MA

WAVE MOTION : A simple example of wave motion in one dimension can be provided by a displacement moving along a string, fixed at one end only. Suppose the string vibrates with a frequency ν producing waves of length λ which travel in the positive x-direction with a velocity u. The amplitude y, i.e, the height of the wave at any point x and time t, that ie,

$$y = f(x, t)$$

Such a wave motion in one dimension can be represented mathematically by the general partial differential equation

$$\frac{\partial^2 y}{dx^2} = \frac{1}{u^2} \frac{\partial^2 y}{dt^2}.$$

Standing Waves :

vibration of a string fixed at its two ends produce standing wave or stationary wave.

with separated variables, the amplitude y of the wave may be expressed as

$$y = f_1(x) f_2(t)$$

$f_2(t) = A \sin 2\pi\nu t$

$y = f_1(x). A \sin 2\pi\nu t$

Differentiating y twice with respect to t at constant x

$$\frac{\partial y}{dt} = f_1(x).\ 2\pi\nu . A \cos 2\pi\nu t$$

$$\frac{\partial^2 y}{dt^2} = -4\pi^2\nu^2 f_1(x) A \sin 2\pi\nu t$$

$$= -4\pi^2\nu^2 f_1(x) f_2(t) \longrightarrow (i)$$

But we Know, $\frac{\partial^2 y}{dx^2} = \frac{1}{u^2} \frac{d^2 y}{dt^2}$

$$\therefore \frac{d^2 y}{dx^2} = -\frac{4\pi^2\nu^2}{u^2} f_1(x) f_2(t) \longrightarrow (ii)$$