.41$. [3+2]
6. a) What is an elastic wave? Give an example. [1+1]
b) Deduce an expression for energy density associated with a progressive wave propagating in an elastic medium. [3]
7. a) What do you mean by damped oscillation? Sketch the displacement-time graph for it. [1+1]
b) If two waves of wavelengths 50 cm and 51 cm produce 4 beats per sec in a gas medium, find the velocity of sound. [2]
c) What do you mean by half-power frequencies? [1]
8. a) Write down an expression for the velocity of a transverse wave in a stretch string. Hence deduce the expression for fundamental frequency of transverse vibration of a stretched string. [1+2]

- b) Two wires of same material and of same diameter have lengths in the ratio 2:3. What should be the ratio of tensions in the strings such that frequency of vibration of the smaller wire is double of that of the longer wire? [2]
9. a) What is Doppler effect in sound? Is it observed in light also? [1+1]
- b) An engine produces a whistle of frequency 500 Hz, as it approaches a cliff with a velocity 5 ft/sec. If the velocity of sound in air is 1100 ft/sec, how many beats of the driver of the engine will hear. [3]

Group - C

(Answer **any three** questions)

10. a) What is optical path? State Fermat's principle regarding propagation of light between two points. [1+2]
- b) Using Fermat's principle show that all the rays passing through one focus of an elliptic reflector will pass through other focus after reflection. [2]
11. a) What are seidal aberrations? [2]
- b) Prove that for minimum spherical aberration the distance d between two lens of focal length f_1 and f_2 will be $f_1 \sim f_2$. [3]
12. a) Define angular dispersion in a prism. [2]
- b) The refractive indices of crown glass for red and blue lights are 1.517 and 1.523 respectively. Find the dispersive power of crown glass for those two colours. [3]
13. Describe the construction, advantages and disadvantages of Huygen's eyepiece? [5]
14. a) Define dispersive power of a transparent medium. What is normal dispersion? [1+1]
- b) A lens of focal length 30 cm is made of a glass of refractive indices 1.5164 and 1.5249 for two lines. Find axial chromatic aberration for these two lines. [3]