Menoufiya University
Faculty of Engineering
Shebin El-Kom
Second Semester Exam.
Academic Year: 2014-2015

Department: Basic Science of Engineering
Year: 1st year of **Civil Engineering**
Subject/Code: **Physics 2** (BES 122)
Time Allowed: **3 hours**
Date: **7/6/2015**

Answer the Following Questions: (90 *marks*)

Question 1: (18 *marks*)

a) Prove that: "The **square of the wave speed** (v) on taut string is inversely proportional to (تتناسب عكسياً مع) the **linear density** (μ) of the string".

b) Derive the **power** transfer by a wave along a string

c) A body of mass "$m = 200\ g$" 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. The amplitude of the undamped oscillator is $A_o = 5\ cm$.

Question 2: (18 *marks*)

a) Describe and explain with drawing "**Newton's Rings**".

b) If, and only if, the **amplitude** of the wave is **doubled**, what will happen to the following quantities? (i) the wave speed (v) (ii) the wave frequency (f) (iii) the maximum transverse speed ($v_{y,max}$)

c) A submarine (غواصة) is moving in the Atlantic Ocean (المحيط الأطلسى) at a depth of about **1** ***km*** with a speed of about **18** ***km/h***. It produces a sinusoidal sound wave that is described by the displacement wave function:

$$s(x, t) = (2\ \mu m) \cos [(3.55\ m^{-1})\ x - (710\ s^{-1})\ t]$$

Another submarine is moving at the same depth with the same speed. Determine the observed frequency by the 2nd submarine if they ..... (i) moving towards each other, (ii) moving away from each other, (iii) running behind each other.

Question 3: (18 *marks*)

a) Which of the following will cause the **fringes** in a two-slit interference pattern to **move closer** (تتقارب)? **Explain**? (i) increasing the wavelength of the light (ii) increasing the screen distance (iii) decreasing the slit spacing (iv) immersing the entire apparatus in water.

b) Two waves are defined by the following equations:

$$y_1 = A\sin(kx - \omega t) \qquad \text{and} \qquad y_2 = A\sin(kx + \omega t)$$

Define and **determine** the **resultant wave** due to the superposition of these two waves.

c) A **60-*cm*** guitar string (وتر الجيتار) under a tension of **50 *N*** has a mass per unit length of **0.1 *g/cm***. What is the **highest quantized "or resonant" frequency** that can be heard by a person capable of hearing (قادر على سماع) frequencies up to **20000 *Hz***?

Question 4: (18 *marks*)

a) Describe and explain "**Diffraction and interference through a narrow slit**"

b) Write **Bragg's law** and state its **usefulness** (أهمية).

c) Assuming that the average diameter of the human eye through a daytime (النهار) is about **2 *mm***. Estimate **the limiting angle (θ_{min})** of resolution for the human eye, assuming its resolution is limited only by diffraction. Choose **λ = 500 *nm***, near the center of the visible spectrum. If the point sources are **25 *cm*** from the eye (the near point ***L* = 25 *cm***), determine the minimum separation distance *d* between two point sources that the eye can distinguish.

Question 5: (18 *marks*)

a) Correct the underlined words of the following statements:

i) According to "Superposition Principle" each portion (جزء) of the slit acts as a source of light waves that interfere and produce bright and dark fringes.

ii) The amplitude of the standing wave is equal to the square of the amplitude of the individual superimposed waves.

iii) For an angle of incidence equals θ_p (Brewster's angle) the refracted light is completely polarized.

b) Define optical activity and compare between laevorotatory and dextrorotatory materials.

c) Unpolarized light passes through two polaroids; the axis of one is vertical (رأسى) and that of the other is at **60°** to vertical. What is the intensity of the transmitted light with respect to the original intensity of the unpolarized light?

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