

1129
B.E. (Bio-Technology)
First Semester
APH-101: Oscillations and Optics
(Common with IT and CSE)

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

I. Answer the following briefly:-

- a) Two piano strings have the same tension, are made from the same material, and have the same length, but string B is thicker (larger diameter) than string A. Which one will have higher pitch?
- b) Why should we have a narrow source to produce good interference fringes?
- c) Briefly explain the difference between Extrinsic and Intrinsic Fiber optic sensor.
- d) Explain the significance of the band width of an oscillator.
- e) Why four level laser is better than three level laser? (5x2)

UNIT – I

- II. a) Derive the period of oscillation of a loaded vertical spring. If the spring is cut half in length and the same mass is loaded on it, what will be the new period as related to the old one?
b) Derive an expression for the generalized wave equation and obtain its solutions. (2x5)
- III. a) In the steady state forced vibration describe how the phase of the driven system changes with the frequency of the driving system.
b) Two identical under-damped oscillators have damping coefficient and angular frequency P and ω_0 respectively. At $t = 0$ one oscillator is at rest with displacement a_0 while the other has velocity v_0 and is at the equilibrium position. What is the phase difference between these two oscillators? (2x5)

P.T.O.

(2)

- IV. a) What are ultrasonic waves? Explain the production of ultrasonic waves-by piezoelectric crystal.
- b) A point performs harmonic oscillations along a straight line with a period $T = 0.8$ s and an amplitude $a = 8$ cm. Find the mean velocity of the point averaged over the time interval during which it travels a distance $a/2$, starting from (i) the extreme position, (ii) the equilibrium position. (2x5)

UNIT - II

- V. a) Describe the principle and working of a Michelson interferometer. How can the instrument be used to determine the difference between the wavelengths of the two D lines of sodium?
- b) A parallel beam of monochromatic light of wavelength 500 nm is incident normally on a plane transmission grating having 6000 lines per cm. Find the highest order of the grating spectrum. (5,3,2)
- c) Why is it impossible to create a 2-level laser?
- VI. a) Describe and explain the Fraunhofer diffraction pattern obtained with a narrow slit and illuminated by a parallel beam of monochromatic light. (2x5)
- b) Explain Fresnel's theory of rotation of the plane of polarization.
- VII. a) Discuss the various applications of the optical fibers.
- b) Qualitatively explain the steps to produce three dimensional image with the help of holography. (2x5)

x-x-x