Exam. Code: 0906
Sub. Code: 33294

2056

B.E., Second Semester

ASP-X01: Applied Physics

(Common with ECE, EEE, MEC)

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.*

x-x-x

I. Attempt <u>*any five*</u> of the following:-

a) What is physical significance of the reactance offered to the oscillations in forced oscillator? How do you understand anti-phase relation between two reactance?

b) How laser emission isa non-equilibrium negative temperature phenomenon.

c) Why the carrier wave in infra-red region of EM spectrum is preferred for light signal propagation through the optical fiber.

d) The light wave, for all optical phenomenon, is considered as vibration of electric field alone. Justify this statement.

e) Show that the average kinetic and potential energies over a cycle of oscillation are equal.

f) The interfacial angles in a calcite crystal are reduced from 71°& 109° to 68°& 112° in the process of fabrication of Nicol prism. State the underlying physical reason.

g) Verify whether the vector field $\vec{v} = (x + 3y)\hat{\imath} + (y - 2x)\hat{\jmath} + (x - 2z)\hat{k}$ is solenoidal or irrotational in nature.

h) How will you experimentally distinguish between unpolarized light wave and the one which is a mixture of unpolarized and linearly polarized light waves. (5x2)

UNIT - I

II. (a) Consider an oscillating system under the influence of a periodic force $F = F_o e^{i\omega t}$. Derive the expression for the displacement of the oscillator in the steady state phase of oscillation. Further find the frequency at which oscillator attains its displacement resonance and determine displacement and phase at resonance.

(b) A simple pendulum has a length of 1.0m. Its bob, initially at mean position, is gently kicked horizontally so that it starts returning towards mean position after a distance of 9.5 mm away from the mean position. Write the equation representing the displacement of oscillation of this oscillator. Further calculate the maximum speed attained by the bob during oscillation and also the minimum time it takes to reach this speed. (Assume $g = \pi^2$). (6,4)

P.T.O.

III. (a) Show that the damping force is neither a constant nor depends upon displacement or acceleration but it solely depends upon the velocity of the oscillator.

(b) If the mass of the string of a pendulum is equal to that of bob, then how does its time period compare with that of a simple pendulum having same length of massless string.

(c) Using Biot Savert law, obtain Maxwell's second equation and give its significance. (3,2,5)

IV. (a) State and derive Poynting vector theorem giving physical significance of each term.

(b) Show that there is a phase difference of 45° between electric and magnetic field oscillations for EM waves propagating in a boundless conducting medium.

(c) A medium has a conductivity 10^{-1}S/m and dielectric constant 50. Verify whether this medium is conductor or insulator, when EM waves of 1kHz frequency propagate through it. (5,3,2)

UNIT - II

V. (a) Discuss the methods of polarization using the phenomenon of dichroism giving advantages of each.

(b) Discuss the structure of Liquid Crystal Display (LCD) device and give physical basis of its functioning.

(c) An isotropic liquid is placed in the electric field of strength 200V/m. The liquid exhibits double refraction with difference in refractive indices for ordinary and extra-ordinary rays to 0.005. If the electric field strength is increased to 4KV/m, then calculate the difference between two refractive indices. (4,3,3)

VI. (a) Discuss the construction and working of He-Ne laser explicitly citing the role of He and Ne atoms in the lasing action. Why this laser has a continuous power output.

(b) Justify that three level lasers a ways require a cooling system.

(c) What is monochromaticity of a laser? Why is it poor for diode lasers? (5,3,2)

VII. (a) Discuss various kinds of attenuations and losses suffered by the light signal propagating through the optical fiber.

(b) Discuss various types of temperature sensors fabricated using the optical fiber.

(c) Find the radius of the core of a step index optical fiber to be used for single mode operation at a wavelength of 820nm. The refractive index of core and cladding are 1.480 and 1.478 respectively. (5,3,2)

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