

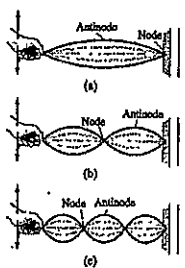
Menoufia University Faculty of Engineering, Shebin El-Kom Basic Engineering Science Department First Semester Examination, 2018-2019 Date of Exam: 14 /1 / 2019		Subject: PHYSICS Code: BES116 Year: First Year Mechanical Power Eng. Time Allowed : 3 hours Total Marks : 90 marks
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**Answer the following questions.**

**Question 1**

**(23 marks)**

- a. (i) At what displacement of SHO is the energy half kinetic and half potential energy.  
 (ii) What is the fraction of the total energy of SHO is kinetic and what fraction potential when the displacement is half the amplitude. (8 marks)
- b. What is the equation describing the motion of a spring that is stretched 8.8 cm from equilibrium and then released, and whose period is 0.75s. (5 marks)
- c. In the corresponding figure, the length of string (L) is 7m. (5 marks)  
 Find the frequency of wave in each case a,b and c.  
 Note the velocity of wave is constant for all cases and equal to 300 m/s.



- d. A piano string is 1.10 m long and has a mass of 9.00 g. (a) How much tension must the string be under if it is to vibrate at a fundamental frequency of 131 Hz? (b) What are the frequencies of the first four harmonics? (5 marks)

**Question 2**

**(22marks)**

- a. True or false with explain:
- i) If you want use LRC circuit as electrical oscillator, the relation between the required electric components is  $R^2 > 4L/C$
- ii) The design of shock absorbers in car under condition of underdamping. (6 marks)
- b. 7. A 750 g block oscillates on the end of a spring whose force constant is  $k = 56.0 \text{ N/m}$ . The mass moves in a fluid which offers a resistance force  $F = -bv$ , where  $b = 0.162 \text{ N.s/m}$ . (a) What is the period of the motion, (b) What is the fractional decrease in amplitude per cycle and (c) Write the displacement as a function of time if  $t = 0, x = 0$ , and at  $t = 1.00 \text{ s}, x = 0.120 \text{ m}$ . (6 marks)
- c. i) Drive the expression of velocity for transverse wave traveling through a certain cord under tension. ii) Is the velocity of wave increased, if you use denser cord? (5 marks)
- d. A piano string is 1.10 m long and has a mass of 9.00 g. (a) How much tension must the string be under if it is to vibrate at a fundamental frequency of 131 Hz? (b) What are the frequencies of the first four harmonics? (5 marks)

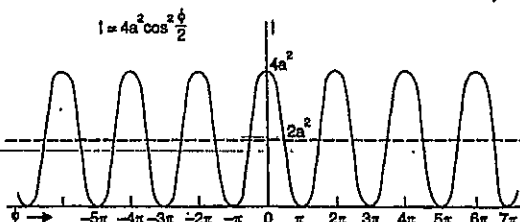
**Question 3**

**(23 marks)**

- a. i) what is the physical meaning of beating phenomenon? ii) Drive the expression of the beat frequency. (5 marks)
- b. A bat at rest sends out ultrasonic sound waves at 50KHz and receives the then returned from an object moving away from it at 25m/s. What is the received sound frequency? (speed of sound in air is 343m/s). (5 marks)
- c. Consider a series RLC circuit for which  $R = 7.60 \Omega, L = 2.20 \text{ mH}, C = 1.80 \mu\text{F}$ . (a) Calculate the frequency of the damped oscillation of the circuit. (b) is the electric charge in the circuit oscillating? (5 marks)

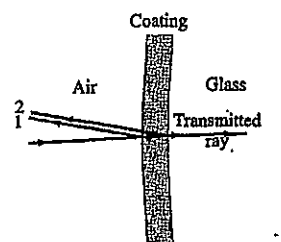
d. True or false with explain: (8 marks)

i) The following figure shows the intensity distribution for the interference fringes from two waves of same frequency and amplitude.



ii) The corresponding figure represented a glass lens with refractive index ( $n_1 = 1.3$ ) coated with thin film of transparent material refractive index ( $n_2 = 1.45$ ). The required minimum thickness of thin film to reduce reflected light is

$$t = \frac{\lambda}{2n_2}, \text{ where } \lambda \text{ is the wavelength of light.}$$



iii) In case of single slit diffraction, the width of central maximum equal to the width of subsidiary maximum.

**Question 4**

**(22 marks)**

a. In air wedge interference, prove that the distances between fringes are equally spaced. (5 marks)

b. How you can determine the wavelength of light source using Newton's rings experiment? (5marks)

c. The intensity on the screen at a certain point in double slit interference pattern is 64.0% of the maximum value. (a) What minimum phase difference (in radians) between sources produces this result? (b) Express this phase difference as a path difference for 486.1 nm light. (6 marks)

d. A diffraction grating has 16000 rulings in its 2.4 cm width. Determine (a) its resolving power in first and second orders, and (b) the minimum wavelength resolution  $\Delta\lambda$  it can yield for  $\lambda \approx 410 \text{ nm}$  (6 marks)

*With our Best Wishes*

This exam measures the following ILOs																
Question Number	Q1-b	Q1-d	Q2-a	Q3-b	Q4-c, b	Q4-a	Q2-e	Q2-b: a, d	Q2-c	Q3-a, b, c	Q3-c	Q4-b	Q4-c	Q1-d	Q1-c	
Skills	a11-	a1-2	a11-	a1-2	a13-	a13-	b3-1	b31-	b2-	b21-	b32-	b32-	c13-	C1-1	c13-	
	Knowledge & Understanding Skills						Intellectual Skills						Professional Skills			