## **CHAPTER FOURTEEN**



## **O**SCILLATIONS

14.1	Introduction
14.2	Periodic and oscillatory
	motions
14.3	Simple harmonic motion
14.4	Simple harmonic motion
	and uniform circular
	motion
14.5	Velocity and acceleration
	in simple harmonic mot
<b>14.6</b>	Force law for simple
	harmonic motion
14.7	Energy in simple harmor
	motion
14.8	Some systems executing
	simple harmonic motion
14.9	Damped simple harmon
	motion
14.10	Forced oscillations and
	resonance
	Summary
	Points to ponder
	Exercises
	Additional Exercises

ic

## 14.1 INTRODUCTION

In our daily life we come across various kinds of motions. You have already learnt about some of them, e.g., rectilinear motion and motion of a projectile. Both these motions are non-repetitive. We have also learnt about uniform circular motion and orbital motion of planets in the solar system. In these cases, the motion is repeated after a certain interval of time, that is, it is periodic. In your childhood, you must have enjoyed rocking in a cradle or swinging on a swing. Both these motions are repetitive in nature but different from the periodic motion of a planet. Here, the object moves to and fro about a mean position. The pendulum of a wall clock executes a similar motion. Examples of such periodic to and fro motion abound: a boat tossing up and down in a river, the piston in a steam engine going back and forth, etc. Such a motion is termed as oscillatory motion. In this chapter we study this motion.

The study of oscillatory motion is basic to physics; its concepts are required for the understanding of many physical phenomena. In musical instruments, like the sitar, the guitar or the violin, we come across vibrating strings that produce pleasing sounds. The membranes in drums and diaphragms in telephone and speaker systems vibrate to and fro about their mean positions. The vibrations of air molecules make the propagation of sound possible. In a solid, the atoms vibrate about their equilibrium positions, the average energy of vibrations being proportional to temperature. AC power supply give voltage that oscillates alternately going positive and negative about the mean value (zero).

The description of a periodic motion, in general, and oscillatory motion, in particular, requires some fundamental concepts, like period, frequency, displacement, amplitude and phase. These concepts are developed in the next section.