## Chapter 5. Oscillations

### MCQ's ( 1 Mark Each)

1) A particle is moving in a circle with uniform speed. Its motion is
   a) Periodic and simple harmonic
   b) Non periodic
   c) Periodic but not simple harmonic
   d) Non periodic but simple harmonic

   **Ans: c) Periodic but not simple harmonic**

2) A particle is performing simple harmonic motion with amplitude A and angular velocity $\omega$ . the ratio of maximum velocity to maximum acceleration is

   a) $\omega$

   b) $1 / \omega$

   c) $\omega^2$

   d) $A / \omega$

   **Ans: b) 1 / $\omega$**

3) Acceleration of a particle executing S.H.M. at its mean position.
   a) Is infinity
   b) Varies
   c) Is maximum
   d) Is zero

   **Ans: d) Is zero**

4) In a second's pendulum, mass of Bob is 50 g. If it is replaced by 100 g mass, then its period will be.
   a) 1 s b) 2 s c) 3 s d) 4 s

   **Ans: b) 2 s**

5) The maximum speed of a particle executing S.H.M. is 10 m/s and maximum acceleration is 31.4 m/s$^2$. Its periodic time is

a) 1 s b) 2 s c) 4 s d) 6 s

**Ans: b) 2 s**

6) When the displacement of a simple harmonic oscillator is half of its amplitude, its P.E. is 3 J. Its total energy is

a) 6 J b) 12 J c) 15 J d) 20 J

**Ans: b) 12 J**

7) Two S.H.M.'s have zero phase difference and equal amplitudes A. The resultant amplitude on their composition will be

a) 2 A b) zero c) $\sqrt{2}$ A d) $\sqrt{2A}$

**Ans: a) 2 A**

**Very Short Answer (VSA) ( 1 MARK Each )**

1) A simple pendulum moves from one end to the other in ¼ second. What is its frequency? ***( Ans: 2 Hz )***
2) A particle executes S.H.M. of 2 cm. At the extreme position, the force is 4 N. What is the force at a point midway between mean and extreme positions? ***( Ans: F = 2 N )***
3) A simple pendulum is inside a space craft. What will be its periodic time? ***( Ans: infinite )***
4) What is amplitude of S.H.M.
5) What is seconds pendulum.
6) State the formula for frequency of S.H.M in terms of force constant.
7) What does the phase of π/2 indicate in linear S.H.M.?
***(Ans: particle is at the positive extreme position during first oscillation)***

**Short Answer I (SA1) (2 MARKS Each )**

1) Derive differential equation of linear S.H.M.
2) Define linear S.H.M.
3) State any two laws of simple pendulum.
4) State formula for angular frequency and time period of damped oscillations.
5) A particle is performing S.H.M. of amplitude 5 cm and period of 2s. Find the speed of the particle at a point where its acceleration is half of its maximum value.

***(Ans: V = 13.6 X 10 $^{-2}$ m/s )***

**6)** The acceleration due to gravity on the surface of moon is 1.7 m/s$^2$. What is the time period of a simple pendulum on the surface of moon if its time period on the surface of earth is 3.5 s? (g on the surface of earth = 9.8 m/s$^2$ ) ***(Ans.: 8.40 sec)***

**7)** The total energy of a body of mass 2 kg performing S.H.M. is 40 J. Find its speed while crossing the center of the path**.** ***(Ans.: V = 6.324 m/s )***

**Short Answer II (SA2) ( 3 MARKS Each )**

**1)** The period of oscillation of simple pendulum increases by 20% , when its length is increased by 44 cm. find its initial length**.** ***(Ans.: $L_1$ = 1 m)***

2) A particle performing S.H.M. has velocities of 8 cm/s and 6 cm/s at displacements of 3 cm and 4 cm respectively. Calculate the amplitude and period of S.H.M.
***(Ans: Amplitude = 5 cm, T= 3.14 sec )***

3) A particle performs linear S.H.M. of period 4 seconds and amplitude 4 cm. Find the time taken by it to travel a distance of 1 cm from the positive extreme position.
***(Ans: t = 0.46 sec)***

**Long Answer (LA) ( 4 marks Each)**

1) Obtain an expression for resultant amplitude of, composition of two S.H.M.'s having same period along same path.

2) Define angular S.H.M. and obtain its differential equation.

3) Obtain the expression for the period of a magnet vibrating in a uniform magnetic field and performing S.H.M.

4) Explain damped oscillation.

5) Derive differential equation of damped harmonic oscillations.

6) Explain reference circle method for projection of a rotating rod.

7) Explain 1) Free Oscillations 2) Force Oscillations 3) Resonance

8) Using differential equation of linear S.H.M., obtain an expression for acceleration, velocity and displacement of simple harmonic motion.

9) Define ideal simple pendulum and obtain an expression for its periodic time.

10) Deduce the expression for kinetic energy, potential energy and total energy of a particle performing S.H.M. State the factors on which total energy depends.