Manoura University
Faculty of Engineering
Engineering Specific Programs
Fall Semester 2015/2016
Course Title: Physics-1

BCE, MTE, BME & CIE
Final Exam (50%)
Time: 2 hours
Date : 9th January 2016

Answer All Questions

Questions No. 1: (12 Marks)

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

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

1-c) Express only without proving the work done by an ideal gas during the following processes: (اكتب المعادلة فقط لكل إجراء) (i) Constant volume process (ii) Constant pressure process (iii) Isothermal process (3 Degrees)

1-d) A steel rod is fixed from its two ends at 25 °C. If its temperature is deceased to -15 °C, what is type and magnitude of the stress developed in the rod. Take the thermal expansion coefficient for steel is 12×10^{-6} °C^{-1} and Young's modulus 2×10^{11} Pa. (4 Degrees)

Questions No. 2: (13 Marks)

2-a) A metal rod is 10 cm long and cross sectional area 3 cm^2. One end is in contact with steam at 100 °C while the other end contacts a block of ice at 0 °C. In a time 15 minutes 250 g of ice melts. Calculate the thermal conductivity of the metal. Consider heat flows only from end to end. Take the latent heat of fusion of ice is 3.334×10^5 J/Kg. (5 Degrees)

Mechanical properties of metals and waves (*1st term*)

Question 3: (12 marks)

(a) A massive object of m = 5 kg oscillates with simple harmonic motion. Its position as a function of time varies according to the equation: $X(t) = 2 \sin [(\pi/2)\, t + \pi/6)$ m. **(i)** What is the position and velocity of the object at t = 0 s? **(ii)** What is the maximum kinetic energy of the object? **(iii)** If the object is then oscillating in an oil with damping constant b = 10 kg/s, find the amplitude after 1.5 s. *(6 marks)*

(b) The following data for the length of rubber are obtained as a function of the load (mass) suspended from the end of the strip (3.0 mm x 3.0 mm cross section) :

Load, kg	0.0	0.2	0.4	0.6	0.8	1.0
Length, cm	15.0	16.8	18.6	20.7	23.4	26.4

(i) Draw the stress-strain curve. **(ii)** Determine the approximate value of yield strength. **(iii)** Determine the percent elongation. *(6 marks)*

Question 4: (13 marks)

(a) A standing wave is described by the following equation:

$Y(x,t) = (2.0\ cm)\, [\sin (20\ m^{-1})\, x] \cos (150\ t)$. **(i)** What is the position of the 3rd antinodes?

(ii) Write the equations of the two waves that make this standing wave. **(iii)** Find the amplitude at x= 15cm *(6 marks)*

(b) A person in a parked car (ساكنة) sounds the horn. The frequency of the horn's sound is 290 Hz. A driver in an approaching car measures the frequency of the sound coming from the parked car to be 316.0 Hz. What is the speed of the approaching car? (V_{sound} = 343 m/sec) *(4 marks)*

(c) The explosion of a firecracker (صوت الصفير) in the air at a height of 40 m produces a 100 dB sound level at the ground below. What is the instantaneous total radiated power, assuming that it