B.Sc. IV Semester Degree Examination, April/May - 2019

PHYSICS

Physical Optics and Electricity

PAPER - 4.1

Time : 3 Hours

Maximum Marks :80

Instructions to Candidates:

1. Section -I is compulsory

2. Answer any four questions each from Section -II and from Section - III

SECTION - I

(12×1=12)

1. Answer any twelve of the following:

  A. Choose the correct answer:

    i) Corpuscular theory of light explains the phenomena of

      a) Interference
      b) Diffraction
      c) Polarisation
      d) None of the above

    ii) Area of half period zone is

      a) Independent of order of zone
      b) Depends on order of zone
      c) Depends on wavelength of light
      d) Both (a) and (c)

    iii) In case of positive crystals

      a) $\mu_e > \mu_o$
      b) $\mu_e < \mu_o$
      c) $\mu_e = \mu_o$
      d) None of these

    iv) Resonance in LCR series occurs when natural frequency

      a) Is equal to applied frequency

      b) Is greater than applied frequency

      c) Is less than applied frequency

      d) None of the above

[P.T.O.

B. Fill in the blanks:

i) If the path difference between two waves is $\lambda/4$, the corresponding phase difference is ----------

ii) In Fraunhoffer diffraction, the source and screen are effectively at ---------- distance from aperture.

iii) In L-R circuit current ----------- the applied emf.

iv) Optical activity of a substance is measured by its -------------

C. State True or False:

i) LCR series circuit is called rejector circuit.

ii) Zone plate has single focal length.

iii) Coherent sources can be obtained from a single source.

D. Answer in one or two sentences:

i) Define interference of light.

ii) What is uniaxial crystal?

iii) Define rms value of ac current.

iv) What is band width?

SECTION -II

$(4 \times 4 = 16)$

2. Write a note on wave theory of light.

3. Explain in brief Young's double slit experiment.

4. Prove that resultant amplitude at a point due to a wave front is equal to half of the amplitude due to first half period zone.

5. Give the differences between half wave plate and quarter wave plate.

6. Obtain an expression for efficiency of a full wave rectifier.

7. Describe how time period and voltage are measured using CRO.

SECTION -III

(4×13=52)

8. a) Give the theory of interference by Fresnel's biprism and obtain an expression for fringe width.

   b) A parallel beam of light of wave length 6000×10^{-10} m is incident on thin transparent film of refractive index 1.5 such that the angle of refraction is $45°$ in the film. Calculate the smallest thickness of the film which will appear dark by reflection.

   (9+4)

9. a) Give the theory of interference in wedge shaped thin film and explain why broad source is necessary to observe interference in thin film.

   b) When a movable mirror of Michelson's interferometer is shifted through 0.0589mm, a shift of 200 fringes is observed. What is the wavelength of light used? (9+4)

10. a) What is zone plate? Give the theory of zone plate and obtain an expression for primary focal length of zone plate.

    b) A parallel beam of light is normally incident upon a plane diffraction grating having 14500 lines per inch. The first order spectrum of two bright lines are at a deviation of $19°39'$ and $19°40'30"$. Calculate the difference in their wavelength.

    (9+4)

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

    b) Calculate the thickness of doubly refracting crystal required to introduce a path difference of $\lambda/2$ between the ordinary ray and extraordinary ray when $\lambda = 6000 A°$, $\mu_o = 1.55$, $\mu_e = 1.54$.

    (9+4)

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

    b) Give the comparison between LCR series and parallel resonance circuit. (9+4)

13. a) Derive an expression for current, impedance and resonant frequency when an alternating emf is applied to LCR parallel circuit.

   b) An inductance of 10H is connected in series with a resistance of 50Ω to a 220v, 50Hz ac source. Calculate the value of the capacitor to be connected in series to make the power factor unity.

   (9+4)