

Fourth Semester B.Sc. Degree Examination, September 2020

(Non-CBCS)

Physics

Paper IV (401) - ACOUSTICS, OPTICS AND LASER

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates : Answers should be written completely in English.

PART - A

- I. Answer any **FIVE** of the following questions. Each question carries **6** marks :  
(5 × 6 = 30)
1. (a) What are sound waves?  
(b) Derive an expression for the velocity of transverse waves in stretched string.  
(1 + 5)
2. Explain with necessary theory the Foucault's rotating mirror experiment to determine the velocity of light.  
(6)
3. (a) What are Newton's rings?  
(b) Show that their radii are in the ratio of the square root of natural numbers.  
(1 + 5)
4. (a) Give the theory of Interference at an air wedge by the reflected light system.  
(b) On what principle Michelson's Interferometer works? Mention any one application.  
(4 + 2)
5. (a) What is a zone plate?  
(b) Derive an expression for the focal length of zone plate.  
(1 + 5)
6. (a) Define specific rotation of an optically active substance.  
(b) Describe an experiment to determine the specific rotation of sugar solution using Laurent's half shade polarimeter.  
(1 + 5)
7. Explain how linearly, circularly and elliptically polarised light are produced and detected.  
(6)
8. (a) What is population inversion?  
(b) With a neat diagram explain the construction and working of Ruby Laser.  
(1 + 5)

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**PART – B**

II. Answer any **FOUR** of the following questions. Each question carries **5** marks :

**(4 × 5 = 20)**

9. A man standing between two parallel cliffs, fires a gun. He hears the first echo after two seconds and the next after five seconds. What is the distance between the two cliffs? Velocity of sound in air is 330 m/s.
10. In an experiment with Fresnel's Bi-Prism the fringes are of 0.2 mm thick and are observed 1 m away from the slit. A convex lens introduced between the Bi-Prism and screen gives an image of the source which are separated by 0.7 cm on the screen. If the lens is 30 cm from the slit, find the wavelength of light used.
11. A beam of light of wavelength  $5896 \text{ \AA}$  from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. What is the distance between the first dark fringe on either side of the central bright fringe?
12. If the polarising angle for glass is  $57^\circ$ , what will be the angle of refraction for a ray of light incident at  $49^\circ$  on the glass surface?
13. A 20 cm long tube containing sugar solution rotates the plane of polarisation by  $12^\circ$ . If the specific rotation of sugar is  $0.011 \text{ rad m}^2 \text{ kg}^{-1}$ , calculate the concentration of the solution.
14. The output power of a gas laser is 1 mW. The emitted wavelength being 630 nm. Calculate the number of photons emitted per second.

$$h = 6.625 \times 10^{-34} \text{ JS and } C = 3 \times 10^8 \text{ m/s.}$$

**PART – C**

III. Answer any **FIVE** of the following questions. Each question carries **2** marks :

**(5 × 2 = 10)**

15. (a) Thunder is heard after seeing the flash of light – Explain.
- (b) Bubbles of colourless soap solution appears coloured in sun light, why?
- (c) Diffraction effect is common in sound but not in light waves – Explain.

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- (d) In Young's double slit experiment, when the width of slit becomes very large, what happens to the interference pattern?
- (e) Does the value of polarising angle depend on colour of light? Explain.
- (f) What are Laevo rotatory and Dextro rotatory substances?
- (g) Can we obtain a linearly polarized light with a retarding plate? Justify.
- (h) Expand the term LASER.

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