

Computer Lab Report Form #6: Waves Investigations

Student's Name: _____

BU ID _____

Lab Section Day/Time/TF _____

Investigation 1: Waves on a Cable

1.1 Harmonics

1. Find the wavelength for each of the following harmonics (page 4):

Harmonic number	Wavelength (m)
1	
2	1.0
3	
5	

2. Please, complete the following table (page 5):

harmonic number	n (number of loops)
1	
3	
6	

3. Please, write a formula that relates the wavelength of a harmonic mode to its number of loops. Your formula (page 6):

4. Check your formula by completing the following table (page 6):

n (number of loops)	λ (m)
2	
3	0.6667
4	0.50
6	
7	

1.2 Definition of the Amplitude of a Wave

Complete the following table for the displayed amplitudes for the indicated normal modes (page 7):

N	A (m)
1	
2	0.10
3	
6	

1.3 Definition of Period of a Wave

Please answer the following question (page 7):

For the fundamental mode the period is $T = \rule{1cm}{0.4pt}$ s.

1.4 Relationship Between Period and Frequency

1. Find the period and frequency for the following harmonics (page 8):

N	T (s)	ν (Hz)
1		
2		
3		
4		

2. What numerical pattern do you detect in the frequencies as a function of the (harmonic) loop number (page 8):

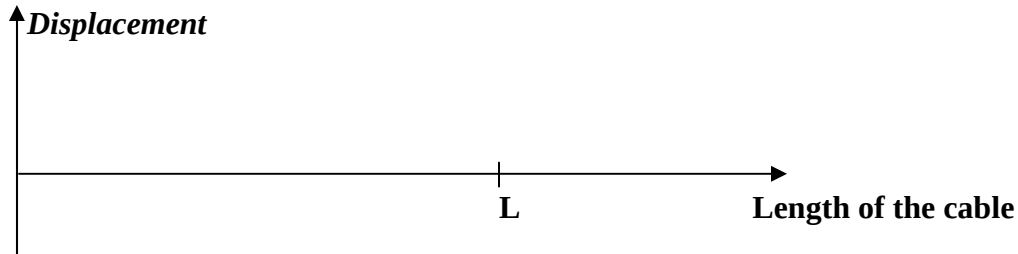
1.5 Dispersion Relationship for Waves on a Cable

1. What properties of a cable determine the speed of a wave on it? (page 9)

2. What is the speed c of a wave on the cable? $c = \rule{1.5cm}{0.4pt}$ (page 10)

Investigation 2: Energy of Waves on a Cable

1. On the graph space provided below, draw the appearance of the whole length of the cable when it has maximum potential energy (page 14):

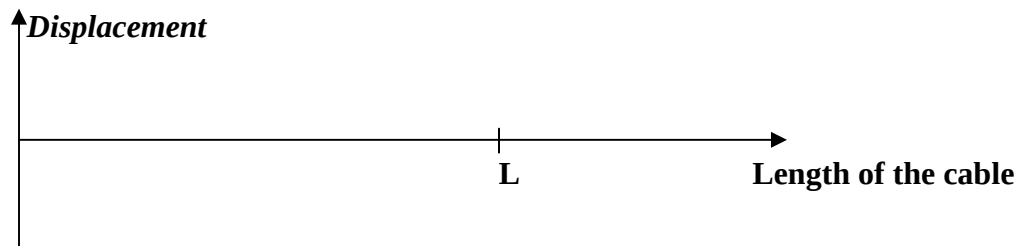


2. Please answer whether the velocities of the points of the cable, at the instance of maximum potential energy, are at a minimum or maximum (page 14)? Circle the correct answer below:

at minimum

at maximum

3. On the graph space provided below draw the appearance of the whole length of the cable when it has maximum kinetic energy (page 15):



4. Please answer whether the velocities of the points of the cable, at the instance of maximum kinetic energy, at a minimum or maximum (page 15))? Circle the correct answer below:

at minimum

at maximum

5. Whether or not the energy of the harmonic motion is uniformly distributed over the length of the cable (page 16))?)? Circle the correct answer below:

uniformly

non uniformly

6. Circle the right answer below (page 16):

a) For the $n = 1$ harmonic, the region with maximum energy density is centered about $x = ?$

0 m

 $1/2$ m $1/4$ m

b) For the $n = 4$ harmonic, a region with minimum energy density is centered about $x = ?$

 $1/8$ m $2/3$ m $1/4$ m

7. Which harmonics are represented on page 18?

(left top) $n =$; (right top) $n =$; left bottom) $n =$; (right bottom) $n =$

Investigation 3: Harmonics of a Square Membrane

1. Enter the number of loops that you observe for each harmonic in the table. Count the loops in the x and y directions separately (page 22):

Harmonic (x, y)	n_x	n_y
(1, 1)		
(2, 1)		
(4, 1)		
(3, 1)		

2. Enter the number of loops that you observe for each harmonic in the table. Count the loops in the x and y directions separately (page 23):

Harmonic (x, y)	n_x	n_y
(1, 2)		
(1, 4)		
(1, 3)		
(1, 5)		

3. Enter the number of loops that you observe for each harmonic in the table. Count the loops in the x and y directions separately (page 23):

Harmonic (x, y)	n_x	n_y
(2, 2)		
(3, 4)		
(2, 3)		
(5, 2)		

4. How does the frequency of oscillation depend on the number of loops n_x and n_y (page 25) ?

5. Write the measured frequency ν of oscillation for the following modes (page 25):

(n_x, n_y)	ν (Hz)
(1, 1)	
(2, 1)	2.24
(2, 2)	
(3, 4)	
(6, 8)	10
(5, 12)	

6. Write a formula for the frequency of a harmonic as a function of n_x and n_y ? (page 25)

7. Complete the following table (page 28).

(n_x, n_y)	Δx (m)	Δy (m)	$E(x_0, y_0) \Delta x \Delta y$ (j)	$E_{\text{Mode}} (j)$
(1, 1)	$x_0 = 0.5, \Delta x = 0.05$	$y_0 = 0.5, \Delta y = 0.05$		
(3, 1)	$x_0 = 0.3, \Delta x = 0.05$	$y_0 = 0.5, \Delta y = 0.05$		
(2, 4)	$x_0 = 0.25, \Delta x = 0.05$	$y_0 = 0.375, \Delta y = 0.05$		

8. Complete the following table (page 29).

Mode 1 (n_{x1}, n_{y1})	Frequency 1 ν_1 (Hz)	Mode 2 (n_{x2}, n_{y2})	Frequency 2 ν_2 (Hz)	Frequency of Superposed Modes ν_{super} (Hz)
(1, 6)		(1, 9)		
(1, 8)		(1, 10)		
(1, 9)		(1, 10)		

9. Write an expression for ν_{super} in terms of ν_1 and ν_2 . (page 29):