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

4S—PHYSICS

(Optics, Laser and Renewable Energy Sources)

Time : Three Hours]   [Maximum Marks : 80

N.B. :— (1) **ALL** questions are compulsory.

(2) Draw neat and labelled diagram wherever necessary.

1. (A) Fill in the blanks :

(i) Propagation of light through a fiber core depends on the phenomenon known as ....

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

(iii) The central spot of Newton's ring by reflected light is ....

(iv) In Ruby laser .... pumping is used.   2

(B) Choose correct alternative :

(i) If N be the number of lines per cm, the grating element in cm will be ....

(a) $\dfrac{2.54}{N}$ (b) $\dfrac{N}{2.54}$

(c) N   (d) $\dfrac{1}{N}$

(ii) In quantum optics, light is assumed to consist of ....

(a) Particle or photon   (b) Wave

(c) Ray   (d) Wave and ray

(iii) The S.I. unit of power of radiation is ....

(a) cal/m^2 (b) joule

(c) w/m^2 (d) watts

(iv) A laser beam consists of ....

(a) Light material particles   (b) Electrons

(c) Highly coherent photons   (d) Cosmic rays   2

(C) Answer in one sentence :

(i) What is fiber optics ?

(ii) What is half wave plate ?

(iii) Define diffraction of light.

(iv) What is power of lens ?   4

EITHER

2. (A) Obtain an expression for path difference in reflected light from thin films. Hence also obtain the conditions for bright and dark fringes.   6

   (B) Explain the method to determine the wavelength of monochromatic light by using Newton's rings.   4

   (C) Newton's rings are observed in reflected light of wavelength 5.9×10^{-5} cm. The diameter of the 10th dark ring is 5 mm. Find the radius of curvature of the lens.   2

OR

3. (P) What are focal points ?   2

   (Q) State cardinal points. Explain nodal points and principal points.   4

   (R) Determine the equivalent focal length of two thin co-axial lens of focal length F_1 and F_2 separated by a distance 'a'.   6

EITHER

4. (A) Deduce an expression for the resolving power of a plane transmission grating.   4

   (B) Distinguish between Fresnel and Fraunhofer types of diffraction.   3

   (C) Explain resolving power of optical instrument and explain Rayleigh's criteria of resolution.   5

OR

5. (P) Explain the meaning of half period zones. Why are they so called ?   3

   (Q) Give the elementary theory of plane transmission grating.   6

   (R) Light of wavelength 6250 Å is incident normally on a plane transmission grating. A second order spectral line is observed at an angle of 30°. Calculate the number of lines per cm on the grating surface.   3

EITHER

6. (A) State and explain Brewster's law.   3

   (B) What is quarter wave plate ? Deduce the formula for its thickness.   4

   (C) What are uniaxial and biaxial crystals ? Give one example of each.   3

   (D) What is halfshade polarimeter ?   2

OR

7. (P) Give the theory of production of elliptical and circularly polarised light.   5

   (Q) Explain the phenomenon of double refraction.   3

   (R) Explain how Nicol Prism can be used as a polariser.   4

EITHER

8. (A) Describe the construction and working of ruby laser.   5

   (B) Explain the difference between spontaneous and stimulated emission.   3

   (C) State the medical and industrial applications of laser.   4

OR

9. (P) Explain how laser can be used for recording and reconstruction of an image from holograms.   6

(Q) Explain three level laser system.   4

(R) What are the main characteristics of laser ?   2

EITHER

10. (A) Define :

    (i) Acceptance angle

    (ii) Critical angle.   2

(B) Derive an expression for numerical aperture.   4

(C) Describe fiber optic communication system with block diagram.   6

OR

11. (P) Explain the phenomenon of total internal reflection.   3

(Q) Give the advantages of optical fiber over conventional communication system.   3

(R) Explain the types of optical fiber.   6

EITHER

12. (A) What is renewable energy ?   2

(B) Describe principle, construction and working of a solar cell.   6

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

OR

13. (P) What is fuel cell ?   2

(Q) Describe any two methods to store solar energy.   4

(R) Explain :

    (i) Wind energy

    (ii) Geothermal energy

    (iii) Ocean energy.   6