Old Exams - Questions Ch-16

T081 :

Q1. The displacement of a string carrying a traveling sinusoidal wave is given by: $y(x,t) = y_m \sin(kx - \omega t + \varphi)$. At time $t = 0$ the point at $x = 0$ has a displacement of zero and is moving in the positive y direction. Find the value of the phase constant φ. (Ans: 180^0)

Q2. A stretched string of mass 2.0 g and length 10 cm, carries a wave having the following displacement wave: $y(x,t) = 0.05\sin(2\pi x - 400\pi t)$, where x and y are in meters and t is in seconds. What is the tension in the string? (Ans: 800 N)

Q3: A harmonic wave in a string is described by the equation: $y(x,t) = 0.200 \sin(\pi x - 40.0 t)$, where x and y are in m and t in s. If the mass per unit length of this string is 15.0 g/m, determine the power transmitted to the wave.
(Ans: 6.11 W)

Q4.Two identical traveling waves of amplitude 10.0 cm, moving in the same direction, are out of phase by π/4 rad. Find the amplitude of the resultant wave.(Ans: 18.5 cm)

T072

Q1. The equation of a transverse sinusoidal wave traveling along a stretched string is: y (x,t) = 0.035 sin (0.020x + 4.0t) ,where x and y are in meters and t is in seconds. What is the transverse speed of the particle at x = 0.035 m when t = 0.26 s? (Ans: 7.1 cm/s)

Q2.A standing wave is set up on a string that is fixed at both ends. The standing wave has four loops and a frequency of 600 Hz. The speed of waves on the string is 400 m/s. What is the length of the string? (Ans: 1.3 m)

Q3. If you set up the fifth harmonic on a string that is fixed at both ends, which of the following statements is CORRECT? (Ans: There is an antinode at the middle of the string.)

Q4. Two identical sinusoidal waves, each having amplitude *ym*, are traveling in the same direction on the same stretched string. What phase difference between them will give a resultant wave whose amplitude is 0.5 *ym*? (Ans: 151 degrees)

Q5. A stretched string is 2.70 m long, has a mass of 0.260 kg, and is under a tension of 36.0 N. A wave of amplitude 8.50 mm is traveling on this string. What must be the frequency of the wave for the average power to be 85.0 W? (Ans: 179 Hz)

T071:

Q#1: Two identical sinusoidal traveling waves are sent along the same string in the same direction. What should be the phase difference between the two waves so that the amplitude of the resultant wave is equal to the amplitude of each wave? (Ans: 120^0)

Q#2:A stretched string is fixed at both ends. Two adjacent resonant frequencies of the string are 224 Hz and 256 Hz. What is the frequency of the third harmonic standing wave pattern? (Ans: 96 Hz)

Q#4:A wave with an amplitude of 1.0 cm and wavelength 2.5 m is generated on a string with a linear density of 20 g/m that is under a tension of 5.0 N. What is the maximum transverse speed of a point on the string? (Ans: 0.40 m/s)

T062:

Q#1: A uniform wire, having a mass of 0.4 kg and length of 6.5 m, is connected to a pulse generator. The tension is maintained in the wire by suspending a 3.5 kg mass on the other end. Find the time it takes a pulse to travel from a pulse generator to the other end. (Ans: 0.28 s)

Q#2. Two identical traveling waves, with a phase difference φ, are moving in the same direction. If they are interfering and the combined wave has an amplitude 0.5 times that of the common amplitude of the two waves, calculate φ (in radians). (Ans: 2.64)

Q#3. A string, fixed at its ends, vibrates according to the equation: $y= 0.5\sin(1.5\pi x)\cos(40\pi t)$ where *x* and are in meters and *t* is in seconds. What are the amplitude and velocity of the component waves whose superposition can give rise to this wave? *y* (Ans: 0.25 m, 26.7 m/s)

Q#4. When a wave travels through a medium, individual particles execute a periodic motion given by the equation: $y = 4.0 \sin[\pi/4(2t+x/8)]$ where x and y and are in meters and *t* is in seconds. The phase difference at any given instant between two particles that are 20.0 m apart is: *xy (Ans:* 112.5°)

Q#5. A string is fixed at both ends. On increasing the tension in the string by 2.5 N, the fundamental frequency is altered in the ratio of 3 : 2. The original stretching force is: (Ans: 2 N)

T061:

Q1. A vibrator having a frequency of 200 Hz generates a standing wave of six loops with amplitude of in a string clamped at both side. If the speed of the wave on the string is 100 m/s, what is the length of the string? (Ans: 1.5 m)

Q#2. For the superposition of the following two harmonic waves: $y_1=(4.0\text{ m})\sin(2\pi x-4\pi t)$ and $y_2=(4.0\text{ m})\sin(2\pi x+4\pi t)$, where *x* is in meter and *t* is in second, the distance between any two successive nodes will be (Ans: 0.50 m)

Q#3. A particle of a string moves up and down as a traveling sinusoidal wave passes through it. If the time for that particle to move from maximum displacement to zero displacement is , what is the frequency of the wave? (Ans: 1.25 Hz)

Q#4. A string of length 50.0 m and mass of 25.0 grams is under tension of 75.0 N. An electric vibrator operating at 40.0 Hz is generating a harmonic wave in the string. The average power the vibrator can supply to the string is 500 W. What is the amplitude of the wave? (Ans: 0.29 m)

T052:

Q#9. Equations 1-5 describes five sinusoidal waves traveling on five different strings.

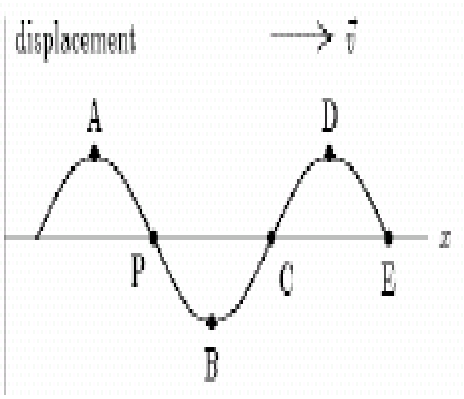
1. $y(x, t) = 2 \sin(2x - 4t)$
2. $y(x, t) = 2 \sin(4x - 10t)$
3. $y(x, t) = 2 \sin(6x - 12t)$
4. $y(x, t) = 2 \sin(8x - 16t)$
5. $y(x, t) = 2 \sin(10x - 20t)$

(x and y are in centimeters and t is in seconds). All strings have the same tension and all have the same linear mass density, except one. The string with the different linear mass density is:

Q#16. A string is vibrating in its fifth-harmonic standing wave pattern described by the equation : $y(x,t)= 0.25 \sin(\pi x) \times \cos(15t)$ m. Find the length of the string. (Ans: 5 m)

Q#19. A string, under a tension of 100 N, is observed to oscillate at two adjacent resonant frequencies of 300 Hz and 400 Hz. Then tension in the string is changed and the string is observed to oscillate at resonant frequencies of 400 Hz and 480 Hz with no intermediate frequencies. Find the new tension in the string. (Ans: 64 N)

Q#14. A traveling sinusoidal wave is shown in the figure 1. At which point is the motion 180^0 out of phase with the motion at point P? (Ans: C)



T051:

Q#1. The tension in a string with a linear mass density of 1.0×10^{-3} kg/m is 0.40 N. A sinusoidal wave with a wavelength of 20 cm on this string has a frequency of: (Ans: 100 Hz)

Q#2. A wave is described by y(x, t) = 0.1 sin(3x –ωt), where x and y are in meters. If the maximum transverse speed is 60 m/s, what is the speed of the wave? (Ans: 200 m/s)

Q#3. Two sinusoidal waves having wavelength of 5 m and amplitude of 10 cm, are traveling in opposite directions on a 20-m long stretched string fixed at both ends. Excluding the nodes at the ends of the string, how many nodes appear in the resulting standing wave? (Ans: 7)

Q#4. Two stretched strings have the same linear density. The tension in the second string is half the tension in the first ($T_2=T_1/2$), and its length is only one third the first ($L_2=L_1/3$). Compare the fundamental frequencies for both strings (f1/f2). (Ans: 0.47)

T042:

Q#1 A transverse sinusoidal wave is traveling on a string with a speed of 300 m/s. If the wave has a frequency of 100 Hz, what is the phase difference between two particles on the string that are 85 cm apart? (Ans: 1.8 radians.)

Q#2: Figure 2 shows the displacements at the same instant for two waves, P and Q, of equal frequency and having amplitude Y and 2*Y, respectively. If the two waves move along the positive x-direction, what is the amplitude of the resultant wave, and the phase difference between the resultant wave and the wave P? (Ans: Resultant amplitude is Y, and the phase difference is Pi.**)**

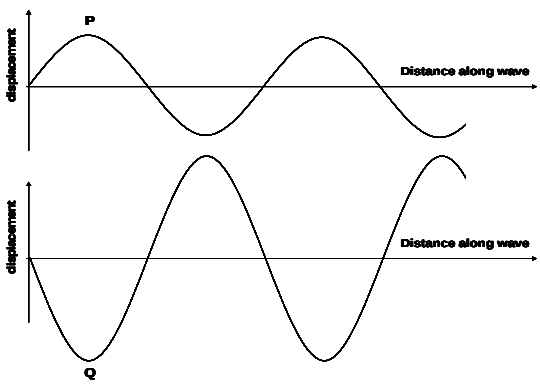


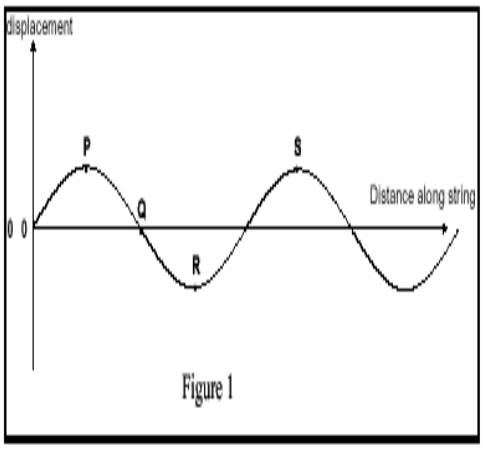
Figure 2

Q#3: A 50 cm long string with a mass of 0.01 kg is stretched with a tension of 18 N between two fixed supports. What is the resonant frequency of the longest wavelength on this string? (Ans: 30 Hz.**)**

Q#4: A transverse sinusoidal wave of frequency 100 Hz is traveling along a stretched string with a speed of 20.0 m/s. What is the shortest distance between a crest and a point of zero transverse acceleration? (Ans: 0.05 m.)

T-041:

Q#1 Figure 1 shows the snapshot of part of a transverse wave traveling along a string. Which statement about the motion of elements of the string is correct? For the element at S : (Ans: the magnitude of its acceleration is a maximum. **)**



Q#2 A wave in a string, is given by the equation: y(x,t) = 0.24*sin(3.0*x-24*t), where x and y are in meters and t is in seconds. Calculate the magnitude of the transverse speed at x = 2.0 m and t = 1.0 s. [Ans: 3.8 m/s.]

Q#4 In figure 2, two equivalent pulses, Pulse 1 and Pulse 2, are sent from points A and B at the same time, respectively. Which pulse reaches point C first? [Ans: Pulse 1.]

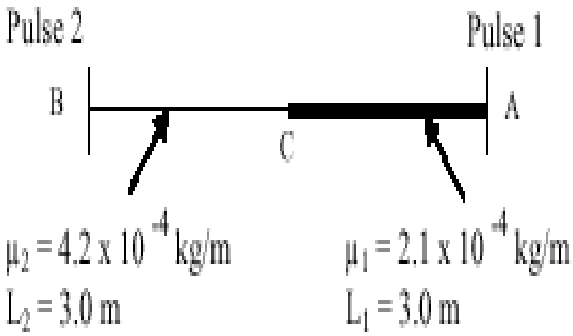


Figure 2