Section – C

Q-5. (a) A light of wavelength 500 nm falls normally on a single slit of width 0.10 mm. What would be (i) the total angular width of the central maximum and (ii) the linear width as observed on a screen placed 1.2 m away. (10)

(b) Sodium light falls on a plane transmission grating having 450 lines/cm and width of the grating surface as 2.0 cm. Examine if two spectral lines of sodium light of wavelengths 589.0 nm and 589.6 nm can be distinctly resolved in the (i) first order and (ii) second order by this grating. (10)

Q-6. (a) A phase retardation plate of quartz has thickness of 0.0124 cm, with n_o=1.544 and n_c = 1.553. Calculate the wavelengths in the visible region for which it will act as (i) quarter wave plate and (ii) half wave plate. (12)

(b) A sugar solution in a tube of length 2.0 dm produces optical relation of 12^o. Then the sugar solution is diluted to one-half of its initial concentration. What will be the optical rotation produced by 3.0 dm long tube if the dilute solution is contained in it? (8)

Q-7. (a) Calculate the coherence length of a light beam for which the band width is 10^{10}Hz. What is the degree of non-monochromaticity for wavelength of 450nm? (7)

(b) What will be the refractive indices of the core and cladding material of an optical fibres if its numerical aperture is 0.22 and fractional refractive index is 0.012? (6)

(c) You have beam given two optical fibres A and B. The refractive indices of the core and cladding material for A are 1.52; 1.41 and those for B are 1.53; 1.39 respectively which of the two optical fibres will have higher light gathering power? (7)

Q-8. (a) An isotropic material of relative permittivity ε_r is placed normal to uniform external electric field with an electric displacement vector $5x10^{-4}$ units. If the volume of the dielectric slab is 0.5 m^3 and the magnitude of the polarization is $4x10^{-4}$ units, calculate the value of ε_r and the total dipole moment of the slab. (7)

(b) The dielectric constant of helium at 0^oC and 1 atm pressure is 1.000074. Calculate the dipole moment induced in each helium atom when the gas is in an electric field intersity of 100V/m.

Given $\varepsilon_o = 8.85x10^{-12}$ F/m and $N_A = 6.023x10^{23}$ atoms/ mole. (7)

(c) In plane electromagnetic wave, the electric field oscillates at a frequency of $3x10^{11}$Hz and amplitude 50 V/m. Calculate the (i) wavelength of the wave and (ii) amplitude of the oscillating magnetic field. (6)

Roll No. ……..

Lingaya's University, Faridabad
B.Tech (Term – II)
Examination – January, 2010
Physics
Paper: PH-101

Time: 3 Hours] **[Max. Marks: 100**

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after the examination.

Note: *All questions carry equal marks. Attempt five questions. Question 1 is compulsory . Select two questions from Section B & Two from Section C.*

Section – A

Q-I Part A

Select the correct answer of the following multiple choice questions.

(i) Which of the following phenomena of light attributes to the bright colours of the 'eye' of the peacock's tail feathers?

(a) Scattering (b) Diffraction (c) Dispersion (d) Interference

(ii) Two sources of light are coherent if they have

(a) same amplitude (b) same wavelength (c) same amplitude and wavelength (d) same frequencies and constant phase difference

(iii) On increasing gradually the distance between the slits in Fresnel's biprism experiment, the fringe width of interference pattern.

(a) remain the same (b) Increases
(c) decreases (d) first increases and then decreases

(iv) When a liquid is introduced between the convex les and the plane glass plate in Newton's rings experiment the rings

(a) elongate (b) contract (c) first elongate and then contract (d) first contract and then elongate

(v) Circular patches often observed on the ground when sunlight filters through the leaves of the tree arise due to

(a) Interference (b) Diffraction (c) Polarization (d) Scattering

(vi) A single slit, having width a is illuminated by light of wavelength λ. The angular separation between central maxima and the first minima in the diffraction pattern is

(a) λ a (b) λ/a (c) λ/2a (d) λ/4a

(vii) The dispersive power of a plane diffraction grating increases with increasing

(a) number of lines/cm on the grating only (b) grating element
(c) order of the spectrum only (c) both order of the spectrum and number of lines/cm on the grating.

(viii) Which of the following establishes the transverse nature of light waves?

(a) Photo electric effect (b) Diffraction (c) Polarization (d) Compton effect

(ix) When an ordering beam of light is passed through a calcite crystal, the refracted light splits into two rays (O-ray and E-ray). Which of the following statements is true?

(a) only E-ray is polarized (b) only O –ray is polarized (c) Both E-and O-rays are polarized (d) Neither E-rays nor O-rays is polarized

(x) When a beam of ordinary light is incident on a glass plate at polarizing angle, the reflected and refracted beams are

(a) inclined at 60^o (b) inclined at 45^o

(c) perpendicular to each other (d) Parallel to each other

(xi) Population inversion in laser action implies that

(a) population of the lower energy level is maximum

(b) Population of lower energy level is more than that of the upper energy level.

(c) Population of the upper energy level is more than that of the lower energy level.

(d) Population of the ionized state is maximum.

(xii) The optical – fibre communication make use of

(a) Interference (b) Polarisation
(c) Reflection (d) Total internal reflection

(xiii) The ratio of the electric and magnetic field vectors has the same dimensions as that of

(a) Inductance (b) Permittivity (c) Resistance (d) Capacitance

(xiv) The equation of continuity represents the law of conservation of

(a) mass (b) charge (c) energy (d) momentum

(xv) Which of the following substances behaves as a dielectric?

(a) Tungsten (b) Germanium (c) Mica (d) Copper

(xvi) Dielectric loss may occur due to

(a) Ionisation (b) Polarisation (c) Resistivity (d) radioactinvity

(xvii) An inertial frame is

(a) Decelerated (b) Accelerated
(c) moving with uniform velocity or at rest (d) either decelerated or accelerated

(xviii) A metre rod moves along the length with a relativistic velocity, it appears to be

(a) contracted along its length (b) elongated along its length
(c) contracted in all directions (d) elongated perpendicular to its length

(xix) The (unifield) atomic mass unit (u) is related to energy (in MeV) as

(a) 1u=931.5 MeV (b) 1u = 93.1 MeV

(c) 1u = 931.5 MeV/(c^2) (d) 1u = 9.31 MeV

(xx) Which of the following materials is used for the production of ultrasonic waves by magnetostriction effect?

(a) Diamagnetic (b) Ferromagnetic
(c) Paramagnetic (d) both diamagnetic and paramagnetic (½x20=10)

Part- B

(a) What do you understand by double refraction. (5)

(b) Write a short note on He-Ne laser (5)

Section – B

Q-2. (a) What are Newton's rings? Describe and explain the formation of Newton's rings by reflected light. Derive an expression for diameter of nth dark ring in reflected light. (14)

(b) Explain how Newton's rings can be used to determine the wavelength of monochromatic light. (6)

Q-3. (a) What is Piezo-electric effect? Describe the working of Piezo-electric generator for producing ultrasonic waves. (14)

(b) How will you determine the speed of ultrasonic waves in a liquid using acoustic grating. (6)

Q-4. (a) Derive an expression for the variation of mass with velocity using Lorentz's transformation equations and law of conservation of linear momentum. (14)

(b) Obtain from it the mass – energy equivalence relation (6)