Some Practice Problems for Damping and Waves

1. Draw displacement vs time graph for $\omega/\gamma = 10$, $\omega/\gamma = 0.5$, and $\omega/\gamma = 0.03$.

2. In oscillatory circuit L= 0.4h, C = 0.0020μF. (i) What is maximum value of resistance (R) for the circuit to be oscillatory? and (ii) What is its resonant frequency?

3. Find whether the discharge of capacitor through the following inductive series circuit is oscillatory or not. Given, C = 0.1μF, L = 10 mh, and R 200 Ω. If oscillatory, find the frequency of oscillation and resonant frequency.

4. Find whether the discharge of capacitor through the following inductive series circuit is oscillatory or not. Given, C = 0.5 mF, L = 100 nh, and R= 200 Ω. If oscillatory, find the frequency of oscillation and resonant frequency.

5. For a damped oscillator m =250gm, k = 85N/m and b = 70gm/s.
   (i) What is the period of the motion?
   (ii) How long does it take for the amplitude of the damped oscillations to drop to half its initial value?
   (iii) How many oscillations does it complete in life time?
   (iv) What is its life time?
   (v) Let the maximum displacement of undamped oscillator is 35 cm. If the damping is stopped after 20 cycles, what is the damping energy?
   (vi) What is the ratio of the oscillation amplitude to the initial oscillation amplitude after 20 cycles?

6. The equation of a travelling wave is $y = 4.0\sin(0.10x - 2t)$. Find (i) amplitude, (ii) wavelength, (iii) speed, and (iv) frequency of wave.

7. At time t=0 the displacement of a particle in a medium is $y = 4.0\sin 2\pi(\frac{x}{100})$ and the velocity of wave is 30cm/s. Find the displacement equation when t = 3s.

8. When a simple harmonic wave is propagated through a medium, the displacement of the particle at any instant of time is given by, $y = 5.0sin\,\pi(360t - 0.15x)$. Calculate (i) the amplitude of the vibrating particle, (ii) wave velocity, (iii) wavelength (iv) frequency and (v) time period.

9. A simple harmonic wave of amplitude 8 units travels a line of particles in the direction of positive X axis. At any instant for a particle at a distance of 10 cm from the origin, the displacement is +6 units and at a distance a particle from the origin is 25 cm, the displacement is +4 units. Calculate the wavelength.

10. Find out the resultant amplitude, node and antinode points in terms of λ of the following equations: $y_1 = A\cos(\frac{1}{3}kx + \omega t)$ and $y_2 = A\cos(\frac{1}{3}kx - \omega t)$.