Menoufiya University
Faculty of Engineering
Shebin El-Kom
Second Semester Exam.
Academic Year: 2015-2016

Department: Basic Science of Engineering
Year: 1st year of **Elec. Engineering**
Subject/Code: **Physics 2** (BES 122)
Time Allowed: **3 hours**
Date: **18/1/2015**

Answer the Following Questions: (90 *marks*)

Question 1: (18 *marks*)

a) Prove with drawing: For D.H.M when the retarding force is small, the oscillatory character of the motion (الطبيعة التذبذبية للحركة) is preserved (محفوظة أو مُتَحَقِّقَة) but the motion ultimately (فى النهاية) ceases (تتوقف).

b) Compare between "under, critically and over damped" systems.

c) A body of mass 200 g is vibrating in a viscous (لزج) medium with a restoring force constant $k = 125\ N/m$ and a damping constant $b = 0.4\ Nm^{-1}s$. Determine the amplitude of the vibration just after (مباشرةً بعد) 10 complete cycles, where the amplitude of the undamped oscillator is 5 cm.

Question 2: (18 *marks*)

a) Prove that the pressure amplitude of the periodic sound wave in a medium is directly proportional to the density of that medium.

b) Describe and explain sound level in decibels.

c) A sinusoidal wave traveling in the positive x direction has amplitude of 15.0 cm, a wavelength of 40.0 cm, and a frequency of 8.00 Hz. The vertical position of an element of the medium at $t = 0$ and $x = 0$ is also 15.0 cm. (a) Find k, T, ω, v of the wave. (b) Find ϕ and write the general expression for the wave function.

Question 3: (18 *marks*)

a) Describe and explain "Intensity Distribution of the Double-Slit Interference Pattern".

b) Why is it so much easier to perform interference experiments with a laser than with an ordinary light source?

c) Calculate the minimum thickness of a soap-bubble film ($n = 1.33$) that results in **constructive** interference in the **reflected** light if the film is illuminated with light whose wavelength in free space is $\lambda = 600\ nm$. b) What if the film is twice as thick? Does this situation produce constructive interference?

Question 4: (18 *marks*)

a) Describe and explain: Standing Waves in a String Fixed at Both Ends:

b) Light of wavelength 589 *nm* is used to view an object under a microscope. If the aperture of the objective has a diameter of 0.900 *cm*, (a) what is the limiting angle of resolution? (b) If it were possible to use visible light of any wavelength, what would be the maximum limit of resolution for this microscope? c) Suppose that water (n = 1.33) fills the space between the object and the objective. What effect does this have on resolving power when 589-*nm* light is used?

c) Two waves traveling in opposite directions produce a standing wave. The individual wave functions are:

$$y_1 = (4.0cm)\sin(3.0x - 2.0t) \qquad y_2 = (4.0cm)\sin(3.0x + 2.0t)$$

where x and y are measured in centimeters. (a) Find the amplitude of the simple harmonic motion of the element of the medium located at $x = 2.3$ *cm*. (b) Find the positions of the nodes and antinodes if one end of the string is at $x = 0$. (c) What is the maximum value of the position in the simple harmonic motion of an element located at an antinode?

Question 5: (18 *marks*)

a) Describe and explain "Malus's law" with drawing.

b) Describe and explain "Polarization by Reflection".

c) An impure sample of sugar of mass 4.5 *g* is dissolved in distilled water to give 50 cm^3 of solution. If the angle of rotation of the plane of polarization of sodium light, caused by this solution when filling a polarimeter tube of length 20 *cm*, was found to be 11.3°, find the percentage of this sample (specific rotation of sugar for sodium light is 66.5° cm^2g^{-1})

This exam measures the following ILOs

Question Number	Q1-a	Q1-b	Q2-a	Q4-a	Q4-b	Q5-b	Q2-b	Q3-a	Q3-b	Q4-c	Q5-a	Q5-c	Q1-c	Q2-c	Q3-c
Skills	a1-1	a1-2	a2-1	a2-1	a1-1	a2-1	b4-1	b4-1	b2-1	b4-1	b2-1	b2-1	c9-1	c9-1	c4-3
	Knowledge &Understanding Skills						Intellectual Skills						Professional Skills		

With my best wishes

Dr. Nasr Eldin Mahmoud