Exam. Code: 0905
Sub. Code: 6644

2031

B.E. (Biotechnology) First Semester

APH-101/201: Oscillations and Optics

(Common with IT and CSE)

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.*

x-x-x

I. Answer any five of the following briefly:-

a) Why is the centre of Newton's ring system formed by reflected light dark?

b) One can hear the beats if the difference in frequency of two sources are less but as the difference of frequencies increases it is not possible to hear the beats. Why it is so?

c) Explain the phenomena of Birefringence. Which type of materials can show this property?

d) Is it possible that index of refraction of a material can be less than 1 ? Explain.

e) In a forced oscillator prove that the velocity amplitude at velocity resonance is frequency independent.

f) On what factors does the amplitude and the phase constant of a oscillator undergoing SHM depends. (5x2)

UNIT - I

II. a) A particle is oscillating under a damping force, prove that the power dissipation is $P = E/\tau$, where E is the average energy and τ is the relaxation time.

b) The displacement of a simple harmonic oscillator is given by $x = a \sin\omega t$. If the values of the displacement x and velocity $\dot{x}$ are plotted on perpendicular axes, eliminate t to show that the locus of the points $(x, \dot{x})$ is an ellipse. Show that this ellipse represents a path of constant energy. (2x5)

III. a) What are ultrasonic waves? Discuss the Piezo-electric method for the production of ultrasonic waves.

b) Discuss the various methods of describing the damping of an oscillator. (2x5)

P.T.O.

IV. a) Explain the meaning of a characteristic impedance of a string. Prove that when a wave travelling on the string is completely reflected it undergoes a phase change of π.

b) Prove that in a resonant LCR series circuit the maximum potential across the condenser occurs at a frequency

$$\omega = \omega_0\left(1-\frac{1}{2Q_0^2}\right)^{1/2} \text{ where } \omega_0^2 = (LC)^{-1} \text{ and } Q_0 = \frac{\omega_0 L}{R} \qquad (2\times5)$$

UNIT - II

V. a) The arms of a Michelson interferometer differ in length by 325 nm. (i) If light of 650 nm is used in the interferometer, will there be destructive or constructive interference at the detector? (ii) At what visible wavelength will there be destructive interference at the detector?

b) What are quarter wave and half wave plates? How they can be used in the detection of light of different states of polarizations. (2x5)

VI. a) A single slit of width 2.3 x 10^{-6} m, is illuminated with light of wavelength 349 nm. A screen is located at a distance of 36 cm from the slit. (i) What is the width of the central bright fringe? (ii) What is the largest value of m for which one can have a minimum? (iii) At what wavelength of light will there be no minimum for this slit?

b) Discuss the various sources of attenuation of signal in optical fibers. (2x5)

VII. a) Describe with diagram the working of a He-Ne laser. Why it is superior in comparison to Ruby laser.

b) How interference is connected in holography to freeze the object and diffraction is connected to unfreeze the object? (2x5)

x-x-x