Exam.Code:0905
Sub. Code: 33244

2076
B.E., First Semester
ASP-X01: Applied Physics
(Common with CSE, Bio-Tech, IT, ECE, Civil, EEE)

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section.***

x-x-x

Question I: Attempt *any five* of the following:-

(a) Find the time period of a pendulum having a string of mass m and length L with bob of same mass m.

(b) Give the response of over-damped LC circuit oscillator to the external voltage.

(c) Why the light waves are considered to be solely the transverse vibrations of electric field.

(d) Why is it easiest to sustain four level laser?

(e) Why do we reduce interfacial angles of calcite crystal while fabricating Nicol prism.

(f) How is light signal propagating through the optical fibre re-energised.

(g) Show that the impedance of an unbound dielectric medium for propagation of EM waves is approximately 374Ω.

(h) Give the principle of temperature sensors fabricated using optical fiber. (5x2)

SECTION - A

Question II:

(a) Show that the average kinetic and potential energies over a complete cycle for a simple harmonic oscillator are equal. How do you conservation of energy from this fact. (4)

(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 equation representing the displacement of oscillation of this oscillator. Further calculate maximum speed attained by the bob during oscillation and also minimum time it takes to reach this speed. (Assume $g = \pi^2$). (4)

(c) What do you understand by impedance of a forced oscillator? Show that inertial and elastic impedance are in anti-phase. (2)

Question III:

(a) Set up equations for EM waves propagation through an unbound conducting medium and obtain the solutionfor electric and magnetic field vectors. Discuss the salient features of this propagation. (6)

(b) What is the curl of a vector field $(3x^2y\hat{\imath} + 5xyz\hat{\jmath} - 2y^2z\hat{k})$ (4)

P.T.O.

Question IV:

(a) Consider a damped oscillator driven by a periodic force $F = F_0 Sin\omega t$. Set up the differential equation of this forced oscillator and obtain the expression for its velocity. Discuss the behaviour of velocity of oscillator with frequency of driving force. (5)

(b) Show that the electric and magnetic field oscillations have a phase difference of $\frac{\pi}{4}$ when the electromagnetic wave propagates through an unbound conducting medium (3)

(c) If the quality factor of an undamped tuning fork of frequency 256Hz is 1000, calculate the time in which its energy is reduced to 1/e of its energy in absence of damping. How many oscillations will the tuning fork make in this time. (2)

SECTION - B

Question V:

(a) Draw a labelled diagram depicting various components of liquid crystal display and discuss its working. (4)

(b) What is Kerr effect. Give one of its applications. (3)

(c) Two Nicol prisms are set so that the light transmitted from them is maximum. Though what angle should one of these Nicol prisms be rotated so that emergent light intensity is reduced to half. (3)

Question VI:

(a) Discuss sequentially various processes involved in the generation of laser. Further justify why laser phenomenon is a non-equilibrium negative temperature phenomenon. (5)

(b) Discuss the construction and working of a Helium-Neon laser and discuss its lasing action. What will be the effect of reducing the relative concentration of Helium gas on laser output. (5)

Question VII:

(a) Discuss various kinds of attenuations suffered by light pulses while propagating through the optical fiber. On the basis of these attenuations justify three optical windows used in fibre-optic communications. (5)

(b) Discuss two applications of the optical fibre in the field of amplitude based sensors. (5)

x-x-x