13MY 44 – IV (28)

B.Sc. IV Semester Degree Examination, May 2013
PHYSICS
Paper – 4.1 : Physical Optics and Electricity

Time : 3 Hours Max. Marks : 80

Instructions : *1) Section **I** is **compulsory.***

*2) Answer **any four** questions from Section **II** and **four** questions from Section **III.***

SECTION – I

1. Answer **any twelve** of the following : **(12×1=12)**

A) Choose the correct answer :

i) Huygen's wave theory failed to explain
   a) Reflection
   b) Refraction
   c) Simultaneous reflection and refraction
   d) Polarisation

ii) In Fraunhofer diffraction, the incident and diffracted wave front
   a) Plane b) Spherical
   c) Cylindrical d) None

iii) O-ray in calcite crystal Obey's the law of
   a) Reflection b) Refraction
   c) Any one d) None of these

iv) In a resonant series LCR circuit
   a) The power factor is zero
   b) The power factor is maximum and is equal to 1
   c) The power factor is minimum and is zero
   d) The power factor is ∞

P.T.O.

B) Fill in the blanks :

i) If the path difference between two waves is λ/f, the corresponding phase difference is _____

ii) If an elliptically polarised light is passed through a quarter wave plate, it is converted into _____ polarised light.

iii) The grating constant is given by the distance _____

iv) In a pure capacitor, the current _____ emf by $\frac{\pi}{2}$.

C) State **true** or **false :**

i) When plane wave front is incident on reflecting surface. The reflected wavefront is spherical.

ii) The focal length of a zone plate is $\frac{1}{f} = \frac{n\lambda}{r^2}$.

iii) In CRD y – plate move the beam sideways.

D) Answer the following in **one** or **two** sentences :

i) Write the relation between phase difference and path difference.

ii) What are Newton's rings ?

iii) What is electrical resonance ?

iv) Define power factor.

SECTION – II **(4×4=16)**

2. Give assumptions of wave theory of light.

3. Explain conditions for constructive and destructive interference in thin films due to reflected light.

4. Distinguish between Fresnel and Fraunhofer diffraction.

5. What is quarter wave plate ? Compute the thickness of quarter wave plate and mention its application.

6. Obtain expression for band width of LCR series resonant circuit.

7. Distinguish between series and parallel resonant circuit.

SECTION – III

8. a) Describe in detail an experiment to determine the wavelength of monochromatic light with Fresnel's biprism.

   b) Interference fringes formed on a screen 1.2 m from a double slit of width 0.45 mm are measured to be 1.5 mm apart. Find the wavelength of the light used. **(9+4)**

9. a) What is zone plate ? Explain its construction and working. Compute it with a lens.

   b) In a plane diffraction grating, the angle of diffraction for the second order principle maximum for the wavelength 6000 Å is 20°, calculate the number of lines in one centimetre of the grating surface. **(9+4)**

10. a) Give the theory of Newton's rings and hence determine λ of monochromatic light.

    b) Newton's rings are observed in reflected light of $\lambda = 5.9\times10^{-7}$ m. The diameter of the 12th dark ring is 0.5×10^{-2} m. Find the radius of curvature of the lens and the thickness of the air film. **(9+4)**

11. a) What is optical activity ? Explain Fresnel's theory of optical rotation.

    b) Specific rotation of sugar solution is 0.01 rad $m^2 kg^{-1}$. A sugar solution of length 0.2 m produces an optical rotation of 25°. Calculate the mass of sugar dissolved in 100CC of water to make the solution. **(9+4)**

12. a) Describe Anderson's bridge experiment to determine the value of self-inductance with necessary theory.

    b) Derive an expression current and impedance when an alternating emf is applied to series LCR circuit. **(6+7)**

13. a) What is low pass filter ? Explain the frequency response RL and RC low pass filter and hence obtain expression for cut-off frequency.

    b) A resistance of 10 ohm and inductance of 0.1 henry are connected in parallel with a capacitance of 10^{-4} farad. Calculate the frequency at which the current is minimum. **(9+4)**
