

Exam. Code: 0905
Sub. Code: 6951

1128
B.E., First Semester
AS-107/102: Physics

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt any five questions.

x-x-x

Question I

- (a) A damped simple harmonic oscillator is driven by a periodic force $\vec{F} = \vec{F}_0 e^{i\omega t}$. Derive the expression for velocity and give various factors affecting the velocity amplitude of oscillation. (6)
- (b) A uniform rod of length L is nailed to a post such that two third of its length is below the nail. It is displaced slightly from its vertical orientation and released so that it executes SHM about its equilibrium position. Derive the expression for the time period of oscillations of the rod. (4)

Question II

- (a) Consider a system of two identical pendula coupled to each other through a spring of stiffness constant k. Discuss various modes of their oscillations. Bring out distinguishing features of their modes of oscillations. (6)
- (b) The Q value of LCR oscillator with $C = 2\mu\text{F}$, $L = 0.2\text{H}$ and frequency of 8kHz is 100. What is the value of R. What will be the frequency of oscillatory discharge if the resistance of the circuit reduces to zero. (4)

Question III

- (a) Discuss the propagation of EM waves in a conducting medium of conductivity (σ), electric permittivity (ϵ) and magnetic permeability (μ). (6)
- (b) What do you understand by Poynting vector. Show that the average value of pointing vector can be expressed as $\vec{S}_{av} = \vec{E}_{rms} \times \vec{H}_{rms}$. (4)

Question IV

- (a) Discuss how light is polarized using the method of dichroism. Give brief account of different polarizers used for this purpose. (5)
- (b) Discuss construction and working of a Helium-Neon laser. (5)

Question V

- (a) Discuss the application of the optical fibers in the field of sensors. (5)
- (b) Show that it is easiest to cause lasing action in the four level system. (5)

Question VI

- (a) Discuss the wave theory of recording of a hologram and show that hologram records whole wave front of object wave. (5)
- (b) What are different mechanisms resulting in attenuation of light signal when it propagates through optical fiber. (5)

Question VII

- (a) Show that Heisenberg's uncertainty principle is a natural consequence wave nature associated with moving material particles. (4)
- (b) Show that in Compton effect, the electron always recoils in the forward hemisphere relative to the direction of the incident photon. (6)

Question VIII

- (a) Consider a particle of mass m and kinetic energy E is trapped in infinitely deep one dimensional potential well. Using steady state Schrodinger's equation, obtain eignfunctions and eigenvalues of the particle. Further argue why this particle can never come to rest in this potential well. (6)
- (b) Discuss the structure of ammonia molecule using uncertainty principle. (4)