2 0 1 4

PHYSICS

(Major)

Paper : 6.3

Full Marks : 60

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Modern Optics)

1. Answer the following question/Choose the correct option :   1×4=4

    (a) What is known as cladding of a fibre?

    (b) Huygens' ayepiece consists of two plano-convex lenses of focal lengths

       (i) $3f$ and f, separated by $2f/3$

       (ii) $3f$ and f, separated by $2f$

       (iii) f and f, separated by $3f/2$

       (iv) None of the above

(c) Light amplification by stimulated emission of radiation is known as

    (i) light amplifier

    (ii) maser

    (iii) laser

    (iv) None of the above

(d) Holography was originally an idea of

    (i) Gabor

    (ii) Snitzer

    (iii) Leith

    (iv) Maima

2. (a) What is an eyepiece? Why should it consist of two lenses?

(b) Draw the schematic diagram of propagation of a ray in step index fibre.

(c) Given refractive indices of the core and cladding of an optical fibre to be $n_1 = 1 \cdot 48$ and $n_2 = 1 \cdot 46$ respectively. Obtain the magnitude of the numerical aperture.   2+2+2=6

3. Describe the principle of He-Ne laser.   5

<div align="center">Or</div>

Outline the main characteristics of laser light.

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

(a) Grating spectrograph

(b) Principle of liquid crystal display (LCD)

5. What is holography? Describe the basic principles of construction and reconstruction of holography.   2+4+4=10

<div align="center">Or</div>

Describe the principle and construction of an optical fibre. Obtain the expression for its numerical aperture.   5+5=10

6. Outline the basic characteristics of non-linear optics. Describe its application in self-focussing of light beam and second harmonic generation.   2+4+4=10

<div align="center">Or</div>

Give the construction and the working principle of a Ramsden's eyepiece and find its cardinal points.   5+5=10

2

(Electromagnetic Theory)

7. Answer the following : $1 \times 3 = 3$

(a) State the condition of the field for which the displacement current becomes zero.

(b) Write the expression for speed of electromagnetic waves in free space.

(c) How are electromagnetic waves produced?

8. What oscillates in e.m. waves? Give two examples of e.m. waves.   2

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

Or

State and prove Poynting's theorem.

10. Derive wave equation in a conducting medium from Maxwell's electromagnetic field equation.   10

Or

Assuming the electric vector to lie in the plane of incidence, calculate the reflection coefficient. Hence, prove Brewster's law.

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