Tutorial 7

PHY 101 Monsoon 2024

Q1. A particle of mass m moves in a one-dimensional potential energy $V(x)=-ax^2+bx^4$, where a and b are positive constants. What will be the angular frequency of small oscillations about the minima of the potential energy?

Q2. Consider a mass-spring system with m=5kg, μ=7kg/sec, k=3kg/sec^2 and a forcing term 2Cos4t N .

(a) Find the steady periodic solution $x_p(t)$and find the amplitude and phase.
(b) Find the position x(t) if x(t=0)=0 m and v=dx/dt at t=0 is 1 m/sec.

Q3. A damped oscillator consists of a mass 200 gm attached to a spring of constant 100Nm^{-1} and damping constant 5 Nm^{-1} s. It is driven by a force F = 6 cos wt Newton, where ω = 30s $^{-1}$. If displacement in steady state is x= A sin (ωt – φ) metre, find A and φ. Also calculate the power supplied to the oscillator.

Q4. The equation of motion is $2 \times 10^{-4}\, d^2x/dt^2 + 4 \times 10^{-2}\, dx/dt + 5x = 0.124 \sin 100t$ where, all quantities are in S.I units. Find (i) Natural frequency of undamped oscillation (ii) Mechanical impedance.