# ECE 105 Quiz 10

## Thursday Tutorial

A transverse wave travels along a stretched string at a speed of 275 cm/s. The string’s linear density is 2.5 g/cm. At x = 10.0 cm the displacement of the string is found to vary with time according to :

**y(t) = 0.210 cos (7.50 – 320 t)**  with y in cm, t in sec and angles in radians

(i) what is the wave’s frequency, f ?

(ii) what is the wavelength, λ ?

(iii) find the general equation, y(x,t), of this wave in terms of a cosine function that will give the transverse displacement, y, for any point x and time t.

(iv) what is the tension in the string?

(v) what is the maximum transverse speed of the string?

**Thursday Group work:**

**1**  What is the phase angle of the pulse **y(t) = 0.210 cos (7.50 – 320 t)**?

1. (7.50 – 320 t)
2. 7.50
3. 320 t
4. cos (7.50 – 320 t)

**2** For a general disturbance traveling on a string, does every particle execute SHM?

**a)** Only in a vertical direction

**b)**  Only in a horizontal direction

**c)** They do not necessarily move in SHM

**d)** Simultaneously in both the vertical and horizontal directions

**3** Given the wave velocity equation v = λf

**a)** v corresponds to the wave’s transverse speed

**b)** v is given by the time derivative of y(t)

**c)** v corresponds to the wave’s longitudinal speed

**d)** Every string particle moves longitudinal with a speed of v

**4** The string’s tension will affect the

**a)** Wave’s speed on the string and the particle transverse speed

**b)** String particle longitudinal speed

**c)**  Only the wave’s speed on the string

**d)** Only the string particletransverse speed

**5** The maximum transverse speed of a wave is given by

**a)** ω2A

**b)** ωA

**c)** ω/k

**d)** None of the above

## Friday Tutorial

A transverse pulse is propagating on a 2.0 m long string of mass 50 g. The pulse is described by the equation:

**y(x,t) = π**  with x,y in meter and t in sec

**π + (3x/2 + πt)2**

(i) ‘Roughly’ sketch the pulse for y(x,0) and y(x,1);

(ii) Use the graph to determine the pulse speed.

(iii) Find the tension, T, in the string.

**Friday Group work:**

**1**  Can the pulse above really be described as a wave?

1. No
2. Yes
3. depends on the time (t) function of the equation
4. depends on the spatial (x) function of the equation

**2** What is the defining feature of a travelling disturbance?

**a)** the sine or cosine function

**b)** a displacement of the carrier medium

**c)** both a and b

**d)** the functional argument (kx +/- ωt)

**3** Do the particles in the medium execute SHM ?

**a)** No

**b)** Yes

**c)** Only vertically

**d)** Only horizontally

**4** Why is the pulse travelling to the left?

1. **as time argument increases the spatial argument must decrease so that same vertical displacement is maintained**

**b)** the phase needs to be constant

**c)** the phase needs to decrease

**d)** the phase needs to increase

**5** Given the wave velocity equation v = λf

**a)** v corresponds to the wave’s longitudinal speed

**b)** v corresponds to the wave’s transverse speed

**c)** v is given by the time derivative of y(t)

**d)** Every string particle moves longitudinal with a speed of v

# Solutions

## Thursday Tutorial

A transverse wave travels along a stretched string at a speed of 275 cm/s. The string’s linear density is 2.5 g/cm. At x = 10.0 cm the displacement of the string is found to vary with time according to :

**y = 0.210 cos(7.50 – 320 t)**  with y in cm, t in sec and angles in radians

(i) what is the wave’s frequency, f ?

**f = ω/2π = 320/2π = 50.9 Hz**

(ii) what is the wavelength, λ ?

**v = f λ = 275 therefore λ = 275/50.9 = 5.40 cm/s**

(iii) find the general equation, y(x,t), of this wave in terms of a cosine function that will give the transverse displacement, y, for any point x and time t.

**k = 2π/ λ = 2π/5.40 = 1.16 /cm; the phase constant z = 7.50 – (1.16)10 = 4.1**

**y = 0.210 cos(1.16x – 320 t – 4.1)**

(iv) what is the tension in the string?

**v = root(T/u) = f λ = 50.9(0.054) = 2.75 m/s ; u = 0.0025/0.01 = 0.25 kg/m**

**T = 2.752(0.25) = 1.9 N Error !**

(v) what is the maximum transverse speed of the string?

**dy/dt]max = 0.21(320)sin( ) = 67.2 cm/s**

## Friday Tutorial

A transverse pulse is propagating on a 2.0 m long string of mass 50 g. The pulse is described by the equation:

**y(x,t) = π**  with x,y in meter and t in sec

**π + (3x/2 + πt)2**

(i) ‘Roughly’ sketch the pulse for y(x,0) and y(x,1);

****

(ii) find the tension, T, in the string.

**v = root(T/u) with u = 0.05/2 = 0.025 k/m**

**and v = ω/k = π/(3/2) = 2π/3 m/s**

**T = v2u = (2π/3)2 0.025 = 0.11 N**