Exercise-1

ONLY ONE OPTION CORRECT TYPE

SECTION (A) : BASIC QUESTION

1. Transverse waves can propagate - **[KCET 2000]**
(1) Neither in solids nor in gases (2) Only in gases
(3) Only in solids (4) Both in solids and gases

2. The waves in which the particles of the medium vibrated in a direction perpendicular to the direction of wave motion is known as - **[AIIMS 1998]**
(1) Transverse wave (2) Longitude waves
(3) Propagated waves (4) None of these

3. A medium can carry a longitudinal wave because it has the property of- **[KCET 1994]**
(1) Mass (2) Density (3) Compressibility (4) Elasticity

4. The property of a medium necessary for wave propagation is -
(1) Its inertia (2) Its elasticity (3) Its low resistance (4) All of above

5. Water wave are -
(1) Transverse (2) Longitudinal
(3)Sometimes longitudinal some time transverse (4) Neither transverse nor longitudinal

6. Superposition is the main characteristic of
(1) wave motion (2) particle motion
(3) wave and particle motion (4) none of the two motions

7. Which of the following are longitudinal waves ?
(1) sound waves (2) radio waves
(3) infrared waves (4) electromagnetic waves

8. A longitudinal travelling wave transports **[REE - 2000]**
(1) energy and linear momentum (2) energy and angular momentum
(3) energy and torque (4) angular momentum and torque

9. Two waves are given by $y_1 = a \sin(\omega t - kx)$ and $y_2 = a \cos(\omega t - kx)$. The phase difference between the two waves is - **[MPPMT 1993]**
(1) $\frac{\pi}{4}$ (2) π (3) $\frac{\pi}{8}$ (4) $\frac{\pi}{2}$

SECTION (B) : EQUATION OF TRAVELLING WAVE.

1. In a transverse progressive wave of amplitude A, the maximum particle velocity is four times its wave velocity. The wavelength of the wave is - **[CPMT 2000]**
(1) $\frac{\pi A}{4}$ (2) $\frac{\pi A}{2}$ (3) πA (4) $2\pi A$

2. The equation of a progressive wave is $y = 0.02 \sin 2\pi \left[\frac{t}{0.01} - \frac{x}{0.3}\right]$, where x and y are in meters and t is in second. The velocity of propagation of the wave is - **[KCET 2000]**
(1) 400 (2) 40 (3) 300 (4) 30

3. The plane wave is described by the equation $y = 3\cos\left(\frac{x}{4} - 10t - \frac{\pi}{2}\right)$, where x and y are in meters and t in seconds. The maximum velocity of the particles of the medium due to this wave is - **[AIIMS 2000]**
(1) 30 m/s (2) m/s (3) 3/4 m/s (4) 40 m/s

4. Equation of progressive wave is given by $y = a \sin \pi(40\,t - x)$ where a and x are in meter and t in second. The velocity of the wave in (m/s) is - **[KCET 1999]**
(1) 20 (2) 40 (3) 10 (4) 80

5. In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.17 sec. The frequency of the wave is - **[CPMT 1998]**
(1) 1.47 Hz (2) 0.36 Hz (3) 0.73 Hz (4) 2.94 Hz

6. A transverse wave is represented by the equation $y = y_0 \sin \frac{2\pi}{\lambda}(vt - x)$. For what value of λ is the maximum particle velocity equal to two times the wave velocity - **[CPMT 1998]**
(1) $\lambda = 2\pi y_0$ (2) $\lambda = \frac{\pi y_0}{3}$ (3) $\lambda = \frac{\pi y_0}{2}$ (4) $\lambda = \pi y_0$

7. The equation of waves $y = 10^{-4} \sin (60\,t + 2x)$ where x and y in meter and t in second then what statement is wrong - **[RPMT 1998]**
(1) $\lambda = \pi$ meter (2) Frequency $\left(\frac{30}{\pi}\right)$ Hz
(3) Wave in negative x direction (4) All are correct

8. Equation of progressive wave is given by $y = a \sin \pi\left[\frac{t}{2} - \frac{x}{4}\right]$, where t is in seconds ans x is in meters. Then the distance through which the wave moves in 8 seconds is (in meter) - **[KCET 1998]**
(1) 4 (2) 2 (3) 16 (4) 8

9. The number of waves, contained in unit length of the medium, is called - **[AIIMS 1998]**
(1) Elastic wave (2) Wave number (3) Wave pulse (4) Electromagnetic wave

10. A wave is represented by $y = 3 \sin 2\pi\left(\frac{t}{0.04} - \frac{X}{0.01}\right)$ cm. The frequency of the wave and the maximum acceleration under this frequency are - **[RPET 1997]**
(1) 25 Hz, 7.5×10^4 cm/s^2 (2) 100 Hz, 4.7×10^3 cm/s^2
(3) 50 Hz, 7.5×10^3 cm/s^2 (4) 25 Hz, 4.7×10^4 cm/s^2

11. The equation of wave is given by : $y = 10 \sin\left(\frac{2\pi t}{30} + \frac{\pi}{6}\right)$. If the displacement is 5 cm at t = 0, then the total phase of t = 7.5 sec will be - **[AIIMS 1996]**
(1) $\frac{\pi}{3}$ rad (2) $\frac{2\pi}{5}$ rad (3) $\frac{2\pi}{3}$ rad (4) $\frac{\pi}{2}$ rad

12. If the distance between two consecutive crests is 5 cm and 2 waves passes from a point in one second the wave velocity is- **[RPMT 1992]**
(1) 2 cm/sec (2) 2.5 cm/sec (3) 5 cm/sec (4) 10 cm/sec

13. A plane wave is represented by $x = 1.2 \sin (314t + 12.56\,y)$. Where x and y are distance measured along in x and y direction in meters and t is time in seconds. This wave has - **[MPPET 1991]**
(1) A wavelength of 0.25 m and travels in +ve x direction
(2) A wavelength of 0.25 m and travels in +ve y direction

(3) A wavelength of 0.5 m and travels in –ve y direction
(4) A wavelength of 0.5 m and travels in –ve x direction

14. Equation of progressive wave is y = 0.02 sin (30t – 4x) where y & t are in meter and sec. Then velocity of wave is - **[RPET 1992]**
(1) 4 m/s in positive x direction (2) 30 m/s in positive x direction
(3) 7.5 m/s in positive x direction (4) 30 m/s in negative x direction

15. Equation of a progressive wave is given by y = a sin (ωt – kx). Then which of the following equation is not correct - **[RPET 1992]**
(1) $y = a \sin 2\pi \left(nt - \frac{x}{\lambda}\right)$ (2) $y = a \sin \frac{2\pi}{\lambda}(vt - x)$
(3) $y = a \sin \left(\frac{1}{T} - \frac{\pi}{\lambda}\right)$ (4) None of these

16. The equation of a progressive wave is y = 10 sin π (0.01x – 2t) cm., the value of frequency in Hz. will be - **[RPMT 1992]**
(1) 2π (2) π (3) 2 (4) 1

17. A wave execute SHM with maximum particle velocity V_m. If displacement is $\frac{3}{5}$ times the amplitude then partical velocity is - **[RPET 1991]**
(1) $\frac{2}{7} V_m$ (2) $\frac{3}{5} V_m$ (3) $\frac{4}{5} V_m$ (4) $\frac{4}{7} V_m$

18. The displacement represented by y (x, t) = a cos (kx + ωt) represents-
(1) Transverse wave propagating in + x direction.
(2) Transverse wave propagating in – x direction.
(3) Longitudinal wave propagating in + x direction.
(4) Longitudinal wave propagating in – x direction.

19. Equation of a progressive wave $y = a \sin \left(400\pi t - \frac{\pi x}{0.85}\right)$ then its velocity will be :**[RPMT-2000]**
(1) 34 m/s (2) 40 m/s (3) 340 m/s (4) 400 m/s

20. A plane progressive wave is given by y = 25 cos (2πt – πx) Then the amplitude and frequency are respectively **[RPMT-2003]**
(1) 25, 100 (2) 25, 1 (3) 25, 2 (4) 50 π, 2

21. The displacement y of wave travelling in the x-direction is given by
$y = 10^{-4} \sin \left(600t - 2x + \frac{\pi}{3}\right)$ **[RPMT-2008]**
where, x is expressed in metres and t in seconds. The speed of the wave motion, in ms^{-1} is :
(1) 300 (2) 600 (3) 1200 (4) 200

22. A transverse progressive wave on a stretched string has a velocity of 10 ms^{-1} and a frequency of 100 Hz. The phase difference between two particles of the string which are 2.5 cm apart will be - **[MPPMT 1994]**
(1) $\frac{\pi}{8}$ (2) $\frac{\pi}{4}$ (3) $\frac{3\pi}{8}$ (4) $\frac{\pi}{2}$

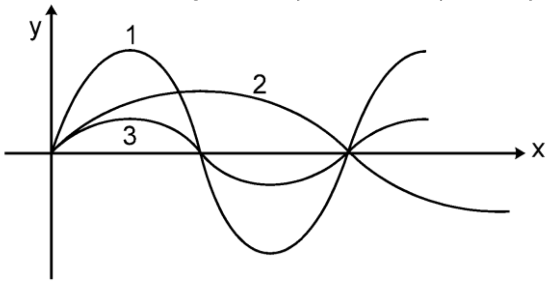
23. The wave described by y = 0.25 sin (10 πx –2πt), where x and y are in meter and t in second, is a wave travelling along the **[AIPMT 2008]**
(1) –ve x direction with frequency 1 Hz
(2) +ve x direction with frequency π Hz and wavelength λ = 0.2 m

(3) +ve x direction with frequency 1 Hz and wavelength $\lambda = 0.2$ m
(4) –ve x direction with amplitude 0.25 m and wavelength $\lambda = 0.2$ m

24. A wave travelling along the x- axis is described by the equation $y(x,t) = 0.005 \cos(\alpha x - \beta t)$. If the wavelength and the time period of the wave are 0.08 m and 2.0 s, respectively, then α and β in appropriate units are **[AIEEE 2008 3/105, –1]**

(1) $\alpha = \frac{0.08}{\pi}, \beta = \frac{2.0}{\pi}$
(2) $\alpha = \frac{0.04}{\pi}, \beta = \frac{1.0}{\pi}$
(3) $\alpha = 12.50\pi, \beta = \frac{\pi}{2.0}$
(4) $\alpha = 25.00\pi, \beta = \pi$

25. Graph shows three waves that are separately sent along a string that is stretched under a certain tension along x–axis. If ω_1, ω_2 and ω_3 are their angular frequencies respectively then :



(1) $\omega_1 = \omega_3 > \omega_2$ (2) $\omega_1 > \omega_2 > \omega_3$ (3) $\omega_2 > \omega_1 = \omega_3$ (4) $\omega_1 = \omega_2 = \omega_3$

26. Which of the following function correctly represents the wave equation for finite values of x and t :
(1) $y = x^2 - t^2$
(2) $y = \cos x^2 \sin t$
(3) $y = \log(x^2 - t^2) - \log(x - t)$
(4) $y = e^{2x} \sin t$

27. When a wave travels in a medium the particle's displacement is given by the equation $y = 0.03 \sin\pi(2t - 0.01x)$, where x and y are in metre and t in second. The wavelength of the wave is:**[RPMT-2006]**
(1) 200 m (2) 100 m (3) 20 m (4) 10 m

28. Which of the following equations represents a wave travelling along y-axis ? **[RPMT-2007]**
(1) $y = A \sin(kx - \omega t)$
(2) $x = A \sin(ky - \omega t)$
(3) $y = A \sin ky \cos \omega t$
(4) $y = A \cos ky \sin \omega t$

29. The phase difference between two waves, represented by
$y_1 = 10^{-6} \sin\{100t + (x/50) + 0.5\}$ m
$y_2 = 10^{-6} \cos\{100t + \left(\frac{x}{50}\right)\}$ m
where x is expressed in meters and t is expressed in seconds, is approximately: **[AIPMT 2004]**
(1) 1.07 rad (2) 2.07 rad (3) 0.5 rad (4) 1.5 rad

30. A transverse stationary wave passes through a string with the equation $y = 10\sin\pi(0.02x - 2.00t)$ where x is in meters and t in seconds. The maximum velocity of the particles in wave motion is **[AIIMS 2000]**
(1) 63 (2) 78 (3) 100 (4) 121

31. Which one of the following represents a wave - **[CPMT 1994]**
(1) $y = A \sin kx$ (2) $y = A \sin \omega t$ (3) $y = A \sin(\omega t - kx)$ (4) None of these

SECTION (C) : INTERFERENCE REFLECTION, TRANSMISSION, POWER TRANSMITED ALONG THE STRING.

1. The equation of displacement of two waves are given as
$y_1 = 10 \sin(3\pi t + \pi/3)$

$y_2 = 5 (\sin 3\pi t + \sqrt{3} \cos 3\pi t)$, then what is the ratio of their amplitude - **[AIIMS 1997]**
(1) 1 : 2 (2) 2 : 1 (3) 1 : 1 (4) None of these

2. When a wave enters from air to any medium, then what remains unchanged - **[RPET 1996]**
(1) Wavelength (2) Frequency (3) Speed (4) All of the above

3. Two waves represented as $y_1 = a \sin\left(\omega t + \frac{\pi}{6}\right)$, $y_2 = a \cos \omega t$ the resultant amplitude is - **[RPMT 1996]**
(1) a (2) $a\sqrt{2}$ (3) $a\sqrt{3}$ (4) 2a

4. The displacement equations for two waves undergoing super position are respectively $y_1 = 4 \sin \omega t$ and $y_2 = 3 \sin (\omega t + \pi/2)$ the amplitude of the resultant wave is - **[RPMT 1996]**
(1) 5 (2) 7 (3) 1 (4) 0

5. If two waves of same frequency and amplitude superpose to produce resultant of the amplitude of either wave, then their phase difference is-
(1) π (2) $2\pi/3$ (3) $\pi/3$ (4) Zero

6. Necessary condicition for interference is that-
(1) The amplitudes of two waves may differ but the phase difference is constant.
(2) The amplitudes of two waves are same and the phase difference is constant.
(3) The amplitudes of two waves are same and the phase difference may change.
(4) The amplitudes of two waves may differ and the phase difference may vary.

7. A wave y = 10 sin (ax + bt) is reflected from a dense medium at an origin. If 81% of energy is reflected then the equation of reflected wave is-
(1) y = –8.1 sin (ax – bt) (2) y = –8.1 sin (ax + bt)
(3) y = –9 sin (ax – bt) (4) y = 9 sin (ax – bt)

8. The resultant amplitude, when two waves of same frequency but with amplitudes a_1 and a_2 superimpose at phase difference of $\frac{\pi}{2}$ will be -
(1) $a_1 + a_2$ (2) $a_1 - a_2$ (3) $\sqrt{a_1^2 + a_2^2}$ (4) $a_1^2 + a_2^2$

9. A wave shown by the equation $y = a \sin (\omega t + \phi)$ is totally reflected by a light medium, then the following will change - **[RPMT 1992]**
(1) Amplitude (a) (2) Angular frequency (ω)
(3) Phase (ϕ) (4) Frequency and phase

10. Two waves represented by : $y_1 = a \sin\left(\omega t + \frac{\pi}{3}\right)$ and $y_2 = a \sin \omega t$ superimpose on each other then resultant amplitude will be : **[RPMT-2001]**
(1) a (2) $\sqrt{2}a$ (3) 2a (4) $\sqrt{3}a$

11. Two wire of length 1m and 2m respectively and mass 150 gm. and 300 gm. respectively. If the tensions are same on both the wires, the ratio of velocities of transverse waves will be - **[RPMT 1992]**
(1) 1 : 1 (2) 1 : 2 (3) 2 : 1 (4) $\sqrt{2}$: 1

SECTION (D) : STANDING WAVE AND RESONANCE

1. Four wires of identical lengths, diameters and of the same material are stretched on a sonometer wire. The ratio of their tension is 1 : 4 : 9 : 16. The ratio of their fundamental frequencies is - **[KCET 2000]**
(1) 1 : 4 : 9 : 16 (2) 4 : 3 : 2 : 1 (3) 1 : 2 : 3 : 4 (4) 16 : 9 : 4 : 1

2. When the length of the vibrating segment of a sonometer wire is increased by 1%, the percentage change in its frequency is - **[KCET 1999]**

(1) 1 (2) 2 (3) $\frac{100}{101}$ (4) $\frac{99}{100}$

3. If vibrations of a string are to be increased by a factor two, then tension in the string must be made **[AIIMS 1999]**

(1) Half (2) Twice (3) Four times (4) Eight times

4. The wire of a sonometer has a length of 1 m and mass 5×10^{-4} kg. It has a tension of 20N. IF the wire is pulled at a point 25 cm away from one end and released, the frequency of its vibrations will be - **[RPET 1999]**

(1) 200 Hz (2) 150 Hz (3) 250 Hz (4) 100 Hz

5. A standing wave having 3 nodes and 2 antinodes is formed between two atoms having a distance of 1.21 Å between them. The wavelength of the standing wave is - **[CPMT 1998]**

(1) 1.21 Å (2) 2.42 Å (3) 3.63 Å (4) 6.05 Å

6. Two strings of the same material and same length have their tensions in the ratio 4 : 1 and radii in the ratio 2 : 1. The ratio of their fundamental frequencies is - **[KCET 1998]**

(1) 4 (2) 1 (3) $\frac{1}{2}$ (4) 2

7. If length of wire is 2m and the mass is 80 kg, the tension in wire will be If frequency is $\frac{1}{4}$ Hz: **[RPMT-2004]**

(1) 400 N (2) 40 N (3) 4 N (4) 4000 N

8. Two waves of intensities I and 4I superpose, then the maximum and minimum intensities are- **[AIIMS 1997]**

(1) 5I and 3I (2) 9I and I (3) 9I and 3I (4) 5I and I

9. In stationary waves at nodes - **[RPMT 1996]**

(1) Energy is maximum (2) Pressure and change in density maximum
(3) Change in strain is maximum (4) All of the above

10. The equation y = 0.15 sin 5x cos 300 t, describes a stationary wave.The wavelength of the station any wave is - **[MPPMT 1995]**

(1) zero (2) 1.256 metres (3) 2.512 metres (4) 0.628 metres

11. The length of a sonometer wire AB is 110 cm. Where should the two bridges be placed from A to divide the wire in 3 segments whose fundamental frequencies are in the ratio of 1 : 2 : 3 **[CPMT 1995]**

(1) 30 cm and 90 cm (2) 40 cm and 80 cm (3) 60 cm and 90 cm (4) 30 cm and 60 cm

12. There are some points in a stationary waves which - **[RPMT 1995]**

(1) Are never at rest (2) Are always in motion
(3) Are at rest twice in each cycle (4) Are at rest once in each cycle

13. The tension in piano wire is 10N. What should be the tension in the wire to produce a note of double the frequency- **[AIIMS 1995]**

(1) 5 N (2) 20 N (3) 40 N (4) 80 N

14. The equation of a stationary wave is $y = 0.8 \cos\left(\frac{\pi x}{20}\right) \sin 200\,\pi t$, where x is in cm and t is in sec. The separation between consecutive nodes will be - **[MPPET 1994]**

(1) 20 cm (2) 10 cm (3) 40 cm (4) 30 cm

15. A wave represented by the given equation $y = a \cos (kx - \omega t)$ is superposed with another wave to form a stationary wave such that the point x = 0 is a node. The equation for the other wave is - **[MPPMT 1994]**

(1) $y = a \sin (kx + \omega t)$ (2) $y = - a \cos (kx + \omega t)$
(3) $y = - a \cos (kx - \omega t)$ (4) $y = - a \sin (kx - \omega t)$

16. In a stationary wave, all particles are - **[MPPMT 1994]**
(1) At rest at the same time twice in every period of oscillation
(2) At rest at the same time only once in a every period of oscillation
(3) Never at rest at the same time
(4) Never at rest at all

17. A plane wave is described by the equation $y = 3 \cos \left(\frac{x}{4} - 10t - \frac{\pi}{2}\right)$. The maximum velocity of the particles of the medium due to this wave is - **[MPPMT 1994]**

(1) 30 (2) $\frac{3\pi}{2}$ (3) $\frac{3}{4}$ (4) 40

18. The equation of a wave travelling in a string can be written as $y = 3 \cos \pi (100 t - x)$. Its wavelength is - **[MPPMT 1994]**
(1) 100 cm (2) 2 cm (3) 5 cm (4) None of these

19. A stationary wave is represented by $y = A \sin (100 t) \cos (0.01x)$, where y and A are in millimeters, t is in seconds and x is in metres. The velocity of the wave is - **[CPMT 1994]**
(1) 1 m/s (2) 10^2 m/s (3) 10^4 m/s (4) Not derivable

20. In a stationary wave - **[RPMT 1992]**
(1) At each point energy is same (2) Energy propagates in the direction of propagation
(3) At each point energy is zero (4) Energy transfer does not take place

21. The frequency of a stretched wire is n, if tenstion is increased by two times, the frequency will be **[RPMT 1991]**

(1) 2n (2) $\frac{n}{2}$ (3) n (4) $\sqrt{2}n$

22. Equation $y = 2a \cos Kx \sin \omega t$ represents - **[RPMT 1991]**
(1) Progressive wave (2) Stationary wave (3) Light wave (4) None of these

23. In a tight string, to double the fundamental frequency its length is made $\frac{3}{4}$ times the initial length, tension will be changed by which multiple ? **[RPMT-2010]**

(1) $\frac{3}{8}$ (2) $\frac{2}{3}$ (3) $\frac{8}{9}$ (4) $\frac{9}{4}$

24. Standing waves are produced in 10 m long stretched string. If the string vibrates in 5 segments and wave velocity is 20 m/s, its frequency is **[AIIMS 1998]**
(1) 5 Hz (2) 4 Hz (3) 2 Hz (4) 10 Hz

25. A string a musical instrument is 50 cm long and its fundamental frequency is 270 Hz. If a frequency of 1000 Hz is to be produced, then required length of string is - **[CPMT 2000]**
(1) 13.5 cm (2) 10.3 cm (3) 5.4 cm (4) 2.7 cm

26. A wave of frequency 100 Hz travels along a string towards its fixed end. When this wave travels back, after reflection, a node is formed at a distance of 10 cm from the fixed end. The speed of the wave (incident and reflected) is- **[CPMT 1994]**
(1) 5 m/s (2) 10 m/s (3) 20 m/s (4) 40 m/s

27. In stationary waves, antinodes are the points where there is -
(1) Minimum displacement and minimum pressure change
(2) Minimum displacement and maximum pressure change
(3) Maximum displacement and maximum pressure change
(4) Maximum displacement and minimum pressure change

28. In the n_{th} normal mode of vibration of a string there are **[RPMT-2014]**
(1) n nodes; n natinodes (2) (n + 1) nodes ; (n + 1) antinodes
(3) n nodes ; (n + 1) antinodes (4) (n + 1) nodes ; n antinodes

29. A string is stretched between fixed points separated by 75 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. Then, the lowest resonant frequency for this string is **[AIEEE 2006 3/180]**
(1) 10.5 Hz (2) 105 Hz (3) 1.05 Hz (4) 1050 Hz

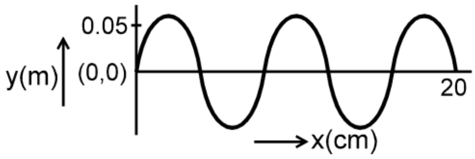
30. In a stationary wave represented by y = a sin ωt cos kx, amplitude of the component progressive wave is
(1) $\frac{a}{2}$ (2) a (3) 2a (4) None of these

31. A sonometer wire when vibrated in full length has frequency n. Now it is divided by the help of bridges into a number of segments of length ℓ_1, ℓ_2, ℓ_3, ..., When vibrated these segments have frequencies n_1, n_2, n_3, ... then the correct relation is : **[AIPMT 2000]**
(1) $n = n_1 + n_2 + n_3 + ...$ (2) $n_2 = n_{12} + n_{22} + n_{32} + ...$
(3) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3} + ...$ (4) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}} + ...$

Exercise-2

ONLY ONE OPTION CORRECT TYPE

1. For the wave shown in figure, the equation for the wave, travelling along +x axis with velocity 350 ms^{-1} when its position at t = 0 is as shown



(1) 0.05 sin ($\frac{314}{4}$ x – 27500 t) (2) 0.05 sin ($\frac{379}{5}$ x – 27000 t)
(3) 1 sin ($\frac{314}{4}$ x – 27500 t) (4) 0.05 sin ($\frac{289}{5}$ x + 25700 t)

2. The displacement of a wave disturbance propagating in the positive x-direction is given by $y = 1/(1 + x_2)$ at time t = 0 and $y = 1/[1 + (x – 1)_2]$ at t = 2 seconds where x and y are in metres. The shape of the wave disturbance does not change during the propagation. The velocity of the wave is **[JEE - 90]**
(1) 2.5 m/s (2) 0.25 m/s (3) 0.5 m/s (4) 5 m/s

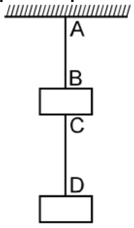
3. A transverse wave is described by the equation $Y = Y_0 \sin 2\pi (ft – x/\lambda)$. The maximum particle velocity is equal to four times the wave velocity if **[JEE - 1984]**
(1) $\lambda = \pi Y_0/4$ (2) $\lambda = \pi Y_0/2$ (3) $\lambda = \pi Y_0$ (4) $\lambda = 2\pi Y_0$

4. A travelling wave on a string is given by $y = A \sin [\alpha x + \beta t + \frac{\pi}{6}]$. The displacement and velocity of oscillation of a point α = 0.56 /cm, β = 12/sec, A = 7.5 cm, x = 1 cm and t = 1s is
(1) 4.6 cm, 46.5 cm s^{-1} (2) 3.75 cm, 77.94 cm s^{-1}

(3) 1.76 cm, 7.5 cm s^{-1} (4) 7.5 cm, 75 cm s^{-1}

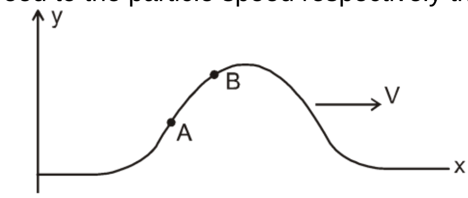
5. A transverse wave of amplitude 0.50m, wavelength 1m and frequency 2 Hz is propagating in a string in the negative x-direction. The expression form of the wave is
(1) y(x, t) = 0.5 sin (2πx – 4πt) (2) y(x, t) = 0.5 cos (2πx + 4πt)
(3) y(x, t) = 0.5 sin (πx – 2πt) (4) y(x, t) = 0.5 cos (2πx – 2πt) **[REE - 89]**

6. Two blocks each having a mass of 3.2 kg are connected by a wire CD and the system is suspended from the ceiling by another wire AB (figure). The linear mass density of the wire AB is 10 g/m and that of CD is 8 g/m. The speed of a transverse wave pulse produced in AB and in CD are : **[HCV Ex. 21]**



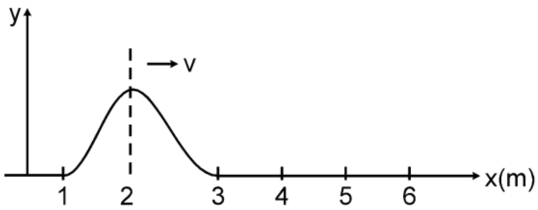
(1) 79 m/s and 63 m/s (2) 63 m/s and 79 m/s
(3) 63 m/s in both (4) 79 m/s in both

7. A wave pulse is generated in a string that lies along x-axis. At the points A and B, as shown in figure, if R_A and R_B are ratio of wave speed to the particle speed respectively then :



(1) $R_A > R_B$ (2) $R_B > R_A$ (3) $R_A = R_B$
(4) Information is not sufficient to decide.

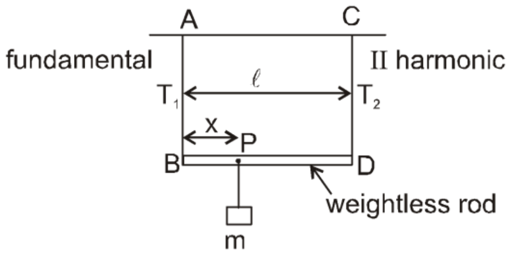
8. Wave pulse on a string shown in figure is moving to the right without changing shape. Consider two particles at positions x_1 = 1.5 m and x_2 = 2.5 m. Their transverse velocities at the moment shown in figure are along directions :



(1) positive y–axis and positive y–axis respectively
(2) negative y–axis and positive y–axis respectively
(3) positive y–axis and negative y–axis respectively
(4) negative y–axis and negative y–axis respectively

9. When two waves of the same amplitude and frequency but having a phase difference of ϕ, travelling with the same speed in the same direction (positive x), interfere, then
(1) their resultant amplitude will be twice that of a single wave but the frequency will be same
(2) their resultant amplitude and frequency will both be twice that of a single wave
(3) their resultant amplitude will depend on the phase angle while the frequency will be the same
(4) the frequency and amplitude of the resultant wave will depend upon the phase angle.

10. A massless rod BD is suspended by two identical massless strings AB and CD of equal lengths. A block of mass 'm' is suspended point P such that BP is equal to 'x', if the fundamental frequency of the left wire is twice the fundamental frequency of right wire, then the value of x is :
[JEE–2006, mains, 3/184]



(1) l/5 (2) l/4 (3) 4l/5 (4) 3l/4

11. If the ratio of two sound intensities is 1 : 16, the ratio of their amplitudes will be-

(1) $\frac{1}{2}$ (2) $\frac{1}{4}$ (3) $\frac{1}{8}$ (4) $\frac{1}{16}$

12. Two waves of same frequency and of intensity I_0 and $9I_0$ produces interference. If at a certain point the resultant intensity is $7I_0$ then the minimum phase difference between the two sound waves will be -

(1) 90º (2) 100º (3) 120º (4) 110º

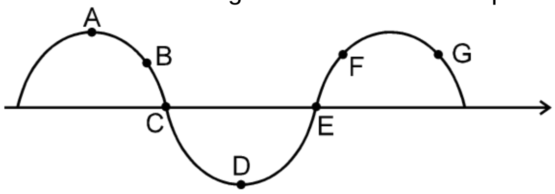
13. If the ratio of amplitudes of two waves at any point in the medium is 1 : 3, then the ratio of maximum and minimum intensities due to their superposition will be

(1) 2 : 3 (2) 3 : 1 (3) 2 : 1 (4) 4 :1

14. Two waves of equal amplitude A, and equal frequency travels in the same direction in a medium. The amplitude of the resultant wave is

(1) 0 (2) A (3) 2A (4) between 0 and 2A

15. The following figure depicts a wave travelling in a medium. Which pair of particles are in phase.



(1) A and D (2) B and F (3) C and E (4) B and G

16. The rate of transfer of energy in a wave depends

(1) directly on the square of the wave amplitude and square of the wave frequency
(2) directly on the square of the wave amplitude and square root of the wave frequency
(3) directly on the wave frequency and square of the wave amplitude
(4) directly on the wave amplitude and square of the wave frequency

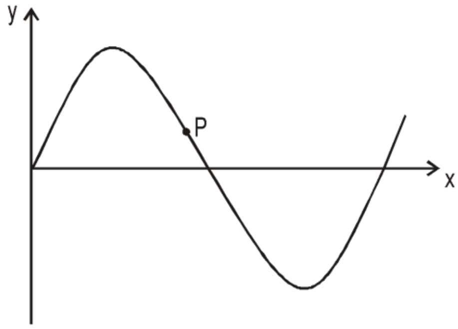
17. A wave moving with constant speed on a uniform string passes the point x = 0 with amplitude A_0, angular frequency ω_0 and average rate of energy transfer P_0. As the wave travels down the string it gradually loses energy and at the point x = ℓ, the average rate of energy transfer becomes $\frac{P_0}{2}$. At the point x = ℓ, angular frequency and amplitude are respectively :

(1) ω_0 and $A_0/\sqrt{2}$ (2) $\omega_0/\sqrt{2}$ and A_0 (3) less than ω_0 and A_0 (4) $\omega_0/\sqrt{2}$ and $A_0/\sqrt{2}$

18. For a wave displacement amplitude is 10^{-8} m, density of air 1.3 kg m^{-3}, velocity in air 340 ms^{-1} and frequency is 2000 Hz. The intensity of wave is

(1) 5.3×10^{-4} Wm^{-2} (2) 5.3×10^{-6} Wm^{-2} (3) 3.5×10^{-8} Wm^{-2} (4) 3.5×10^{-6} Wm^{-2}

19. A transverse sinusoidal wave moves along a string in the positive x-direction at a speed of 10 cm/s. The wavelength of the wave is 0.5 m and its amplitude is 10 cm. At a particular time t, the snap-shot of the wave is shown in figure. The velocity of point P when its displacement is 5 cm is **[JEE - 2008, 3/163]**



(1) $\frac{\sqrt{3}\pi}{50}\hat{j}$ m/s (2) $-\frac{\sqrt{3}\pi}{50}\hat{j}$ m/s (3) $\frac{\sqrt{3}\pi}{50}\hat{i}$ m/s (4) $-\frac{\sqrt{3}\pi}{50}\hat{i}$ m/s

20. A stretched string of length L, fixed at both ends can sustain stationary waves of wavelength λ given by (n is number of loop)
(1) $\lambda = n^2/2L$ (2) $\lambda = L^2/2n$ (3) $\lambda = 2L/n$ (4) $\lambda = 2L\,n$

21. The wave produced in the wire of a sonometer are -
(1) Transverse, progressive and polarized (2) Longitudinal
(3) Transverse, stationary and polarized (4) Transverse, stationary and un polarised

22. The equation of a stationary wave is $Y = 10 \sin \frac{\pi x}{4} \cos 20\pi t$. The distance between two consecutive nodes in meters is -
(1) 4 (2) 2 (3) 5 (4) 8

23. Stationary wave is represented by
$y = A \sin (100t) \cos (0.01x)$
where y and A are in mm, t in sec, and x in m. The velocity of the wave -
(1) 1 m/s (2) 10^2 m/s (3) 10^4 m/s (4) not derivable

24. A wave represented by the equation $y = a \cos(kx - \omega t)$ is superposed with another wave to form a stationary wave such that the point x = 0 is a node . The equation for other wave is : **[JEE - 88]**
(1) $a \sin(kx + \omega t)$ (2) $-a \cos(kx + \omega t)$ (3) $-a \cos(kx - \omega t)$ (4) $-a \sin(kx - \omega t)$

25. A stretched sonometer wire resonates at a frequency of 350 Hz and at the next higher frequency of 420 Hz. The fundamental frequency of this wire is
(1) 350 Hz (2) 5 Hz (3) 70 Hz (4) 170 Hz

26. Two stretched wires A and B of the same lengths vibrate independently. If the radius, density and tension of wire A are respectively twice those of wire B, then the fundamental frequency of vibration of A relative to that of B is **[REE - 90]**
(1) 1 : 1 (2) 1 : 2 (3) 1 : 4 (4) 1 : 8

27. Two strings A and B have lengths ℓ_A and ℓ_B and carry pendulum of masses M_A and M_B at their lower ends the upper ends being supported by rigid supports. If n_A and n_B are their frequencies of their oscilations and $n_A = 2n_B$, then : **[AIPMT 2000]**
(1) $\ell_A = 4\ell_B$, regardless of masses (2) $\ell_B = 4\ell_A$, regardless of masses
(3) $M_A = 2M_B$, $\ell_A = 2\ell_B$ (4) $M_B = 2M_A$, $\ell_B = 2\ell_A$.

28. The equation of a wave is represented by :- **[AIPMT-2001]**
$y = 10^{-4} \sin\left(100t - \frac{x}{10}\right)$ m, where x and y are in meter and t in second; then the velocity of wave will be
(1) 0.01 m/s. (2) 10 m/s. (3) 100 m/s . (4) 1000 m/s.

29. If the tension and diameter of a sonometer wire of fundamental frequency n is doubled and density is halved then its fundamental frequency will become - **[AIPMT-2001]**

(1) $\frac{n}{4}$ (2) $\sqrt{2}n$ (3) n (4) $\frac{n}{\sqrt{2}}$

30. A wave travelling in positive X-direction with A = 0.2 m, velocity = 360 m/s and wavelength λ = 60 m, then correct expression for the wave is :- **[AIPMT 2002]**

(1) $y = 0.2\sin 2\pi\left(6t+\frac{x}{60}\right)$ (2) $y = 0.2\sin\pi\left(6t+\frac{x}{60}\right)$

(3) $y = 0.2\sin 2\pi\left(6t-\frac{x}{60}\right)$ (4) $y = 0.2\sin\pi\left(6t-\frac{x}{60}\right)$

31. Vibrations of rope tied by two rigid ends shown by equation
$y = \cos 2\pi t \sin 2\pi x$
then minimum length of the rope will be : **[RPMT-2001]**

(1) 1m (2) 1/2 m (3) 5m (4) 2π m

32. Two waves of intensities ratio are 9 : 1 then the ratio of their resultant's maximum and minimum intensities will be : **[RPMT-2002]**

(1) 10 : 8 (2) 7 : 2 (3) 4 : 1 (4) 2 : 1

33. Linear density of a string is 1.3×10^{-4} kg/m and wave equation is y = 0.021 sin (x + 30t). Find the tension in the string where x in metre and t in second : **[RPMT-2002]**

(1) 0.12 N (2) 0.21 N (3) 1.2 N (4) 0.012N

34. A wave y = a sin (ωt - kx) on a string meets with another wave producing a node at x = O. Then the equation of the unknown wave is : **[AIEEE - 2002 4/300]**

(1) y = a sin (ωt + kx) (2) y = -a sin (ωt + kx) (3) y = a sin (ωt - kx) (4) y = -a sin (ωt - kx)

35. Length of a string tied to two rigid supports is 40 cm. Maximum length (wavelength in cm) of a stationary wave produced on it, is - **[AIEEE - 2002 4/300]**

(1) 20 (2) 80 (3) 40 (4) 120

36. A metal wire of linear mass density of 9.8 g/m is stretched with a tension of 10 kg-wt between two rigid supports 1 metre apart. The wire passes at its middle point between the poles of a permanent magnet and it vibrates in resonance when carrying an alternating current of frequency n. The frequency n of the alternating source is : **[AIEEE 2003 4/300]**

(1) 50 Hz (2) 100 Hz (3) 200 Hz (4) 25 Hz

37. Two vibrating strings of the same material but lengths L & 2 L have radii 2 r and r respectively. They are stretched under the same tension. Both the strings vibrate in their fundamental modes, the one of length L with frequency f_1 and the other with frequency f_2. The ratio f_1/f_2 is given by: **[JEE-2000 Screening, 1/100]**

(1) 2 (2) 4 (3) 8 (4) 1

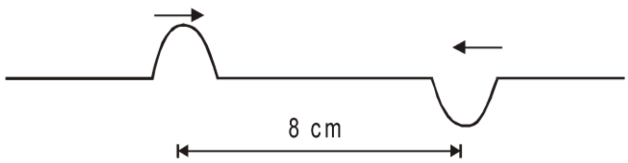
38. Two sinusoidal waves with same wavelengths and amplitude travel in opposite directions along a string with a speed 10 ms^{-1}. If the minimum time interval between instants when the string is flat is 0.5s, the wavelength of the waves is : **[REE - 2000]**

(1) 25 m (2) 20 m (3) 15 m (4) 10 m

39. The ends of a stretched wire of length L are fixed at x = 0 & x = L . In one experiment the displacement of the wire is $y_1 = A \sin(\pi x/L) \sin \omega t$ & energy is E_1 and in other experiment its displacement is $y_2 = A \sin(2\pi x/L) \sin 2\omega t$ and energy is E_2 . Then : **[JEE - 2001 Screening, 2/200]**

(1) $E_2 = E_1$ (2) $E_2 = 2 E_1$ (3) $E_2 = 4 E_1$ (4) $E_2 = 16 E_1$

40. Two symetrical and identical pulses in a stretched string, whose centres are initially 8 cm apart, are moving towards each other as shown in the figure. The speed of each pulse is 2 cm/s. After 2 seconds, the total energy of the pulses will be : **[JEE - 2001 Screening, 2/200]**



(1) zero (2) purely kinetic
(3) purely potential (4) partly kinetic and partly potential

41. A sonometer wire resonates with a given tuning fork forming standing waves with five antinodes between the two bridges when a mass of 9 kg is suspended from the wire . When this mass is replaced by a mass M, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. The value of M is **[JEE - 2002 Screening, 3/300]**

(1) 25 kg (2) 5 kg (3) 12.5 kg (4) 1/25 kg

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. A wave in a string has an amplitude of 2 cm. The wave travels in the +ve direction of x axis with a speed of 128 ms^{-1} and it is noted that 5 complete waves fit in 4m length of the string. The equation describing the wave is **[AIPMT 2009]**

(1) y = (0.02)m sin (7.85 x + 100 5t) (2) y = (0.02)m sin (15.7 x – 2010t)
(3) y = (0.02)m sin (15.7 x + 2010t) (4) y = (0.02)m sin (7.85 x – 100 5t)

2. A transverse wave is represented by y = Asin(ωt – kx). For what value of the wavelength is the wave velocity equal to the maximum particle velocity? **[AIPMT 2010]**

(1) πA/2 (2) πA (3) 2πA (4) A

3. Two waves are represented by the equations y_1 = a sin(ωt + kx + 0.57)m and y_2 = a cos(ωt + kx)m, where x is in meter and t in sec.The phase difference between them is : **[AIPMT (Scr)-2011]**

(1) 1.0 radian (2) 1.25 radian (3) 1.57 radian (4) 0.57 radian

4. When a string is divided into three segments of length ℓ_1,ℓ_2 and ℓ_3 the fundamental frequencies of these three segments are ν_1,ν_2 and ν_3 respectively. The original fundamental frequency (ν) of the string is **[AIPMT-Pre-2012]**

(1) $\sqrt{\nu} = \sqrt{\nu_1} + \sqrt{\nu_2} + \sqrt{\nu_3}$ (2) $\nu = \nu_1 + \nu_2 + \nu_3$

(3) $\frac{1}{\nu} = \frac{1}{\nu_1} + \frac{1}{\nu_2} + \frac{1}{\nu_3}$ (4) $\frac{1}{\sqrt{\nu}} = \frac{1}{\sqrt{\nu_1}} + \frac{1}{\sqrt{\nu_2}} + \frac{1}{\sqrt{\nu_3}}$

5. The equation of a simple harmonic wave is given by **[AIPMT (Mains)-2012]**

$$y = 3\sin\frac{\pi}{2}(50t - x)$$

Where x and y are in meters and t is in seconds. The ratio of maximum particle velocity to the wave velocity is

(1) 2π (2) $\frac{3}{2}\pi$ (3) 3π (4) $\frac{2}{3}\pi$

6. A wave travelling in the +ve x-direction having displacement along y-direction as 1m, wavelength 2πm and frequency of $\frac{1}{\pi}$ Hz is represented by : **[NEET-2013]**

(1) $y = \sin(2\pi x - 2\pi t)$
(2) $y = \sin(10\pi x - 20\pi t)$
(3) $y = \sin(2\pi x + 2\pi t)$
(4) $y = \sin(x - 2t)$

7. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by: **[AIPMT-2014]**

(1) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$
(2) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$
(3) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$
(4) $n = n_1 + n_2 + n_3$

8. A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. The lowest resonant frequency for this string is : **[AIPMT 2015]**

(1) 205 Hz
(2) 10.5 Hz
(3) 105 Hz
(4) 155 Hz

9. A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. The ratio λ_2/λ_1 is :

[AIPMT-2016]

(1) $\sqrt{\frac{m_1+m_2}{m_1}}$
(2) $\sqrt{\frac{m_1}{m_2}}$
(3) $\sqrt{\frac{m_1+m_2}{m_2}}$
(4) $\sqrt{\frac{m_2}{m_1}}$

PART - II : AIIMS QUESTION (PREVIOUS YEARS)

1. Five sinusoidal waves have the same frequency 500 Hz but their amplitudes are in the ratio $2:\frac{1}{2}:\frac{1}{2}:1:1$ and their phase angles $0, \frac{\pi}{6}, \frac{\pi}{3}, \frac{\pi}{2}$ and π respectively. The phase angle of resultant wave obtained by the superposition of resultant wave obtained by the superposition of these five waves is

[AIIMS 2010]

(1) 30º
(2) 45º
(3) 60º
(4) 90º

PART - III : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. The equation of a wave on a string of linear mass density 0.04 kg m^{-1} is given by y = 0.02 (m) sin $\left[2\pi\left(\frac{t}{0.04(s)} - \frac{x}{0.50(m)}\right)\right]$. The tension in the string is : **[AIEEE 2010 144/4 –1]**

(1) 4.0 N
(2) 12.5 N
(3) 0.5 N
(4) 6.25 N

2. The transverse displacement y(x,t) of a wave on a string is given by

$y(x,t) = e^{-\left(ax^2+bt^2+2\sqrt{ab}\ xt\right)}$. This represents a : **[AIEEE - 2011, 4/120, –1]**

(1) wave moving in +x–direction with speed $\sqrt{\frac{a}{b}}$ (2) wave moving in –x-direction with speed $\sqrt{\frac{b}{a}}$

(3) standing wave of frequency $\sqrt{b}$ (4) standing wave of frequency $\frac{1}{\sqrt{b}}$

3. A travelling wave represented by y = A sin ((ωt – kx) is superimposed on another wave represented by y = A sin (ωt + kx). The resultant is : **[AIEEE 2011, 11 MAY; 4, –1]**

(1) A wave travelling along + x direction

(2) A wave travelling along – x direction

(3) A standing wave having nodes at x = $\frac{n\lambda}{2}$, n = 0, 1, 2 ....

(4) A standing wave having nodes at x = $\left(n+\frac{1}{2}\right)\frac{\lambda}{2}$; n = 0, 1, 2 .....

4. **Statement - 1 :** **[AIEEE 2011, 11 MAY; 4, –1]**

Two longitudinal waves given by equations : y_1 (x, t) = 2a sin (ωt – kx) and y_2 (x, t) = a sin (2ωt – 2kx) will have equal intensity.

Statement - 2:

Intensity of waves of given frequency in same medium is proportional to square of amplitude only.

(1) Statement-1 is true, statement-2 is false.

(2) Statement-1 is true, statement-2 is true, statement-2 is the correct explanation of statment-1

(3) Statement-1 is true, statement-2 is true, statement-2 is not the correct explanation of statement-1

(4) Statement-1 is false, statement-2 is true.

5. A uniform string of length 20 m is suspended from a rigid support. A short wave pulse is introduced at its lowest end. It starts moving up the string. The time taken to reach the support is : (take g = 10 ms^{-2})

[JEE Main 2016]

(1) 2 s (2) $2\sqrt{2}$ s (3) $\sqrt{2}$ s (4) $2\pi\sqrt{2}$ s

6. A heavy ball of mass M is suspended from the ceiling of a car by a light string of mass m (m ≪ M). When the car is at rest, the speed of transverse waves in the string is 60 ms^{-1}. When the car has acceleration a, the wave-speed increases to 60.5 ms^{-1}. The value of a, in terms of gravitational acceleration g, is closest to : **[JEE Main 2019]**

(1) $\frac{g}{30}$ (2) $\frac{g}{20}$ (3) $\frac{g}{5}$ (4) $\frac{g}{10}$

7. A string of length 1m and mass 5g is fixed at both ends. The tension in the string is 8.0N. The string is set into vibration using an external vibrator of frequency 100 Hz. The separation between successive nodes on the string is close to : **[JEE Main 2019]**

(1) 20.0 cm (2) 10.0 cm (3) 33.3 cm (4) 16.6 cm

8. Equation of travelling wave on a stretched string of linear density 5 g/m is y = 0.03 sin (450 t – 9x) where distance and time are measured in SI units. The tension in the string is : **[JEE Main 2019]**

(1) 12.5 N (2) 7.5 N (3) 10 N (4) 5 N

9. A travelling harmonic wave is represented by the equation y (x, y) = 10^{-3} sin (50t + 2x), where x and y are in meter and t is in seconds. Which of the following is a correct statement about the wave ?

[JEE Main 2019]

(1) The wave is propagating along the positive x–axis with speed 25 ms^{-1}

(2) The wave is propagating along the negative x–axis with speed 25 ms^{-1}

(3) The wave is propagating along the negative x–axis with speed 100 ms^{-1}

(4) The wave is propagating along the positive x–axis with speed 100 ms^{-1}

Answers

EXERCISE - 1

SECTION (A) :

1.	(3)	**2.**	(1)	**3.**	(4)	**4.**	(4)	**5.**	(3)	**6.**	(1)	**7.**	(1)
8.	(1)	**9.**	(4)										

SECTION (B) :

1.	(2)	**2.**	(4)	**3.**	(1)	**4.**	(2)	**5.**	(1)	**6.**	(4)	**7.**	(4)
8.	(3)	**9.**	(2)	**10.**	(1)	**11.**	(3)	**12.**	(4)	**13.**	(3)	**14.**	(3)
15.	(3)	**16.**	(4)	**17.**	(3)	**18.**	(2)	**19.**	(3)	**20.**	(2)	**21.**	(1)
22.	(4)	**23.**	(3)	**24.**	(4)	**25.**	(1)	**26.**	(3)	**27.**	(1)	**28.**	(2)
29.	(1)	**30.**	(1)	**31.**	(3)								

SECTION (C) :

1.	(3)	**2.**	(2)	**3.**	(3)	**4.**	(1)	**5.**	(2)	**6.**	(1)	**7.**	(4)
8.	(3)	**9.**	(3)	**10.**	(4)	**11.**	(1)						

SECTION (D) :

1.	(3)	**2.**	(1)	**3.**	(3)	**4.**	(1)	**5.**	(1)	**6.**	(2)	**7.**	(2)
8.	(2)	**9.**	(3)	**10.**	(2)	**11.**	(3)	**12.**	(3)	**13.**	(3)	**14.**	(1)
15.	(2)	**16.**	(1)	**17.**	(1)	**18.**	(2)	**19.**	(4)	**20.**	(4)	**21.**	(4)
22.	(2)	**23.**	(4)	**24.**	(1)	**25.**	(1)	**26.**	(3)	**27.**	(4)	**28.**	(4)
29.	(2)	**30.**	(1)	**31.**	(3)								

EXERCISE - 2

1.	(1)	**2.**	(3)	**3.**	(2)	**4.**	(2)	**5.**	(2)	**6.**	(1)	**7.**	(2)
8.	(2)	**9.**	(3)	**10.**	(1)	**11.**	(2)	**12.**	(3)	**13.**	(4)	**14.**	(4)
15.	(4)	**16.**	(1)	**17.**	(1)	**18.**	(4)	**19.**	(1)	**20.**	(3)	**21.**	(4)
22.	(4)	**23.**	(4)	**24.**	(2)	**25.**	(3)	**26.**	(2)	**27.**	(2)	**28.**	(4)
29.	(3)	**30.**	(3)	**31.**	(2)	**32.**	(3)	**33.**	(1)	**34.**	(2)	**35.**	(2)
36.	(2)	**37.**	(4)	**38.**	(4)	**39.**	(3)	**40.**	(2)	**41.**	(1)		

EXERCISE - 3

PART - I

1.	(4)	**2.**	(3)	**3.**	(1)	**4.**	(3)	**5.**	(2)	**6.**	(4)	**7.**	(1)
8.	(3)	**9.**	(3)										

PART - II

1. (2)

PART - III

1.	(4)	**2.**	(2)	**3.**	(4)	**4.**	(1)	**5.**	(2)	**6.**	(3)	**7.**	(1)
8.	(1)	**9.**	(2)										