U.G. 2nd Semester Examination - 2021
PHYSICS
[HONOURS]
Course Code : PHY-H-CC-T-04

Full Marks : 20   Time : 1 Hour

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP–A

1. Answer any **five** questions: 1×5=5

    a) State the conditions to be fulfilled for the production of sustained interference fringes.

    b) What are the factors on which the amplitude of light waves from a half-period zone at the point of observation depend?

    c) What is meant by Rayleigh Criterion of resolution?

    d) Write down the difference between progressive and stationary waves.

    e) Why is the base angle of biprism of Fresnel biprism experiment made very small?

    f) What is ideal string?

    g) Explain the rectilinear propagation of light on the basis of wave theory.

    h) Sound emitted from struck string will be richer in harmonics than that of plucked string. Explain.

GROUP–B

2. Answer any **one** question: 5×1=5

    a) i) Obtain the intensity expression for Fraunhofer pattern of a double slit.

        ii) Distinguish between the resolving power and dispersive power of a grating. 3+2

    b) i) Show that the beat frequency is equal to the difference in frequencies of the component oscillations.

        ii) Neglecting the effect of surface and finite depth, the wave velocity of water waves of wavelength (λ) is given by

        $$C_p = \sqrt{\frac{g\lambda}{2\pi}}$$

        Prove that the group velocity is half the wave velocity.   3+2

c) i) Under what conditons circular and straight fringes are produced by Michelson's interferometer.

ii) Explain the colour phenomenon exhibited by thin flims. 2+3

GROUP-C

3. Answer any **one** question: 10×1=10

a) i) Show that the group velocity c_g and phase velocity C are related as

$$c_g = c - \lambda \frac{dc}{d\lambda}$$

where λ is the mean wavelength.

ii) For a stretched string of length l the displacement is given by

$$y(x,t) = \sum_{n=1}^{\infty} c_n \sin \frac{n\pi x}{l} \cos(\omega_n t - \phi_n)$$

where the symbols have their usual significance. Show that the total energy of the string is

$$E = \frac{M}{4} \sum_n \omega_n^2 c_n^2$$

where M is the mass of the string. 2+(4+4)

b) i) Show that the velocity of transverse waves along a stretched string is given by

$$c = \sqrt{\frac{T}{m}}$$

where T is the tension and m is the mass per unit length of the string.

ii) What are Lissajous figures? How can it be demonstrated experimentally? Explain how the pattern changes with time when frequencies of the component oscillations differ slightly. 4+(1+2+3)

c) i) Show that in Young's experiment that in two dimensions the shape of the fringes is hyperbolic. Why these fringes are called non-localized?

ii) A zone plate is constructed so that the radii of the circular zones as the same as the radii of dark Newton's ring formed between a plane surface and plano-convex lens having radius of curvature 2m. Find the principal focal length of the zone plate.

iii) Fraunhofer diffraction pattern is observed by a double slit having slit width a=0.16mm and separation between the slits b=0.8mm. Find the missing orders.

(3+1)+3+3

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