100917

No. of Printed Pages : 3

GS-298

IV Semester B.Sc. Examination, May/June - 2019
(CBCS) (Freshers+Repeaters) (2017-18 & onwards)

PHYSICS - IV

Optics and Fourier Series

Time : 3 Hours Max. Marks : 70

Instruction : *Answer* ***any five*** *questions from each part.*

PART - A

Answer **any five** questions. Each question carries **eight** marks. **5x8=40**

1. (a) Explain Huygens principle and deduce the law of refraction for a spherical wave on a plane refracting surface. **5+3**

(b) What are coherent sources ? Describe any one method of producing the coherent sources.

2. (a) Obtain an expression for the displacement of fringes when a thin transparent film is introduced in the path of one of the interfering beams in biprism. **4+4**

(b) Write an expression for path difference in the reflected light from the air wedge. Hence derive an expression for fringe width.

3. (a) Explain Fresnel's diffraction at a straight edge and obtain the conditions for secondary maxima and minima. **6+2**

(b) Write any two differences between Fresnel's and Fraunhofer's diffraction.

4. (a) Define resolving power and dispersive power of a grating. **2+6**

(b) Describe with mathematical theory of diffraction grating at minimum deviation.

5. (a) What are retarding plates ? Write the expression for the thickness of quarter wave plate. **2+6**

(b) Explain how retarding plates can be used for the production and detection of circularly, elliptically and plane polarized light.

6. (a) What are spontaneous and stimulated emission of radiation ? **2+3+3**

(b) Write the characteristics of laser.

(c) Mention any three applications of laser.

P.T.O.

2+6

7. (a) State Fourier's theorem.
   (b) Analyse the sawtooth wave using Fourier's theorem.

8. (a) Explain (i)Numerical aperture, (ii) Acceptance angle of an optical fibre.
   (b) Derive an expression for numerical aperture of an optical fibre. 4+4

PART - B

Solve **any five** problems. Each problem carries **four** marks. 5x4=20

9. In the Fresnel's biprism experiment the distance between slit and screen is 0.82m, the wavelength of light used is 650nm and the tringe width is 1.62×10^{-3} m. Find the distance between two virtual sources.

10. Newton's rings are obtained by using monochromatic light of wavelength 600nm. The radius of curvature of the surface of the lens used is 1m. Calculate the diameter of the 10^{th} dark ring.

11. A point source of light of wavelength 589.6 nm in placed at a distance of 1m from zone plate. The image of the source is formed at a distance of 2m on the other side of the zone plate. What is the focal length of the zone plate? Also find the radius of the second zone.

12. A diffraction grating having 450000 lines per metre is illuminated normally by a parallel beam of monochromatic light and second order spectral line is observed to be deviated through 30°. Calculate the wavelength of the spectral line.

13. Calculate the concentration of the sugar solution if the plane of polarization is rotated through an angle of 26.4° while travelling through 0.2m length of the solution. Given specific rotation of sugar solution is 0.011 rad m^2 kg^{-1}.

14. Calculate the energy difference in eV between the two energy levels of the neon atoms of He-Ne gas laser, the transitions between which results in the emission of light of wavelength 630nm. Also calculate the number of photons emitted per second, if the optical power output is 2×10^{-3} w.

15. Prove that Fourier transform of a function $\exp\left(-\frac{t^2}{2}\right)$ is $\sqrt{2\pi}\, e^{\frac{-w^2}{2}}$.

16. An optical fiber has numerical aperture of 0.32. The refractive index of cladding is 1.48. Calculate the refractive index of the core, the acceptance angle of the fiber and the fractional index change.

PART - C

17. Answer **any five** questions. Each question carries **two** marks. **5x2=10**

(a) What type of fringes are observed in a biprism experiment with a white light source ?

(b) Why does an extremely thin film appears dark in reflected light ? Explain.

(c) Why are Fresnel's half period zones so called ? Explain.

(d) When red light is replaced by violet light, how does resolving power of the telescope change ? Explain.

(e) Is the longitudinal wave be polarized ? Explain.

(f) Can a two level system is suitable for lasing ? Explain.

(g) Can Fourier's theorem be used for analysing sound waves ? Explain.

(h) What is meant by pulse dispersion in optical fibres ?

-o0o-