GOVERNMENT ENGINEERING COLLEGE, SHEIKHPURA
Department of applied science and Humanities

Course : B.Tech (EE & ECE)   Session : 2019-20 (II Semester)
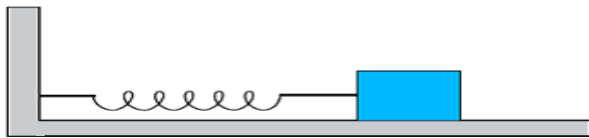Subject : 103201 – PHYSICS   Module : 1

Topics Covered : MECHANICAL AND ELECTRICAL SIMPLE HARMONIC OSCILLATORS, DAMPED HARMONIC OSCILLATOR, FORCED MECHANICAL AND ELECTRICAL OSCILLATORS, IMPEDANCE, STEADY STATE MOTION OF FORCED DAMPED HARMONIC OSCILLATOR

Assignment cum tutorial sheet

1. A 5 kg collar is attached to a spring of spring constant 500 N a horizontal rod.The collar is displaced from its equilibrium position Calculate (a) the period of oscillation, (b) the maximum speed and (c) maximum acceleration of the collar.

2. A spring balance has a scale that reads from 0 to 50 kg. The length of the scale is 20cm. A body suspended from this balance, when displaced and released, oscillateswith a period of 0.6 s. What is the weight of the body

3. A spring having a spring constant horizontal table as shown in the figure. A mass of 3 kg is attached tothe free end of the spring. Themass is then pulled sideways to a distance of 2.0 cm and released. Determine (i) the frequency of oscillations, (ii) maximum acceleration of the mass and (iii) the maximum speed of the mass.

4. The angular frequency of the oscillations in an LC circuit is 2.0×10^3 rad/s. (a) If L=0.10H what is C ? (b) Suppose that at t=0 all the energy is stored in the inductor. What is the value of ϕ? (c) A second identical capacitor is connected in parallel with the original capacitor. What is the angular frequency of this circuit?

5. In an LC circuit, the self-inductance is 2.0×10^{-2} H and the capacitance is 8.0×10^{-6} F. At t=0 all of the energy is stored in the capacitor, which has charge 1.2×10^{-5} C. (a) What is the angular frequency of the oscillations in the circuit? (b) What is the maximum current flowing through circuit? (c) How long does it take the capacitor to become completely discharged? (d) Find an equation that represents $q(t)$.

6. Discuss the effect of damping force on a system (a mass attached to a spring) executing SHM in a viscous medium and obtain an expression for displacement of the damped oscillator .

7. What are damped oscillations? Write equation for electrical damping oscillator. Give an example. What is critical damping ?

8. What are forced or driven oscillations? Write the eqation for mechanical force driven oscillator. Give an example. Discuss Q- factor and Resonance.

9. Discuss the LCR Circuit as forced damped oscillator.

10. What is Quality Factor or "Q" of a resonant circuit ?

11. What are the two basic characteristics of a simple harmonic motion? What is the ratio of maximum acceleration to the maximum velocity of a simple harmonic oscillator?

12. Draw the displacement time graph for critical damped oscillations.

13. Give the expression for total mechanical energy of the damped oscillator. Explain the terms.