2018

PHYSICS

(Major)

Paper : 6.3

Full Marks : 60

Time : 3 hours

The figures in the margin indicate full marks for the questions

GROUP—A

(Modern Optics)

(*Marks* : 40)

1. Answer the following questions : 1×4=4

(a) Write the unit of Einstein's coefficient of spontaneous emission.

(b) What is rainbow holography?

(c) In which type of optical fiber the intermodal dispersion is maximum?

(d) Which one moves faster in a negative crystal, E-ray or O-ray?

2. Answer the following questions : 2×3=6

   (a) Write one advantage and one disadvantage of multimode fiber over monomode fiber.

   (b) A Ramsden's eyepiece has been constructed using two plano-convex lenses separated by a distance 4 cm. Calculate the equivalent focal length of the eyepiece.

   (c) What is the difference between spectrograph and spectrometer?

3. Explain the principle of liquid-crystal display. 5

Or

Describe how Wollaston prism is used to separate the plane-polarised O-ray and E-ray. 5

4. Write the basic characteristics of Laser. Explain the working of He-Ne laser. Write the differences between three-level laser and four-level laser. 4+4+2=10

Or

What is second harmonic generation? Show that the field of second harmonic generation becomes maximum at a length.

$$L = \frac{\lambda}{4(\eta_\omega - \eta_{2\omega})}$$

of the medium where η_ω and $\eta_{2\omega}$ are refractive indices at frequencies ω and 2ω. What is phase matching criterion? 2+6+2=10

5. Define acceptance angle and numerical aperture of an optical fiber. Obtain an expression for numerical aperture.

The core and cladding region of an optical fiber have refractive indices 1·5 and 1·4 respectively. If the fiber is emerged in water ($r.i. = 1 \cdot 3$), calculate its acceptance angle and numerical aperture. 2+5+3=10

Or

Explain why two lenses eyepiece is preferred over single lens eyepiece. With neat ray diagram describe the working of Huygen's eyepiece. Can it be used for measurement purpose? Give reasons. 2+6+2=10

6. Write short note on any *one* of the following : 5

(a) Oil-Immersion Objective

(b) Holography

GROUP—B

(Electromagnetic Theory)

(*Marks* : 20)

7. Answer the following questions : 1×3=3

(a) Write the Maxwell's equation which implies the absence of magnetic monopoles.

(b) State Poynting theorem.

(c) For a non-magnetic medium, write the relation between dielectric constant and refractive index.

8. What are circularly and elliptically polarised light? 2

9. Establish the equation of continuity in electromagnetic theory and discuss its significance. 5

Or

Starting from Maxwell's equations, obtain the electromagnetic wave equation. 5

10. Define skin depth. Derive an expression for the skin depth in case of a linear homogeneous isotropic good conducting medium. Show that in such a medium magnetic field and electric field differ in phase by 45°. 1+7+2=10

Or

For an electromagnetic wave with electric vector parallel to the plane of incidence, calculate the reflection coefficient. Hence explain total internal reflection. 7+3=10

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