

# 11.15-24

EE23BTECH11023-ABHIGNYA GOGULA

## Question:

One end of a long string of linear mass density  $8.0 \times 10^{-3} \text{ kg m}^{-1}$  is connected to an electrically driven tuning fork of frequency 256 Hz. The other end passes over a pulley and is tied to a pan containing a mass of 90 kg. The pulley end absorbs all the incoming energy so that reflected waves at this end have negligible amplitude. At  $t = 0$ , the left end (fork end) of the string  $x = 0$  has zero transverse displacement ( $y = 0$ ) and is moving along positive  $y$ -direction. The amplitude of the wave is 5.0 cm. Write down the transverse displacement  $y$  as a function of  $x$  and  $t$  that describes the wave on the string.

## SOLUTION

parameter	description	value
$\mu$	linear mass density	$8.0 \times 10^{-3} \text{ kg m}^{-1}$
$f$	frequency	256 Hz
$m$	mass	90 kg
$a$	amplitude	5.0 cm

The displacement equation of wave:

$$y(x, t) = a \sin(\omega t - kx) \quad (1)$$

$$\omega = 2\pi \times 256 \quad (2)$$

$$\omega = 1.6 \times 10^3 \text{ rad/s} \quad (3)$$

$$V = \sqrt{\frac{T}{\mu}} \quad (4)$$

$$V = 332 \text{ m/s} \quad (5)$$

$$\lambda = \frac{V}{f} \quad (6)$$

$$\lambda = 1.29 \text{ m} \quad (7)$$

$$k = \frac{2\pi}{\lambda} \quad (8)$$

$$k = 4.84 \text{ m}^{-1} \quad (9)$$

then from (1)

$$y(x, t) = 0.05 \sin(1.6 \times 10^3 t - 4.84x) \text{ m} \quad (10)$$