

(4)

Group - C

Answer any **one** of the following questions : $10 \times 1 = 10$

15. (a) Obtain the intensity expression for Fraunhofer diffraction pattern of a single slit. Deduce the condition for the maxima and minima. Find the intensity ratio of first three maxima. $4+2+2$
- (b) What is the difference between a grating spectra and prism spectra? 2
16. (a) What is Rayleigh criterion of Resolution? Derive an expression for the Resolving power of a telescope. Two stars situated at a distance of 9.5×10^{12} km from a telescope of diameter 20 cm are sending light of wavelength 600 nm. Find the distance of separation of the stars for which they are just resolved. $1+3+2$
- (b) Show how circular fringes are produced in a Michelson's interferometer. Show that the radii of circular fringes are proportional to the square root of the natural numbers. 4
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Total Pages : 4

B.Sc/2nd Sem (H)/PHS/24(CBCS)

2024

2nd Semester Examination

PHYSICS (Honours)

Paper : C 4-T

(Waves and Optics)

[CBCS]

Full Marks : 40

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

Answer any **five** of the following questions : $2 \times 5 = 10$

1. N number of springs of spring constants $k_1, k_2, k_3, \dots, k_N$, are attached one after another and the combination hangs vertically. Find the period of oscillation of a mass m attached at the free end of the spring system.
2. Why are the fringes in Newton's Rings arrangement circular and in air-wedge straight and parallel?

P.T.O.

(2)

3. Is conservation of energy violated in interference?
4. A screen is placed at a distance of 60 cm from a circular aperture of 0.6 cm radius. Find the radius of the first half period zone for light of wavelength 6000 Å. How many zones are contained in the circular aperture?
5. If the intensity level of sound is 140 dB relative to the threshold intensity of 10^{-16}W/cm^2 , what is the intensity of the sound in SI units.
6. In what respect does holography differ from ordinary photography?
7. A progressive harmonic wave is represented by $y(x, t) = a \sin(0.5x - 10t)$ where x is in metre and t is in second. Obtain the wave velocity.
8. In Melde's experiment, the number of loops on the string decreases from 5 to 4 when the tension is increased by 45 gm-wt. what was the initial value of the tension?

Group - B

Answer any **four** of the following questions : $5 \times 4 = 20$

9. (a) Show that at velocity resonance, the maximum velocity is inversely proportional to the damping constant and the velocity of the oscillator is in phase with the driving force.
- (b) Why do we prefer a plano-convex lens of large radius of curvature in Newton's Ring Experiment?

3+2

(3)

10. State the conditions to be fulfilled for the production of sustained interference fringe. Why is central fringe in Lloyd's mirror appeared black? 3+2
11. (a) Show that if the screen on which diffraction pattern is obtained due to a narrow circular aperture be moved towards the aperture, the intensity at the centre would be alternatively maximum and minimum.
- (b) What is meant by 'phase reversal zone plate'? Illustrate its utility with example. 3+2
12. Derive the expression for the radius at m^{th} ring of dark and bright. How do you find wavelength of monochromatic light with the help of Newton's ring Expt. 3+2
13. 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 symbols have their usual significance. Show that the total energy of the string is $= \frac{M}{4} \sum_n \omega_n^2 c_n^2$, where M is the mass of the string. 5
14. What is zone plate? How is it constructed? Explain its action as a convex lens. Point out the differences between convex lens and zone plate. 1+1+2+1

P.T.O.