RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2024

FIRST YEAR [BATCH 2023-27]

Date : 29/05/2024 **PHYSICS**

Time : 11 am – 1 pm **Paper : 2PHYCOC1** Full Marks : 50

Answer **any five** questions: [5×10]

1. a) Explain the formation of Newton's rings between the space bound by a plane convex lens rested upon a flat glass surface illuminated by a monochromatic light. Determine the expression for radius of such ring. Is it a pattern of equal inclination or equal thickness? Explain with reason.

   b) In a Newton's rings experiment the diameter of the 15th ring was found to be 0.590 cm and that of the 5th ring was 0.336 cm. If the radius of the plano-convex lens is 100 cm, calculate the wave length of light used. [(2+4+2)+2]

2. a) What are the differences between Fresnel and Fraunhoffer diffraction.
   b) Describe and explain the intensity distribution of Fraunhoffer diffraction pattern obtained with a narrow slit and illuminated by a parallel beam of monochromatic light.
   c) In a Fraunhoffer diffraction pattern due to a slit, the screen is at a distance of 100 cm from the slit and the slit is illuminated by monochromatic light of wave length 5893Å. The width of the slit is 0.1 mm. Calculate the separation between the central maximum and the first secondary minimum. [2+5+3]

3. a) What do you mean by superposition of two waves?
   b) Show by explicit calculations that beats are produced by superposition of two waves having difference in frequencies.
   c) Draw graphically lissajous figure of two mutually perpendicular vibration represented by.
   $x = a\sin 2wt$
   $y = b\sin wt$. [2+4+4]

4. a) What are s and p polarisation? Which component become absent when a light incident obliquely at Brewster's angle at the interface of two media?
   b) Define double refraction. Why does the extra ordinary ray posses such name?
   c) What is Malus law?
   d) What is the optical activity? [(2+1)+(2+1)+2+2]

5. a) What is chromatic aberration? Derive the condition for achromatism in an achromatic doublet. Discuss the validity of the condition for the choice of the lenses.
   b) What do you mean by zone plate? [(2+4+2)+2]

6. a) Derive an equation of wave due to a stretched string and find its general solution.
   b) Write down the statement of Fermat's principle. Establish law of refraction at a plane interface between two media. [(3+3)+(2+2)]

7. a) What are group and phase velocity? Find a relation between group and phase velocity.
   b) For gravity waves in a liquid the phase velocity c depends on the wave length λ according to the formula $c = A\sqrt{\lambda}$, A being a constant. Show that the group velocity is half the phase velocity.
   c) Show that particle velocity is equal to group velocity. [(2+2+2)+2+2]

[P.T.O.]

8. a) For a stretched string of length l mass m and tension T, Find out the expression of fundamental frequency.

b) A stretches string of length l fixed at both ends. The initial displacement of the string in given by

$$y(x,0) = 0 \quad \text{for } 0 < x < l/3$$

$$= \sin\frac{3\pi x}{l} \quad \text{for } l/3 < x < 2l/3$$

$$= 0 \quad \text{for } 2l/3 < x < l$$

The initial velocity is zero at all points. Find the subsequent motion of the string. [3+7]

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