2017

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) A measure of the light gathering power of an optical fibre is the

(i) numerical aperture

(ii) acceptance angle

(iii) fractional index change

(iv) None of the above

(b) What would you conclude about the nature of light from polarisation?

(c) What is spontaneous emission of radiation?

(d) Huygens' eyepiece 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

2. Describe the principle and construction of an optical fibre. Obtain the expression for its numerical aperture. 2+3+5=10

Or

(a) What are step-index and graded-index fibres? 5

(b) Discuss in brief about the optical fibre communication system with block diagram. 5

3. What is population inversion? What are different methods of achieving population inversion? Briefly discuss each of these methods. 2+4+4=10

Or

(a) Outline the main characteristics of laser light. 4

(b) Describe the basic principle of a Rube laser. 6

4. What is holography? What is the difference between the holograph and the photograph? Describe the construction of a hologram. 2+4+4=10

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

   (a) Babinet's compensator

   (b) Ramsden's eyepiece

GROUP—B

(Electromagnetic Theory)

(*Marks* : 20)

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

   (a) What is light vector?

   (b) What do you mean by circularly polarised light?

   (c) Give the dimensions of displacement current.

7. Calculate the Poynting vector for a 60 W lamp at a distance of 0·5 m from it. 2

8. Obtain the expression for Brewster's angle characterising the total internal reflection. 5

9. *(a)* Obtain the expression for the energy density of electromagnetic field. 5

(b) Two plane polarised waves are made to superimpose each other. Establish the condition for the resultant polarised waves to be circular. 5

Or

Establish the wave equations governing electromagnetic fields $\vec{E}$ and $\vec{H}$ in free space. 10

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