Manoura University
Faculty of Engineering
Specific Engineering Programs
BCE, MTE, BME & CIE
Spring Semester 2017/2018

Course Title: Physics-1
Final Exam (50%)
Time: 2 hours
Date : 20th May 2018
Professor Dr. Moheb Abo Elmaaty

Answer All Questions

Questions No. 1: (13 Marks)

1-a) Write down the dimensions of the following physical quantities:, (i) Power, (ii) Pressure and (iii) Energy. (3 Degrees)

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

1-c) A metal wire of length 100 cm and cross sectional area 1 mm^2 is pulled by a tension of 50 N. If the deformation is entirely elastic and found to be 0.5 mm, (i) what is the tensile stress in the wire? (ii) Calculate the elastic modulus of such metal. (4 Degrees)

1-d) A mass is attached to a spring of constant 100 N/m. It is stretched by 5 cm and then released to oscillate as a simple harmonic motion. Find the following at a distance 4 cm from the equilibrium position: (i) the potential energy, (ii) the kinetic energy, and (iii) the total energy. (4 Degrees)

Questions No. 2: (12 Marks)

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

$y_1 = 0.05 \sin (0.4 x - 40 t)$ m, $y_2 = 0.05 \sin (0.4x - 40 t - 1.8)$ m

For the resultant wave $y = y_1 + y_2$, find (i) the amplitude, (ii) the wave length, and (iii) the period. (4 Degrees)

2-b) A speaker emits 0.5 W acoustic power. Assume it behaves as a point source that emits uniformly in all directions. At what distance from the source will the intensity level is 80 dB? Take the intensity of the least audible sound, $I_o = 10^{-12}$ W/m^2 (4 Degrees)

2-c) A car travels down a road at a speed of 25 m/s. It is emitting sound at a frequency of 500 Hz. What frequency heard by a man standing on the side of the road in the two cases; (i) approaching and (ii) receding. Take the velocity of sound in air 340 m/s. (4 Degrees)

Questions No. 3: (13 Marks)

3-a) Write down the basic idea for making the following thermometers: (i) Resistance thermometer. (ii) Constant volume gas thermometer. (2 Degrees)

3-b) Draw the heating curve of water. (2 Degrees)

3-c) A long thin steel wire is fixed from its ends on two fixed points separated by a distance equals the wire length at a temperature of 25 °C. What is type and magnitude of the stress developed in the wire if the temperature changes to two cases:, (i) -5 °C and (ii) 30 °C. Take the thermal expansion coefficient for steel, 12×10^{-6} °C^{-1} and Young's modulus is 2×10^{11} Pa. (4 Degrees)

3-d) A metal rod of 10 cm long has a cross section area 5 cm^2. One end is in contact with steam at 100 °C while the other end contacts a quantity of ice at 0 °C. The surface of the rod is carefully insulated, so heat flows only from end to end. After reaching the steady state, if 180 g of ice is melted during 10 minutes, calculate the thermal conductivity of the rod. Take the latent heat of fusion for ice is 3.337×10^5 J/Kg. (5 Degrees)

Questions No. 4: (12 Marks)

4-a) A box with a total surface area 0.2 m^2 and a wall of thickness 6 mm is made of an insulating material. A 30-W electric heater inside the box maintains the average temperature of the inside surface of the box is 15 °C above the outside surface. (i) What is the thermal conductivity of the insulating material? If the temperature of the surrounding atmosphere outside the box is 25 °C, find the temperature of the outside surface of the box. Take the Stefan's constant, $\sigma = 5.67\times10^{-8}$ W/m^{2}K^4 and the emissivity of the outside surface of the box is 0.8. (5 Degrees)

4-b) An ideal gas at initial pressure 1.6 MPa and initial volume 5 liters is expanded isothermally to a final volume 20 liters. (i) Calculate the work done by the gas. (ii) Find the quantity of heat transferred to the gas. (ii) What is change in its internal energy? (4 Degrees)

4-c) An ideal gas is taken through a Carnot cycle. If the gas absorbs 1000 J of heat during the isothermal expansion at 300 °C and rejects a quantity of heat in cold reservoir at 40 °C, find (i) the efficiency, (ii) the work done by the gas. (3 Degrees)