Full marks – 20   **Date- 16/11/2022**

Answer any four questions including Question No.1 which is compulsory
All parts of a question should be answered at one place only

1. Answer the following questions   [5x1
   a. The equation of a progressive wave is given by $y = 4sin\pi(0.1x - 2t)$, where x is in cm and t is in seconds. Calculate the wavelength and speed of the wave.
   b. Why are the interference fringes circular in Newton's rings experiment?
   c. The time period of a simple harmonic oscillator is 2 seconds. Find the time period of oscillation if it is subjected to a damping force with damping coefficient 1second⁻¹.
   d. The equation of motion of an oscillator is given by: $3\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 12\pi^2 x = 9\cos 2\pi t$. Identify the type of oscillation and find out the natural frequency of oscillation of the oscillator.
   e. Why solders are advised to break their steps while marching on a bridge?

2.   [4+1
   a. A weakly damped oscillator is subjected to a sinusoidal force of frequency 'p'. Set up the differential equation under this condition. Solve it to find out the steady state solution.
   b. Draw a comparative displacement versus time graph showing under damping, over damping and critical damping.

3.   [5
   Two identical simple pendulums of mass 'm' and length 'l' are connected by a mass less spring of force constant 'k'. Set up the differential equations and compare between Q1 and Q2 modes of oscillations with suitable diagram. Also, write down the frequency of each mode.

4.   [4+1
   a. Prove that the diameters of the dark Newton's rings are proportional to the square root of any natural number in reflected light.
   b. State one condition under which the centre of Newton's ring pattern appears bright.

5.   [5
   Consider a wedge shaped thin film of refractive index μ. If a ray of monochromatic light is incident on it, find out the condition of maxima in reflected light.