(c) You have been given two optical fibres A and B. The refrective indices of the core and cladding materials 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 low light gathering power? (6+7+7)

Q-8. (a) Two parallel plates are found to have equal and opposite charges and separated by a dielectric 5 mm thick having dielectric constant 3. If the field intensity in the dielectric is 10^6 V/m. Calculate the (i) polarization (ii) displacement and (iii) energy density in the dielectric, given : $\varepsilon_o = 8.85 \times 10^{-12}$ c^2 / Nm^2

(b) The dielectric constant of He at NTP is 1.000074. What is the dipole moment of each He atom if the gas is subjected to electric field of $3x\ 10^4$ V/m? Given $\varepsilon_o=8.85x10^{-12}$ F/m

(c) Amplitude of magnetic field in plane wave is 2 Alm. Calculate (i) the magnitude of the electric field for the plane wave in free space and (ii) Magnitude of the electric field when wave propogates in a medium which is characterized by $\sigma = 0$ and $\mu = \mu_o$ and $\varepsilon=4\varepsilon_o$. (7+7+6)

Roll No. ……..

Lingaya's University, Faridabad
B.Tech. 1st Year (Term – I)
Examination – Oct, 2010
Physics (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-1. Part-A.

Select the correct answer of the following multiple choice questions. (1x10=10)

(i) Coloured appearance of coated lens of a Camera is due to the optical phenomenon of

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

(ii) Newton's rings are locus of points of

(a) equal inclination (b) equal thickness
(c) both equal inclination and equal thickness
(d) equal inclination and unequal thickness

(iii) Single slit diffraction pattern is observed if the incident light wavefront is

(a) Elliptical (b) Spherical
(c) Cylindrical (d) Plane

(iv) The resolving power of a plane transmission grating increases with increasing

(a) Grating element only (b) Order of the spectrum only
(c) Total number of ruling on the grating only
(d) Both order of the spectrum and total number of rulings on the grating

(v) Which of the following waves cannot be polarized?

(a) Radiowaves (b) Light waves (c) Acoustic waves (d) X-rays

(vi) The wavelengths produced by a He-Ne laser correspond to the transition in

(a) Helium (b) Neon
(c) Both He and Ne (d) Neither He nor Ne

(vii) The poynting vector has the same dimensions as that of

(a) Electric current density (b) Electromagnetic power density
(c) Electric field (d) Change density

(viii) Dielectric losses may occur due to

(a) Radio activity (b) Polarization
(c) Ionisation (d) Conductivity

(ix) With increase in velocity of a particle its relativistic mass

(a) Decreases very slowly (b) Increases
(c) Sometime decreases and increases depending on the nature of the particle
(d) Decrease rapidly

(x) Which of the following materials exhibits piezo- electric effect?

(a) Iron (b) Aluminum
(c) Quartz (d) Copper

Part-B

(i) What do you understand by single mode and multimode fibre? (5)

(ii) Write short note on Nicol prism. (5)

SECTION – B

Q-2. (a) Describe the construction, principle and working of Michelson interferometer to produce circular fringes with it. (14)

(b) How will you determine the thickness of a thin transparent sheet by it. (6)

Q-3. (a) What is magnetostriction effect? Describe magnetostriction oscillator for producing ultrasonic waves. (14)

(b) Describe acoustic grating method with diagram to determine the speed of ultrasonic waves in a liquid. (6)

Q-4. (a) State postulates of special theory of relativity. Derive the Lorentz's transformation equations for space and time. (14)

(b) Use these equations to derive an expression for

(i) length contraction (ii) time-dilation (6)

SECTION – C

Q-5. (a) Light of wavelength 400.0 nm falls normally on a plane transmission grating which has 5000 lines/ cm ruled on it. What is the dispersion power of the grating in the (i) second order and (ii) third order spectrum. (10)

(b) A plane transmission grating used at normal incidence, gives a spectral line of wavelength 550.0 nm in a certain order superimposed on another spectral line of wavelength 420.0nm corresponding to the next higher order. (i) Calculate the grating element (ii) If the width of the grating surface is 2.5 cm, calculate the resolving power of the grating in the second order. (10)

Q-6. (a) The optical rotation produced by a typical material is found to be 30^o per mm for wavelength 500 nm. And 50^o per mm for wavelength 400 nm (i) if the plane of polarization is expressed as $\theta = \alpha+(\beta/\lambda^2)$ in the visible region of the spectrum, Find the values of constants α and β for the given material.

(ii) Calculate its thickness, if interposed between two crossed-nicols, will produce maximum transmission of light for the wavelength 550 nm. (12)

(b) Plane polarized length is incident on a quartz plate cut with its faces parallel to optic axis. Calculate the plate thickness for which the phase retardation between the O – and E –rays is 60^o for wavelength 600 nm, with n_e=1.553 and n_o = 1.544. (8)

Q-7. (a) The coherence time for an ordinary source is 10^{-10}s. What is the degree of monochromaticity for the wavelength 450 nm?

(b) Aray of light enters from air into an optical fibre. The refractive indices of the core and cladding of the fibre are 1.50 and 1.48 respectively. Calculate the (i) critical angle (ii) Fractional refractive index (iii) acceptance angle and (iv) numerical aperture.