AT–351

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

4S : 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 : 2

(i) The central spot of Newton's rings by transmitted light is _____ .

(ii) In positive crystals, the velocity of ordinary ray is _____ than the velocity of extraordinary ray.

(iii) In Fraunhofer diffraction the light source and screen are at _____ distance from the obstacle.

(iv) Wind energy is the indirect manifestation of _____ energy.

(B) Choose the correct alternatives : 2

(i) In geometrical optics, light can be considered as :

(a) Photon (b) Wave

(c) Ray (d) None of these

(ii) Bending of light waves around the corners of an opaque obstacle in its path is called as :

(a) Interference (b) Diffraction

(c) Polarization (d) Scattering

(iii) He-Ne gas laser is a :

(a) Two level laser (b) Three level laser

(c) Four level laser (d) None of these

(iv) S.I. unit of radiation is :

(a) $Cal.cm^{-2}.min^{-1}$ (b) Cal

(c) Watt (d) $Watt.m^{-2}$

(C) Answer in one sentence each : 4

(i) What is solar radiation ?

(ii) Define critical angle.

(iii) What is interference of light ?

(iv) What is population inversion ?

EITHER

2. (a) Explain the phenomenon of interference in thin film due to transmitted light. 6

(b) How the Newton's rings can be used to determine the refractive index of a given liquid ? Derive the necessary formula. 6

OR

3. (p) Determine the equivalent focal length of coaxial lens combination. 6

(q) Explain the phenomenon of interference in thin wedge shaped air film by reflected light and obtain an expression for fringe width. 6

EITHER

4. (a) Explain Fresnel and Fraunhofer type of diffraction. 3

(b) Show that the radii of Fresnel's half period zones are directly proportional to the square root of the natural numbers. 5

(c) A plane transmission grating has 15000 lines per inch. Find the wave length of monochromatic light used if the first order maximum is obtained at an angle of 20°. 4

OR

5. (p) Give the construction and elementary theory of plane transmission grating. 6

(q) Explain Rayleigh's criterion for resolution. 3

(r) What is zone plate ? How is it constructed ? 3

EITHER

6. (a) State and prove Brewster's law in polarization. 4

(b) Define :

(i) uniaxial crystal

(ii) biaxial crystal

(iii) optic axis. 3

(c) What is quarter wave plate ? Obtain an expression for thickness of quarter wave plate. 5

OR

7. (p) Explain blue colour of the sky. 3

(q) Explain the theory of production of elliptically and circularly polarized light. 5

(r) Explain construction and working of Nicol prism. 4

EITHER

8. (a) State the characteristics of Laser. 2

(b) Explain population inversion. 2

(c) Describe the construction and working He-Ne laser. 4

(d) Give any two applications of laser medical field. 4

OR

9. (p) Distinguish between ordinary light and laser. 3

(q) Explain spontaneous and stimulated emission of radiations. 3

(r) Explain four level laser system. 4

(s) How is hologram constructed ? 2

EITHER

10. (a) What is total internal reflection ? 2

(b) Derive an expression for numerical aperture of step index fibre. 4

(c) What are different type of losses in optical fibre ? 3

(d) Give any three applications of optical fibre. 3

OR

11. (p) Explain single mode and multi-mode step index fibre. 3

(q) State the advantages of optical fibre communication system over conventional communication system. 3

(r) What is acceptance angle ? Derive an expression for acceptance angle of an optical fibre. 6

EITHER

12. (a) State advantages of hydrogen fuel. 2

(b) Explain solar spectrum. 2

(c) State and explain different types of solar concentrating collectors. 4

(d) Explain solar PV panels. 4

OR

13. (p) What is biomass ? 2

(q) State non-renewable energy sources. 2

(r) State the properties of solar storage material. 4

(s) State various factors affecting the availability of solar radiation on earth's surface. 4