



SM – 349

IV Semester B.Sc. Examination, May/June 2018  
(Repeaters)  
(NS – 2012-2013 and Onwards) (CBCS 15-16 and Onwards)  
PHYSICS – IV  
Physical Optics, Lasers and Fibre Optics

Time : 3 Hours

Max. Marks : 70

**Instruction** : Answer **five** questions from **each** Part. 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 Huyghen's principle.  
b) Verify the law of reflection for spherical wave front at a plane surface using Huyghen's principle. (3+5)
2. a) What are coherent sources ?  
b) Derive an expression for displacement of fringes when a thin sheet of transparent material is introduced in the path of one of interfering waves in biprism experiment. (2+6)
3. a) What is zone plate ? What are positive and negative zone plates ?  
b) Derive an expression for focal length of zoneplate. (3+5)
4. a) Give any two differences between prism spectrum and grating spectrum.  
b) Derive an expression for resolving power of plane transmission grating. (2+6)
5. a) Explain spontaneous and stimulated emission of radiation.  
b) Mention any two properties and two application of laser. (4+4)
6. a) What are retarding plates ?  
b) Give the theory of production of circularly and elliptically polarised light. (2+6)



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7. a) What is an optical fibre ? Explain the principle and working of optical fibre.  
b) What is numerical Operture ? Derive an expression for the same. (4+4)
8. a) Explain TE mode and TM mode in optical fibre.  
b) Explain different types of losses in optical fibre. (4+4)

## PART - B

Solve **any five** problems. **Each** problem carries **four** marks. (5×4=20)

9. The width of the fringes obtained by Biprism using light of wavelength  $5893 \text{ \AA}$  is 2 mm when the screen is placed at distance of 1.5 m. Calculate the distance between the two coherent sources.
10. Calculate the thickness of the thin film of refractive index 1.4 in which interference of violet component ( $\lambda = 4000 \text{ \AA}$ ) of incident light can take place by reflection.
11. A narrow slit illuminated by light of wavelength  $6000 \text{ \AA}$  is placed at a distance of 3 m a straight edge. If the distance between straight edge and screen is 5.8 m. Calculate the distance between first and fifth dark band.
12. What should be the minimum number of lines in a grating to reserve two lines of wavelength  $5890 \text{ \AA}$  and  $5896 \text{ \AA}$  in second order.
13. Calculate the number of photons emitted per second by He-Ne source emitting light of  $6300 \text{ \AA}$  wavelength with an optical power of 10 mW.
14. The optical power after propagating through 500 m long is reduced by 20% of its original value. Calculate the fiber loss in dB/km.
15. A tube 0.2 m long containing sugar solution rotate the plane of polarisation through an angle of  $13^\circ$ . If the specific rotation is  $0.012 \text{ rad m}^2 \text{ kg}^{-1}$ , find the concentration of sugar solution.
16. Refractive indices at core and cladding of step index fibre are 1.55 and 1.5 respectively and its diameter is  $30 \text{ \mu m}$ . Calculate V-number of the fibre if wavelength of light propagating is 900 nm.





PART - C

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

17. a) Does interference light obey's law of conservation energy ? Explain.
- b) The central spot in Newton's rings seen in reflected system is dark. Explain why.
- c) Does we observe diffraction pattern when width of the slit made wide ? Explain.
- d) How does resolving power of telescope can be increased ?
- e) When a beam of light is polarised, does its intensity vary ? Explain.
- f) Is stimulated emission coherent ? Explain.
- g) Does total internal reflection takes place in optical fibre when refractive index of core is less than cladding ? Explain.
- h) Intramodal dispersion is also called as chromatic dispersion. Explain why.

