

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

FIRST YEAR [2015-18]

B.A./B.Sc. FIRST SEMESTER (July – December) 2015

Mid-Semester Examination, September 2015

Date : 16/09/2015

PHYSICS (General)

Time : 12 noon – 1 pm

Paper : I

Full Marks : 25

[Answer five questions taking at least one from each group]

Group – A

1. a) Explain how a shear may be considered as an elongation in one direction and an equal contraction at right angles, both at 45° to the shear. How is shear strain related to the longitudinal strain? [3]
b) When a wire is stretched, what will be the Poisson's ratio if the change in volume is neglected due to change in length? [2]
2. a) A beam is bent by external forces. Discuss what internal forces come into play and find an expression for the internal bending moment at any transverse section of the beam. [3]
b) What couple must be applied to a wire of 1 metre long, 1mm in diameter in order to twist one end of it, through 90° , the other end remaining fixed. Rigidity of the material of the wire is $2.8 \times 10^{10} \text{ N-m}^2$. [2]
3. a) Distinguish between surface tension and surface energy. [2]
b) Two soap bubbles of radii a and b coalesce to form a single bubble of radius r . If the external pressure is P , prove that the surface tension, T , of the solution from which the bubbles are formed is given by : $T = P(r^3 - a^3 - b^3) / 4(a^2 + b^2 - r^2)$. Assume that the temperature remains constant. [3]

Group – B

4. a) Define optical path length between two points in a medium of refractive index n . [2]
b) State and explain Fermat's principle. [3]
5. Using Fermat's principle establish the Snell's Law of refraction at a spherical surface. [5]
6. Two thin double convex lenses of refractive index $3/2$ are placed in contact and the space between them is filled with water of refractive index $4/3$. What is that focal length of the combination? Assume radius of curvature of each surfaces of the lenses is 24 cm. [5]

Group – C

7. What is resonance? Distinguish between amplitude resonance and velocity resonance. [1+4]
8. What are beats? Give an analytical description of the phenomenon of beats? [1+4]

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