AS—1427

B.Sc. Part—II (Semester—IV) Examination

PHYSICS

(Optics, Laser and Renewable Energy Sources)

Time : Three Hours]   [Maximum Marks : 80

Note :— (1) All questions are compulsory.

(2) Draw neat and well labelled diagrams wherever necessary.

1. (A) Fill in the blanks :

   (i) Power of convex lens is _____ .

   (ii) Quarter wave plate introduces a phase difference of _____ between O-rays and E-rays.

   (iii) The blue colour of the sky is due to _____ of light.

   (iv) Horizontal flow of air is called _____ .   2

   (B) Choose the correct alternatives :

   (i) The diameter of nth bright Newton's ring is proportional to :

   (a) $\sqrt{2n}$ (b) $\sqrt{2n-1}$

   (c) $\sqrt{n}$ (d) $\sqrt{n+1}$

   (ii) Zone plate behaves like a :

   (a) Convex lens   (b) Convex mirror

   (c) Concave lens   (d) Concave mirror

   (iii) In He-Ne laser, mixture of Helium and Neon is in the ratio of about :

   (a) 10 : 1   (b) 1 : 10

   (c) 1 : 1   (d) None of these

(iv) The acceptance angle is maximum if the critical angle is :

    (a) Minimum   (b) Maximum

    (c) Both (a) and (b)   (d) None of these   2

(C) Answer in **one** sentence :

    (i) Define Power of Lens.

    (ii) What is Gratting element ?

    (iii) What is Geothermal Energy ?

    (iv) What is Optical Pumping ?   4

EITHER

2. (a) What are Newton's rings ? Describe an experimental arrangement to obtain the Newton's rings by reflected light.   6

  (b) Derive an expression for n^{th} dark and bright Newton's rings by reflected light.   6

OR

3. (p) Explain the cardial points of a coaxial lens system.   4

  (q) Obtain an expression for path difference in thin film due to reflected light.   6

  (r) Two thin convex lenses of powers 5 diopters and 2 diopters are kept coaxially 10 cm apart. Find the focal length of lens combination.   2

EITHER

4. (a) Describe with necessary theory, the Fraunhofer diffraction due to a double slit.   6

  (b) What is Plane Transmission Grating ?   2

  (c) Describe in detail, how plane transmission grating be used to determine the wavelength of light ?   4

OR

5. (p) Distinguish between Fresnel and Fraunhofer type of diffraction.   3

  (q) Deduce an expression for the resolving power of a plane transmission grating.   6

  (r) Calculate the minimum number of lines in the grating which will just resolve the sodium lines in the first order spectrum. The wavelengths are 5890 Å and 5896 Å.   3

EITHER

6. (a) Explain the phenomenon of double refraction.   2

     (b) What is Half Wave Plate ? Obtain an expression for its thickness.   4

     (c) Explain how Nicol Prism can be used as polarizer and analyser.   6

OR

7. (p) What is Plane Polarised Light ?   2

     (q) Define :

        (i)   Plane of vibration.

        (ii) Plane of polarization.

        (iii) Optic axis.   3

     (r) What are positive and negative crystals ? Give examples.   4

     (s) Calculate the thickness of quarter wave plate. Given $\lambda = 5890\text{Å}$, $\mu_e = 1.553$, $\mu_o = 1.554$.   3

EITHER

8. (a) Explain the main parts of the laser system.   3

     (b) Explain the three level laser system.   4

     (c) Describe the construction and working of Ruby laser.   5

OR

9. (p) State the properties of laser.   2

     (q) What is Pumping ? State different types of pumping.   3

     (r) How laser can be used for recording a hologram ? Explain.   4

     (s) Give any three applications of laser in Industrial Field.   3

EITHER

10. (a) Describe the structure of optical fibre.   3

      (b) How propagation of light takes place in optical fibre ?   3

      (c) Draw a block diagram fibre optical communication system and explain each block.   6

OR

11. (p) Define critical angle and obtain an expression for critical angle. 4

   (q) Calculate the critical angle between the two materials with indices $n_1 = 1.5$ and $n_2 = 1.4$.

                                               2

   (r) What is :

      (i) Step index fibre ?

      (ii) Graded index fibre ? 4

   (s) Give any two applications of optical fibre. 2

EITHER

12. (a) What is Renewable Energy ? 1

   (b) State different types of renewable energy sources with their advantages and limitations. 4

   (c) Describe the solar water heater with natural circulation system. 4

   (d) Explain the geothermal energy. 3

OR

13. (p) Give the construction and working of photovoltaic cell. 4

   (q) Explain ocean energy and hydrogen energy. 5

   (r) Give the names of different storage methods. 3