

IV Semester B.Sc. Examination, May/June 2014
(Semester Scheme)
(NS) (2012-13 & Onwards)
PHYSICS – IV
Physical Optics, Lasers and Fibre Optics

Time : 3 Hours

Max. Marks : 70

Instruction: Answer **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) Obtain an expression for band width of interference fringes produced by biprism. (3+5)
2. a) Explain any two methods of obtaining coherent sources.
b) Describe with theory the formation of bright and dark interference fringes in the light reflected from a thin film. (2+6)
3. a) Describe how a plane wave front can be divided in to Fresnel's half period zones of radii proportional to square root of natural numbers.
b) Mention any three differences between a zone plate and a convex lens. (5+3)
4. a) Define dispersive power of grating and derive an expression for it.
b) Define resolving power of grating and derive an expression for it. (3+5)

P.T.O.

5. a) What is meant by a retarding plate ?
- b) Give the theory of production of plane polarised, elliptically polarised and circularly polarised lights using retarding plates. (1+7)
6. a) Mention four characteristic properties of laser light.
- b) Describe the construction and working of Helium – Neon Laser, write its energy level diagram also. (2+6)
7. a) Distinguish between a step index monomode fiber and step index multimode fiber.
- b) What is meant by
- i) pulse dispersion
- ii) material dispersion in optical fibers ? On what factors they depend ? (4+4)
8. a) Define :
- i) Mode in fiber
- ii) Cut off wave length
- b) What is attenuation co-efficient ? Write an expression for it.
- c) Explain TE and TM modes in optical fibers. (2+2+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 1.5 is introduced in path of one of interfering beams, the central fringe shifts to a position occupied by seventh bright fringe ? If wave length of light used is 600 nm. Calculate the thickness of transparent sheet.



10. In Newtons rings experiment the diameters of third and ninth rings are 0.3 cm and 0.5 cm respectively. Calculate the diameter of fifteenth ring.
11. In an experiment on diffraction of light at straight edge, the distance between slit and straight edge is 1.5 m and that between straight edge and screen is 3 m. Find the separation between the first and third bright fringes. Given that wave length of light used is 560 nm.
12. A plane transmission grating having 15000 lines per inch produce spectrum at normal incidence. Calculate angular separation between yellow lines of sodium with wave lengths 589 nm and 589.6 nm in second order diffraction.
13. 5 grams of optically active substance is dissolved in 50 ml water, the filtered solution is placed in polarimeter tube of length 20 cm. Calculate the specific rotation of substance. Given that angle of rotation of plane of vibration produced by the solution is 12° .
14. A Laser beam with power per pulse 2 mW lasts 10 ns, contains 7.5×10^7 photons per pulse. Calculate wave length of laser light.
15. Numerical aperture and fractional index difference of an optical fiber are 0.35 and 0.01 respectively. Calculate the refractive index of core and that of cladding.
16. Power of 2 mW laser beam reduces to $15\mu\text{W}$ after traveling through a distance of 25 km in a single mode optical fiber. Calculate attenuation co-efficient.

PART – C

Answer any five questions. Each question carries two marks.

(5×2=10)

17. a) Why does an extremely thin film appears dark in reflected light ? Explain.
b) Why are Newton's rings circular ? Explain.



- c) Why a zone plate exhibit the defect of chromatic aberration ? Explain.
- d) What happen's to diffraction pattern in diffraction of light at single slit experiment, if white light is used as incident light ? Explain.
- e) Why sound waves cannot be polarised and light waves can be polarised ? Explain.
- f) A two level system is not suitable for laser action. Justify.
- g) Why most of optical fiber communication systems operate in 1550 nm. window ? Explain.
- h) What happens if wave guide parameter becomes less than 2.405 ? Explain.