1119
B.E. (Mechanical Engineering)
Second Semester
APH-201: Oscillations and Optics
(Common with IT, ECE and 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 Unit. Calculator is allowed.*

x-x-x

I.   Answer the following briefly:-

a) In a Young's double-slit experiment, the slits are illuminated by sunlight. We can only distinguish colored fringes of the first order. Explain why.

b) Explain how does sunlight gets polarized by the process of scattering.

c) Differentiate between three level laser and four level laser.

d) Explain the link between simple harmonic motion and waves.

e) The period of oscillation of a simple pendulum does not depend on the mass of the bob. By contrast, the period of a mass-spring system does depend on mass. Explain this apparent contradiction.   (5x2)

UNIT – I

II.   a) A small body is undergoing SHM of amplitude A. While going to the right from the equilibrium position, it takes 0.5 s to move from $x = + (A/2)$ to $x = + A$. Find the period of the motion.

b) Prove that the magnitude of velocity of transverse waves on a stretched string is given by $v = (T/\mu)^{1/2}$ where T is the tension in the string and μ is the linear mass density.   (2x5)

III.   a) Discuss the phase behaviour of the displacement and velocity of a forced mechanical oscillator.

b) An LCR circuit has L = 10 mH, C = 1.0 μF, and R = 1Ω (i) After what time t will the amplitude of the charge oscillations drop to one-half of its initial value? (ii) To how many periods of oscillation does this correspond?   (2x5)

IV.   a) What are ultrasonic waves? Discuss the piezoelectric method of generation of ultrasonic waves.

b) Prove that the bandwidth of the resonance absorption curve defines the phase angle range $\tan\varphi = \pm 1$.   (2x5)

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UNIT – II

V. a) Explain the formation of fringes in Newton's Ring experiment.

   b) Discuss the Fraunhofer diffraction due to a single slit and discuss the intensity distribution on the screen.   (2x5)

VI. a) Fringes are observed due to monochromatic light in a Michelson interferometer. When the movable mirror is translated by 0.073 mm, a shift of 300 fringes is observed. What is the wavelength of the light? What displacement of the fringe system takes place when a flake of glass 1.51 and 0.005 mm thickness is placed in the one arm of interferometer?

   b) Discuss the various conditions necessary for the Laser action.

   c) Write short note on off axis holography and why it is more advantageous than on axis holography.   (3,4,3)

VII. a) Draw a graph of the intensity of light transmitted through a silica fibre as a function of the wavelength of light. What attenuation mechanisms are responsible for the main features on your graph? Indicate the transparency windows and state their approximate wavelengths.

   b) Explain the phenomenon of Double refraction. How does plane polarized light is produced with the help of Nicol Prism.   (2x5)

x-x-x