



SA – 626

IV Semester B.Sc. Examination, April/May 2015
(NS) (2012 – 13 & Onwards)
PHYSICS – IV

Physical Optics, Lasers and Fibre Optics

Time : 3 Hours

Max. Marks : 70

Instruction : Answer **any five** questions from Part – A, **five** questions from Part – B and **five** questions from Part – C.

PART – A

Answer **any five** questions. **Each** question carries **eight** marks. (5×8=40)

1. a) State and explain Huygen's principle.
b) Verify the law of reflection for a spherical wave front at a plane surface using Huygen's wave theory. (3+5)
2. a) What are coherent sources ? Mention any two methods of producing coherent sources.
b) Give the theory of Fresnel's biprism and obtain the expression for width of interference fringes. (3+5)
3. a) Distinguish between Fresnel and Fraunhofer diffraction.
b) What is zone plate ? Obtain an expression for focal length of zone plate. (2+6)
4. a) Distinguish between resolving power and dispersive power of grating.
b) Describe the theory of diffraction grating at oblique incidence (minimum deviation). (2+6)
5. a) Explain spontaneous and stimulated emission of radiation.
b) What are the characteristics of lasers ?
c) Mention any three applications of lasers. (2+3+3)

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- 6) a) Derive an expression for the thickness of a quarter wave plate for a light of wavelength λ .
- b) Give the theory of production of circularly and elliptically polarised light. (2+6)
7. a) What is an optical fibre ? Give the principle of optical fibre. Mention any two of its applications.
- b) Explain with diagram :
- i) Acceptance angle
- ii) Numerical aperture. (4+4)
8. a) Explain different types of losses in an optical fibre.
- b) Explain T.E. and T.M. modes in optical fibre. (4+4)

PART – B

Answer **any five** questions. **Each** question carries **four** marks. (5×4=20)

9. When a thin sheet of transparent material of refractive index 1.52 is introduced in the path of one of the interfering beams, the central fringe shifts to a position occupied by the tenth bright fringe. If the wave length of light used is 548.1 nm. Calculate the thickness of the material.
10. In an air wedge experiment a wire of certain thickness is placed at a distance of 40 mm from the edge. Using a light of wavelength 546 nm, 12 fringes are seen in a space of 4 mm. Calculate the thickness of the wire.
11. In a diffraction pattern due to a single slit, the first minimum due to 680 nm coincides with the first maximum due to another of wavelength λ . Find λ .



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12. A light of wavelength 546.1 nm is incident normally on a plane transmission grating. A second order spectral line is observed at an angle of 45° , calculate the grating constant.
13. Determine the concentration of the solution of length 0.2 m which produces an optical rotation of 30° . The specific rotation of the solution is $0.0209 \text{ rad.m}^2/\text{kg}$.
14. Calculate the energy difference in eV between two levels of a gas laser, the transition between which results in the emission of light of wavelength 640 nm. Also calculate the number of photons emitted per second if the optical power output is 2 mW.
15. Find the attenuation in an optical fibre of length 500 m when light signal of power 100 mW emerges out of the fibre with power 90 mW.
16. The angle of acceptance of an optical fibre is 30° when kept in air. Find the angle of acceptance when it is in water of refractive index 1.336.

PART – C

Answer **any five** questions. **Each** question carries **two** marks. **(5×2=10)**

17. a) Can interference fringes be obtained using two independent sources ? Explain.
 - b) What will happen in Newton's rings experiment, if water is introduced between the lens and the plate ?
 - c) It is easy to observe diffraction effect in sound than in light. Explain.
 - d) If the number of rulings in a grating is increased, what is its effect on the resolving power of grating ? Explain.



- e) Can light waves be polarised ? Explain .
- f) Which is the active material in
 - i) Ruby laser and
 - ii) He-Ne laser ?
- g) What is the principle underlying in holography ?
- h) Are fibre optic sensors transducers ? Explain.