Exam.Code:0905
Sub. Code: 6345

1078
B.E., First Semester
AS-107: Physics
(Common)

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt *any five* questions.

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Question 1

(a) Show that the damping force is neither a constant nor dependent on displacement or acceleration. It solely depends upon the velocity of the body executing SHM.   (5)

(b) What is power of an oscillator. Derive the expression for average power of an oscillator and show its variation with frequency of oscillator. Further obtain the expression for Q-value of the oscillator.   (5)

Question 2

(a) Consider a system of two identical pendula coupled to each other through a spring of stiffness constant k. Discuss various modes of their coupled oscillations bringing out distinctive features of each mode.   (6)

(b) A particle of mass 2 gram is making simple harmonic motion along the x-axis. At distances 6cm and 10cm from the equilibrium position, the velocities of the particle are 5cm/s and 4cm/s respectively. Find the time period of oscillation, the amplitude, maximum kinetic energy and maximum momentum.   (4)

Question 3

(a) What is Poynting vector. Derive the expression representing Poynting theorem and offer physical interpretation to each of its term.   (7)

(b) If an alternating electric field $\vec{E} = \vec{E}_0 \cos \omega t$ is applied to a conductor, show that the displacement current flowing in it is negligible as compared to the magnitude of conduction current at any frequency lower than the optical frequencies ($\sim 10^{14}$ Hz).   (3)

Question 4

(a) Discuss the polarization of light using the Nicol prism.   (5)

(b) Show that it is easiest of generate laser in a four level system.   (5)

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Question 5

(a) What is holography. Give its distinctive features as compared to conventional photography. Discuss two applications of holography. (6)

(b) What are optical fibers. Discuss any two sensors fabricated from the optical fiber. (5)

Question 6

(a) Show, using wave theory of light, that whole of the wave front of light is recorded in the process of holography. (5)

(b) What are different mechanisms of light attenuation observed when light propagates through an optical fiber. (5)

Question 7

(a) Show that Heisenberg's uncertainty principle is a natural consequence wave nature associated with moving material particles. (5)

(b) Show that during the process of Compton scattering, the electron always recoils in the forward hemisphere. (5)

Question 8

(a) Obtain time independent Schrodinger's equation from first principle. Argue qualitatively that energy quantization is embedded in this equation. (6)

(b) What is tunnel effect. Interpret this phenomenon using uncertainty principle. (4)

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