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

Engineering physics (2)(PHM1107)

09- 06- 2019
3 hours
60 Marks
Final exam: 3 pages

Answer the following questions:

Question(1) : (ILOs: a1) ***(12Marks)***

(a) Find the peak wavelength of the blackbody radiation emitted by the Sun which has a surface temperature 5800K.

(b)X-ray of wavelength (λ_o=0.2 nm) is incident on stationary electron. Radiation that has a wavelength of (λ'=0.20071 nm) is detected at a scattering angle θ. Calculate θ. ($h/m_ec= 2.34*10^{-3}$ nm)

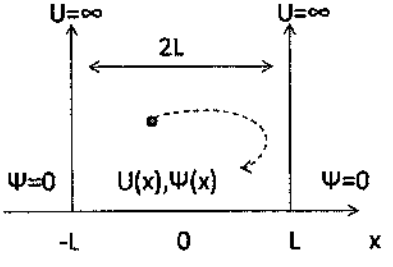
Question(2) : (ILOs: c1) ***(18 Marks)***

(a)What is the " Stopping Potential (V_s)" In a photoelectric effect experiment.

(b)A copper metal is illuminated with light having a wavelength of 200 nm. The work function of the metal is 4.4 ev. Find the maximum kinetic energy of the effected photoelectron. (hc=1240 ev.nm)

(c) A quantum particle of mass m moves in a potential well of length 2L. Its potential energy is infinite for x<-L and for x>+L. Inside the region –L<x<L , its potential energy is given by

$$U(x) = -\frac{\hbar^2 x^2}{mL^2(L^2 - x^2)}$$



In addition, the particle is in a stationary state that is described by the wave function

$$\Psi(x) = A\left(1 - \frac{x^2}{L^2}\right) \quad \text{for} \quad -L<x<L$$

And $\Psi(0) = 0$ elsewhere

Determine the energy of the particle in terms of $\hbar$,m and L

Question(3) : (ILOs: a2) ***(10Marks)***

(a) 1- An oscillatory motion must be simple harmonic if:

A. the amplitude is small B. the potential energy is equal to the kinetic energy

C. the motion is along the arc of a circle D. the acceleration varies sinusoidally with time

E. the derivative, dU=dx, of the potential energy is negative

2-The x and y coordinates of a point each execute simple harmonic motion. The frequencies are the same but the amplitudes are different. The resulting orbit might be:

A. an ellipse B. a circle C. a parabola D. a hyperbola E. a square

3-A sinusoidal force with a given amplitude is applied to an oscillator. To maintain the largest amplitude oscillation the frequency of the applied force should be:

A. half the natural frequency of the oscillator B. the same as the natural frequency of the oscillator

C. twice the natural frequency of the oscillator D. unrelated to the natural frequency of the oscillator

E. determined from the maximum speed desired

4-A block on a spring is subjected to an applied sinusoidal force AND to a damping force that is proportional to its velocity. The energy dissipated by damping is supplied by:

A. the potential energy of the spring B. the kinetic energy of the mass C. gravity

D. friction E. the applied force

(b) Show that the wave velocity in string is $\sqrt{\frac{T}{\rho}}$ where T is the tension in the string and ρ is the mass per unit length.

(c) Discuss the categories of sound waves.

Question(4) : (ILOs: b2) ***(10 Marks)***

(a) 1-A wave is described by $y(x, t) = 0.1 \sin(3x-10t)$, where x is in meters, y is in centimeters, and t is in seconds. The angular frequency is:

A. 0.10 rad/s B. 3π rad/s C. 10π rad/s D. 20π rad/s E. 10 rad/s

2- For a given medium, the frequency of a wave is:

A. independent of wavelength B. proportional to wavelength

C. inversely proportional to wavelength D. proportional to the amplitude

E. inversely proportional to the amplitude

3- Any point on a string carrying a sinusoidal wave is moving with its maximum speed when:

A. the magnitude of its acceleration is a maximum B. the magnitude of its displacement is a maximum

C. the magnitude of its displacement is a minimum D. the magnitude of its displacement is half the amplitude

E. the magnitude of its displacement is one-fourth the amplitude

4- Fully constructive interference between two sinusoidal waves of the same frequency occurs only if they:

A. travel in opposite directions and are in phase B. travel in opposite directions and are 180° out of phase

C. travel in the same direction and are in phase D. travel in the same direction and are 180 ° out of phase

E. travel in the same direction and are 90 ° out of phase

(b) Show that when sound waves are normally incident on a plane steel water interface 86% of the energy is