39

M 7580

Reg. No. : .....

Name : .....

III Semester B.Sc. Degree (CCSS – Reg./Supple./Imp.) Examination, November 2014

COMPLEMENTARY COURSE IN PHYSICS

3C03 PHY : Optics

Time : 3 Hours Max. Weightage : 30

***Instructions** : Answer **all** questions from Section – **A**, **any 6** questions from Section – **B**, **Any 9** questions from Section – **C** and **any 1** questions from Section – **D**.*

SECTION – A

Choose the correct answer. **Each** bunch of questions carries a weightage of **1** :

1. i. Colours of thin films can be attributed to _____

   a) Polarization b) Diffraction

   c) Dispersion d) Interference

   ii. Newton's rings are fringes of equal _____

   a) Inclination b) Thickness

   c) Diameter d) Intensity

   iii. Phenomenon in which source and screen are at infinite distance from the aperture is called _____

   a) Fraunhofer's diffraction b) Fresnels diffraction

   c) Half period zones d) None of these

   iv. Which of the following is a positive crystal ?

   a) Quartz b) Calcite

   c) Sliced crystal d) Liquid crystal

P.T.O.

2. i. Choose the expression for specific rotation when the length of the optically active solution is expressed in centimeter

a) $\frac{10\theta}{lc}$ b) $\frac{\theta}{lc}$

c) $\frac{lc}{\theta}$ d) None of these

ii. Raman effect is also called _____ scattering.

a) Coherent b) Rayleigh

c) Incoherent d) Alpha scattering

iii. What is the radius of the 1st half period zone if a parallel beam of light ($\lambda = 0.5\,\mu$ m) falls on a circular opening and is received on a screen at 20 cm away.

a) 0.2 m b) 0.314 μm

c) 0.1 μm d) 3.16 m

iv. Dispersion in optical fibres is associated with _____

a) Cladding b) Pulse width

c) Microbends d) Material loss **(2×1=2)**

SECTION – B

Answer **any six** questions. **Each** carries **a** weightage of **1** :

3. Distinguish between diffraction and interference phenomena.

4. Give the conditions for maxima and minima for a monochromatic light reflected at nearly normal incidence from a thin soap film.

5. Find the half angular width of the central bright maximum in the Fraunhofer diffraction pattern of a single slit of width 12×10^{-5} cm, when the slit is illuminated by a monochromatic light of wavelength 6000 A°.

6. How ordinary ray and extraordinary rays are produced ? In a calcite crystal which ray travels faster ?

7. Define optical activity. Give an example of dextro-rotatory substance.

8. Briefly describe the principle of Laser. What is optical pumping ?
9. Give the necessary conditions for the incident light to be totally internally reflected back.
10. Find the numerical aperture and half acceptance angle in a step index fibre. Given core index $n_1 = 1.45$ and cladding index $n_2 = 1.41$. **(6×1=6)**

SECTION – C

Answer **any nine** questions. **Each** carries **a** weightage of **2.**

11. A parallel beam of light ($\lambda = 5890A°$) is incident on a thin glass plate ($\mu=1.5$) such that the angle of refraction is 60°. Calculate the smallest thickness of the plate which will appear dark by reflection.
12. Show that the diameters of Newton's rings decrease with a liquid film between the glass plate and the lens compared to those formed an air film.
13. In a Newton's rings experiment the diameters of the 15^{th} ring and 5^{th} ring were 0.590 cm and 0.336 cm. If the radius of the plano-convex lens is 100 cm, calculate the wavelength of the light used.
14. Show that the area of Fresnel's half period zones is a constant.
15. Find the radius of the first half period zone on a zone plate behaving like a convex lens of focal length 60 cm. Given $\lambda = 6000$ A°.
16. Compare the spectra obtained using a prism and diffraction grating.
17. How will you distinguish between a quarter wave plate and a half wave plate by allowing plane polarized light to fall normally on them ?
18. Calculate the thicknesses of a (i) quarter wave plate and (ii) half wave plate. Given $\mu_E = 1.553$, $\mu_O = 1.544$ and $\lambda = 5000$ A°.
19. Write a note on the semiconductor laser by drawing the schematic of the basic structure of a p-n junction laser.
20. Explain the Einstein's coefficients for induced absorption and stimulated emission.

21. Explain Raman lines on the basis of quantum theory of Raman effect.

22. Define acceptance angle in for the propagation of light in optical fibres. How it is related to numerical aperture.

(9×2=18)

SECTION – D

Answer **any one** question. **Each** carries **a** weightage of **4**.

23. a) Discuss the theory and experimental set up for Newton's rings to get conditions of dark and bright rings.

    b) Show that the diameters of successive dark rings are proportional to the square roots of natural numbers for air film between glass plate and lens.

24. a) Discuss the dispersions in optical fibres.

    b) A train of light pulse is transmitted through a 500 m fibre with n1 = 1.4 and n2 = 1.35. Find the total dispersion assuming input pulse of zero line width.

(1×4=4)
