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B.Sc. Fourth Semester Degree Examination, May/June 2017

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 **each** from Section – II and from Section – III.

SECTION – I

1. Answer **any twelve** of the following :

A) Choose the correct answer :

(12×1=12)

i) Rest mass of photon is

a) Zero

b) Infinity

c) 9.1×10^{-31} kgd) 1.6×10^{-19} kg

ii) Interference at wedge shaped film is due to

a) Division of amplitude

b) Division of wavefront

c) Sometimes (a) and Sometimes (b)

d) Neither (a) nor (b)

iii) In diffraction at a thin wire the fringes are observed

a) Outside the geometrical shadow

b) Partly in shadow partly outside

c) Within geometrical shadow

d) In the illuminated portion

iv) At resonance in series LCR circuit, the circuit is

a) Purely resistive

b) Purely capacitive

c) Purely inductive

d) None of these

P.T.O.



- B) Fill in the blanks :
- Quantum nature of light is not supported by the phenomenon of _____
 - The fringe width in diffraction phenomenon are _____
 - _____ is a Uniaxial crystal.
 - In LR series circuit current _____ the applied voltage by $\pi/2$.
- C) State **true** or **false** :
- When plane wavefront is incident on refracting surface, the refracted wavefront is spherical.
 - In interference pattern the fringe width remains the same.
 - A.C.R.O. measures AC/DC voltage and period.
- D) Answer the following in **one** or **two** sentences :
- Write the relation between phase difference and path difference.
 - Define resolving power of a grating.
 - What is Band Pass Filter ?
 - What is a C.R.O. ?

SECTION – II

- Define group velocity and wave velocity. Write the relation between them. (4×4=16)
- State the conditions for sustained interference.
- What is zone plate ? Explain the construction of zone plate.
- Derive an expression for the impedance in a series CR circuit.
- Derive an expression for power in an electrical circuit.
- Describe how voltage and frequency are measured using C.R.O.

SECTION – III

- Give the theory of interference phenomenon and hence obtain an expression for fringe width. 9
 - 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 light used. 4



9. a) Discuss the Fraunhofer diffraction due to single slit and also discuss the intensity distribution on the screen. 9
- b) Find the angular width of full central maximum in the Fraunhofer diffraction of a slit of width 1.1×10^{-6} m when the slit is illuminated by a light of wavelength 5500 Å. 4
10. a) What is optical activity ? Explain Fresnel's theory of optical rotation. 9
- b) Specific rotation of sugar solution is $0.01 \text{ rad m}^2 \text{ kg}^{-1}$. A sugar solution of 0.2 m length produces an optical rotation of 25° . Calculate the mass of sugar dissolved in 100 c.c. of water to make the solution. 4
11. a) Describe Anderson's bridge experiment to determine the value of self inductance with necessary theory. 9
- b) An alternating current of e.m.f. 110 V, 50 Hz is applied to a circuit which contains an inductance of 0.02 henry and a resistance of 10 ohm in series. Determine the current and the phase lag. 4
12. a) What is a rectifier ? Describe with neat circuit diagram the construction and working of a full wave rectifier. Also determine its ripple factor and efficiency. 9
- b) The instantaneous value of a.c. voltage applied to a full wave rectifier having load resistance 5000Ω and resistance of each diode 400Ω is $e = 200 \sin (100 \pi t)$. Calculate the ripple factor and efficiency of a rectifier. 4
13. a) Describe a cathode ray tube and derive an expression for the electrostatic deflection sensitivity. 9
- b) Calculate the cut off frequency in case of R.C. low pass filter circuit when the resistance is 1000Ω and capacitance is $0.1 \mu \text{F}$. 4
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