CENTRAL LIBRARY N.C.COLLEGE

2023/TDC(CBCS)/EVEN/SEM/
PHSHCC-202T/002

TDC (CBCS) Even Semester Exam., 2023

PHYSICS

(Honours)

(2nd Semester)

Course No. : PHSHCC-202T

(Waves and Optics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* questions : 2×10=20

1. Define beats. What is the condition for frequency difference between two sound waves to produce beats? 1+1=2

2. What are the differences between a longitudinal and a transverse wave?

3. What is the relation between group velocity and phase velocity?

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4. Show that

$$y = a\sin\frac{2\pi}{\lambda}(ct - x)$$

satisfies wave equation.

5. What modification did Laplace make in Newton's assumption to calculate the velocity of sound correctly?

6. Explain briefly the concept of stationary wave.

7. What is wavefront? Mention three types of wavefront.

8. Mention two factors on which fringe width in Young's double-slit experiment depends.

9. Write down two examples of thin film interference.

10. What is meant by the visibility of fringes in Michelson interferometer?

11. Name the devices or optical elements used to produce interference and diffraction.

12. How is the resolving power of an optical instrument related to aperture of the lens?

13. Discuss similarities between a zone plate and a convex lens.

14. Discuss the difference between interference and diffraction pattern.

15. Write very briefly on hologram.

SECTION—B

Answer any *five* questions : 6×5=30

16. *(a)* Obtain the expression of resultant for superposition of two collinear oscillations with equal frequencies. 3

(b) Resultant of two SHMs at right angle to each other and having equal time periods and unequal amplitudes is given by

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - 2\frac{xy}{ab}\cos\phi = \sin^2\phi$$

Draw diagrams corresponding to

$\phi = 45°$ and $90°$ 3

17. *(a)* Obtain the differential equation of wave motion. 3

(b) Define intensity of a wave. Write down the expression for total energy of a transversely vibrating string. 1½+1½=3

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18. *(a)* Derive the expression for the velocity of transverse vibrations of a stretched string. 3

(b) Explain the differences between progressive and standing waves with examples. 3

19. Consider a stretched string fixed at both ends. Derive the expression for standing wave pattern on the string. Show that both even and odd harmonics are present. 4+2=6

20. Describe the construction and working principles of Fresnel's biprism.

21. Discuss the phenomena of thin film interference pattern in reflected system. Why does an extremely thin film appear black in reflected system? 5+1=6

22. Derive the Fraunhofer diffraction pattern for a single slit. Give expression for the angular position of the first minimum in terms of width of the slit and wavelength of light. 4+2=6

23. Discuss the construction and theory of spectrum formed by a diffraction grating.

24. Give an expression for Fresnel diffraction pattern of a straight edge.

25. Derive the expression for the phase difference between two points in a wavefront due to the presence of a half-period zone. How is it related to the distances of points from the boundary of the zone? 4+2=6

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