Total No. of printed pages = 5

2015

PHYSICS

(Major)

Theory Paper : M-6.3

Full Marks – 60

Time – Three hours

The figures in the margin indicate full marks for the questions.

GROUP – A

(Modern Optics)

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

   (a) Which person / persons was / were the first to develop the flexible fibrescope ?

      (i) Leith and Maiman

      (ii) Gabor

      (iii) Snitzer

      (iv) Hopkins and Kapany

(b) What is off-axis holography ?

(c) The E-ray travels with the same velocity as O-ray

    (i) along the optic axis

    (ii) perpendicular to the optic axis

    (iii) along the principal plane

    (iv) none of these

(d) The ratio of Einstein's A, B coefficients i.e. A_{21}/B_{21} says is proportional to

    (i) ν

    (ii) ν^2

    (iii) ν^3

    (iv) ν^4

2. (a) Why do you need population inversion in a LASER ?

(b) What is the meaning of holography ? Why is it so called ?

(c) Why do we prefer a Ramsden's eyepiece to a Huygens' eyepiece ?　　2+2+2=6

3. Describe the construction of an oil immersion objective.　　5

Or

A Ramsdens' eyepiece is made of two convex lenses each of focal length 2.5 cm and separated by 1.5 cm. Find (i) the equivalent focal length and (ii) the magnifying power for both distinct and normal visions.

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

(a) Ruby Laser

(b) Second Harmonic Generation.

5. Distinguish between spontaneous and stimulated emission of photons. Describe how one can achieve light amplification by stimulated emission. Discuss some applications of LASERS.　　4+4+2=10

Or

How can you get widely separated O-rays and E-rays by using (i) Rochon's prism and (ii) Wollaston's prism ?　　5+5=10

6. (a) Describe different components of an optical fibre.

   (b) Discuss in brief about the optical fibre communication system. 5+5=10

Or

With the help of a neat diagram, give the construction and the working principle of a Huygens' eyepiece. 2+4+4=10

GROUP – B

(Electromagnetic Theory)

7. Answer the following : 1×3=3

   (a) Is displacement current like conduction current, a source of magnetic field ?

   (b) State two characteristics of an electromagnetic wave.

   (c) Can we produce a pure electric or magnetic wave in space ?

8. Calculate the velocity of e.m wave in vacuum. Given, $\mu_O = 4\pi \times 10^{-7}$ Kg. m/C^2, $\epsilon = 1/(36\pi \times 10^9)$ C^{2}S^2/Kg.m^3. 2

9. A plane polarised e.m wave is incident on an interface between two dielectric media. Find the relation between the angles of incidence, reflection and refraction. 5

Or

Write appropriate solution of Maxwell's equations if $\vec{J}(\vec{r},t) = 0$ and the only charge is a point charge fixed at the origin.

10. Define Poynting vector. What does it represent ? Show that the Poynting vector measures the flow of energy per unit area per second in an e.m wave. 2+2+6=10

Or

Deduce Fresnel's laws of reflection and refraction from the electromagnetic theory of light. Show that the Brewster's law is a direct consequence of Fresnel's laws of reflection. 5+5=10