Chapter 14.
Oscillations

I One mark questions (PART – A):

1. What is an oscillatory (vibratory) motion? (K)
2. Give an example for oscillatory motion.(U)
3. What is periodic motion? (K)
4. Give an example for periodic motion.(U)
5. Is all oscillatory motions are periodic? (K)
6. Define period of periodic motion. (K)
7. Mention the unit of period.(U)
8. Define frequency of periodic motion.(K)
9. Write the unit of frequency.(U)
10. Give the relation between period and frequency. OR How is frequency related to period ?(U)
11. What is angular frequency ?(K)
12. Define amplitude.(K)
13. Mention the unit of amplitude.(U)
14. Define simple harmonic motion(SHM).(K)
15. Give an example for SHM.(U)
16. Give an example for a non simple harmonic periodic motion.(U)
17. What is mean by phase of a particle executing SHM ?(K)
18. What is restoring force ?(K)
19. State force law of simple harmonic motion.(K)
20. What is the relation between simple harmonic motion and uniform circular motion?(U)
21. In which position the particle possess maximum potential energy in SHM ? (S)
22. In which position the particle possess maximum kinetic energy in SHM ?(S)
23. Draw a graph of displacement versus time for a particle executing SHM.(S)
24. What happens to the time period of a simple pendulum, if its length is quadrupled ?(S)
25. What happens to the period of simple pendulum when it is taken to Mt. Everest?(S)
26. What is the period of second's pendulum ?(U)
27. What is mean by damped oscillation ?(K)
28. What is mean by free oscillation ?(K)
29. What is resonance ?(K)

Two mark questions (PART – B):

1. Write the expression for displacement of a particle executing SHM , and explain the terms involved.(U)
2. Mention the characteristics of SHM.(U)
3. State and explain force law of simple harmonic motion.(U)
4. Mention the expression for velocity of a particle executing SHM. Explain the terms involved.(U)
5. Mention the expression for acceleration of a particle executing SHM. Explain the terms involved.(U)
6. Mention the expression for magnitude of maximum velocity and maximum acceleration of a particle executing SHM.(U)

7. Write the expression for kinetic energy of a particle executing SHM, and explain the terms.(U)
8. Write the expression for potential energy of a particle executing SHM, and explain the terms.(U)
9. Write the expression for total energy of a particle executing SHM, and explain the terms.(U)
10. Mention the expression for time period of oscillation of a mass attached to a horizontal spring. Explain the terms involved.(U)
11. Mention the expression for time period of oscillation of a simple pendulum. Explain the terms involved.(U)
12. Draw a graph of energy versus time in the case of a particle executing SHM.(S)
13. Draw a graph of energy versus displacement in the case of a particle executing SHM.(S)

Three mark questions (PART – C):

1. Derive an equation for simple harmonic motion.(U)
2. Write the expression for magnitude of maximum velocity of a particle executing SHM. At which position it possesses; a) maximum value of velocity? b) zero velocity ?(U)
3. Mention the expression for magnitude of maximum acceleration of a particle executing SHM. At which position it possess; a) maximum value of acceleration ? b) zero acceleration ? (U)
4. Derive the expression for kinetic energy and potential energy of a particle executing SHM.(U)
5. Write the expressions for kinetic energy, potential energy and total energy of a particle executing SHM.(U)

Three marks problems…

1. Calculate the magnitude of maximum velocity of a particle executing SHM with a period of 8 s and amplitude 3 cm. (S) **(Ans- 0.024 ms^{-1})**
2. A body executes SHM along x- axis. Its displacement varies with time according to the equation, x = $1.2\cos(50\pi t)$. Where x is in metre, t is in second. Find the amplitude and time period of the particle. (S) **(Ans- 1.2 m, 0.04 s)**

Five mark questions (PART – D):

1. Derive the expression for time period of oscillations of a simple pendulum executing SHM.(U)
2. Derive the expression for kinetic energy, potential energy and total energy of the particle executing SHM.(U)

Five marks problems….

1. A body oscillates with SHM according to the equation, x = 2 $\cos(2\pi t + \frac{\pi}{2})$. Where x is in metre and t is in second. Calculate, a) displacement b) velocity c) acceleration of the body at t = $\frac{1}{2}$ s. (S)
   [Ans- a) 0, b) 4π ms^{-1}, c) 0]
2. A body describes a simple harmonic motion with an amplitude of 4 cm and a period of 0.1 s. Find the magnitude of velocity and acceleration of the body when the displacement is 3 cm from the mean position. (S) **(Ans- 1.663 ms^{-1}, 118.47 ms^{-2})**
3. A particle of mass 0.02 kg is executing SHM along x- axis with a period of 2 s. If the amplitude of the particle is 8 cm, calculate the kinetic energy, potential energy and total energy of the particle at t = $\frac{1}{4}$ s. (S) **(Ans- 0.000316 J, 0.000316 J, 0.000632 J.)**
4. A particle of mass 0.02 kg is executing SHM along y- axis with a period of 2 s. If the amplitude of the particle is 8 cm, calculate the kinetic energy, potential energy and total energy of the particle at t = $\frac{1}{2}$ s. (S) **(Ans- 0, 0.000632 J, 0.000632 J.)**

5. A block is attached to a spring. The spring has a spring constant of 20 Nm^{-1}. If the block oscillates simple harmonically with amplitude of 6 cm, estimate the kinetic energy, potential energy and total energy of the block when it is 2 cm away from the mean position. (S)

(Ans- 0.032 J, 0.004 J , 0.036 J)

6. A simple pendulum oscillates with a frequency equal to 0.6 Hz. Calculate the length of the simple pendulum. If length of the pendulum is doubled, what will be the time period of the pendulum?(S) **(Ans- 0.689 m, 2.357 s)**

7. Particle executing SHM is represented by y = $4\sin(10\pi t)$. Where y is in centimetre and t is in second. Calculate the amplitude, magnitude of maximum velocity and maximum acceleration.(S)

(Ans- 0.04 m, 1.257 ms^{-1}, 39.489 ms^{-2})