Manoura University
Faculty of Engineering
Building & Construction Engineering Program
Fall Semester 2013/2014
Course Title: Physics-1
Course Code: *PHYS011*

Final Exam (50%)
Time: 2 hours
Date : 7th June 2014

Answer All Questions

Questions No. 1: (13 Marks)

1-a) Write down the dimensions of stress, energy and power (3 Degrees)

1-c) Plot the kinetic energy, potential energy and total energy of simple harmonic motion as a function of distance, x from the equilibrium position. (2 Degrees)

1-c) A metal wire of 60 cm long and 1 mm in diameter is stretched by a force of 150 N. If the elongation is measured to be 0.6 mm, determine the Young's modulus of such metal. (4 Degrees)

1-d) A mass-spring system of spring constant 400 N/m. the spring is stretched with 5 cm and then released to oscillate as a simple harmonic motion. Find the potential energy, kinetic energy and total energy at a distance 2 cm from the equilibrium position. (4 Degrees)

Questions No. 2: (12 Marks)

2-a) Consider the two equations of transverse travelling waves as:

$y_1 = 0.04 \sin (2x - 40t)$ m, $y_2 = 0.04 \sin (2x - 40t + 0.5)$ m

Calculate (i) the wave length, (ii) the time period, (iii) the frequency, (iv) the speed of the wave and (v) the amplitude of the resultant waves $y = y_1 + y_2$. (5 Degrees)

2-b) Find the sound level in decibels of an intensity 10^{-6} W/m^2. Take $I_0 = 10^{-12}$ W/m^2. (3 Degrees)

2-c) A car is moving at a speed of 30 m/s. It sounds its horn which has a frequency of 500 Hz. Determine the frequencies heard by a stationary observer as the car is, (i) approaching and (ii) receding from the observer. Take the velocity of sound in air 340 m/s. (4 Degrees)

Please turn over

(c) A thin steel wire is fixed between two fixed points of separation distance equals the wire length at 20 °C. Find the type and magnitude of stress developed in the rod if the wire is at (i) -5 °C and at (ii) 30 °C. The thermal expansion coefficient for steel $\alpha = 12\times10^{-6}$ °C^{-1} and Young's modulus is 2×10^{11} Pa. (4 Degrees)

Questions No. 4: (13 Marks)

4-a) In an experiment, a metal rod of 15 cm long has a cross section area of 5 cm^2. One end is in contact with steam at 100 °C while the other end contacts a block of ice at 0 °C. The surface of the rod is carefully insulated, so heat flows only from end to end. If 40 g of ice is melted in 10 minutes time, calculate (i) the thermal conductivity of the metal rod, and (ii) the amount of steam that condensed at the same time. Take the latent heat of fusion for ice is 3.337×10^5 J/Kg and the latent heat of vaporization for water 2.26×10^6 J/Kg. (6 Degrees)

4-b) An ideal gas with an initial volume of 0.1 m^3 and an initial pressure of 2.0 MPa expands isothermally to a final volume of 2 m^3. Determine, (i) the work done, w and (ii) the heat, Q (3 Degrees)

4-c) An ideal gas is taken through a Carnot cycle. The isothermal expansion and compression processes were at 300 °C and 50 °C, respectively. If the gas absorbs 1000 J of heat during the isothermal expansion, find (i) the work done by the gas in each cycle and (ii) the heat expelled to the cold reservoir in each cycle. (4 Degrees)