

٩٨
 كبرياء
 كبرياء

Kafr Elshiekh University
 Faculty of Engineering
 Department of
 Physical and Mathematical Engineering
 First Year



Engineering physics (2)

12 January 2017
 3 hours
 90 Marks
 Final exam

$v=345 \text{ m/s}$	$c=3 \cdot 10^8 \text{ m/s}$	$h=6.63 \cdot 10^{-34} \text{ J.s}$	$m_e=9.11 \cdot 10^{-31} \text{ Kg}$
---------------------	------------------------------	-------------------------------------	--------------------------------------

Question(1) : (20 Marks)

(a) A (10.6 Kg) object oscillates at the end of a vertical spring that has a spring constant of ($5 \cdot 10^4 \text{ N/m}$). The effect of air resistance is represented by the damping coefficient ($b=3 \text{ N.s/m}$). Calculate the frequency of the damping oscillation.

(b) A (2Kg) object attached to a spring moves without friction and is driven by an external force given by $F=3 \sin 2\pi t \text{ N}$. The force constant of the spring is (15 N/m).

- Derive the equation that calculates the amplitude of forced oscillation without friction.
- Determine the amplitude of the motion.

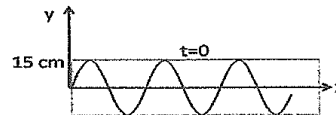
Question(2) : (25 Marks)

(a) In simple harmonic motion, prove that the period of the motion (T) is given by

$$T=2\pi/\omega$$

(b) A Sinusoidal wave traveling in the positive x-direction has amplitude of (15 cm), a wavelength of (40 cm) and a frequency of (8 Hz). The vertical position of an element of medium at $t=0$ and $x=0$ is 0 cm as shown in figure

- Find the wave number k , period T , angular frequency ω , and speed of the wave v .
- Write the general expression for the wave function.



(c) A train is traveling with speed (50 m/s), the whistle blows at a frequency of (900 Hz) as heard by the passengers in the train. What frequency does a person standing by the tracks hear as the train approaches and as the train leaves?

$$f = f_0 \frac{v + v_o}{v + v_s}$$

$$f = f_0 \frac{v + v_o}{v - v_s}$$



Question(3) :

4/1

(25 Marks)

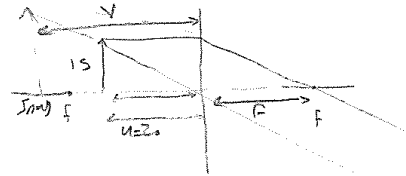
(a) Define the "Dispersion" of light.

(b) There is a standing wave in a (0.5 m) tube. Calculate the 3rd harmonic and draw it if the tube is:

- Open – open
- Open – closed

(c) An object (15 cm) tall is placed (20 cm) away from a lens. A virtual image is formed (10 cm) from the lens. Determine:

- Focal length of lens
- Type of lens used
- Size of image produced
- Draw the ray diagram.



Question(4) :

7=

(20 Marks)

(a) Find the peak wavelength of the black body radiation emitted by the human body when the skin temperature is (39°C).

(b) "The maximum kinetic energy of photoelectrons is independent of light intensity." Describe this feature according to Einstein explanation.

(c) X-rays of wavelength ($\lambda=0.3 \text{ nm}$) are scattered from a block of material. The scattered x-rays are observed at an angle of 45° to the incident beam. Calculate the wavelength.

(d) Calculate the de-Broglie wavelength for an electron moving at (10⁷ m/s).

Best Wishes

Dr. Demyana Adel Abdel Masieh

Question(3) :

4/1

(25 Marks)

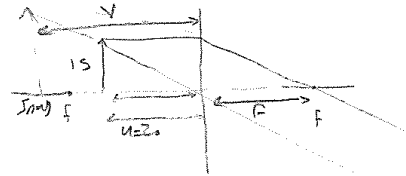
(a) Define the "Dispersion" of light.

(b) There is a standing wave in a (0.5 m) tube. Calculate the 3rd harmonic and draw it if the tube is:

- Open – open
- Open – closed

(c) An object (15 cm) tall is placed (20 cm) away from a lens. A virtual image is formed (10 cm) from the lens. Determine:

- Focal length of lens
- Type of lens used
- Size of image produced
- Draw the ray diagram.



Question(4) :

7=

(20 Marks)

(a) Find the peak wavelength of the black body radiation emitted by the human body when the skin temperature is (39°C).

(b) "The maximum kinetic energy of photoelectrons is independent of light intensity." Describe this feature according to Einstein explanation.

(c) X-rays of wavelength ($\lambda=0.3 \text{ nm}$) are scattered from a block of material. The scattered x-rays are observed at an angle of 45° to the incident beam. Calculate the wavelength.

(d) Calculate the de-Broglie wavelength for an electron moving at (10⁷ m/s).

Best Wishes

Dr. Demyana Adel Abdel Masieh