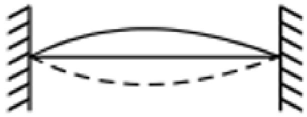
IMPORTANT JEE-NEET FORMULAS

STRING WAVE

Topics	Formulas
GENERAL EQUATION OF WAVE MOTION	$$\frac{\partial^2 y}{\partial t^2} = v^2 \frac{\partial^2 y}{\partial x^2}$$ $$y(x,t) = f(t \pm \frac{x}{v})$$ Where $y\ (x,t)$ should be finite everywhere. $f(t + \frac{x}{v})$ Represents wave travelling in negative x-axis. $f(t - \frac{x}{v})$ Represents wave travelling in positive x-axis. $$y = A\ sin\ (\omega t \pm kx + \phi)$$
TERMS RELATED TO WAVE MOTION (FOR 1-D PROGRESSIVE SINE WAVE)	Wave number (or propagation constant) (k) $$k = \frac{2\pi}{\lambda} = \frac{\omega}{v}$$
Phase of Wave	The argument of harmonic function $(\omega t \pm kx + \phi)$ is called phase of the wave. Phase difference $(\Delta\phi)$: difference in phases of two particles at any time t. $$\Delta\phi = \frac{2\pi}{\lambda}\Delta x$$ And also, $$\Delta\phi = \frac{2\pi}{\lambda}\Delta t$$
SPEED OF TRANSVERSE WAVE ALONG A STRING/WIRE	$$v = \frac{\sqrt{T}}{\mu}$$ here, T = tension μ = mass per unit length
REFLECTION AND REFRACTION OF WAVES	$$y_i = A_i\ sin\ (\omega t - k_1 x)$$ If incident from rarer to denser medium $(v_2 < v_1)$ $$y_t = A_t\ sin\ (\omega t - k_2 x)$$ $$y_r = -A_r\ sin\ (\omega t + k_1 x)$$ If incident from denser to rarer medium $(v_2 > v_1)$ $$y_t = A_t\ sin\ (\omega t - k_2 x)$$ $$y_r = A_r\ sin\ (\omega t + k_1 x)$$
VIBRATIONS OF STRINGS (STANDING WAVE)	
String fixed at both ends	Fixed ends will be nodes. So, waves for which

	$L = \frac{\lambda}{2}$ $L = \frac{2\lambda}{2}$ $L = \frac{3\lambda}{2}$    Are possible giving $L = \frac{n\lambda}{2}$ or $L = \frac{2\lambda}{n}$ Where $n = 1, 2, 3, 4, 5, ….$
String free at one end	For fundamental mode $L = \frac{\lambda}{4}$ or $\lambda = 4L$ First overtone $L = \frac{3\lambda}{4}$ Hence, $\lambda = \frac{4L}{3}$  first overtone So, $f_1 = \frac{3}{4L}\sqrt{\frac{T}{\mu}}$ (First overtone)