

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

(3)

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

(4)

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
