Mansoura university | Faculty o f engineering | Time: 2 hours

Engineering Math. and Physics Dept. Specific programs | Full mark: 50

اجب عن اسئلة الحرارة فى نصف منفصل من كراسة الاجابة و خواص المادة فى النصف الأخر.

1-a Write the international system of units SI. *(3 marks)*

1-b- A structural component has a length of 7 ft 5 inches. What is the corresponding length in centimeters? *(3 marks)*

1-c-A steel wire *2.0m* long with a diameter $d = 3.0\ mm$ has a *10.0 kg* mass hung from it. **How** much will the wire stretch? **Calculate** the stress and strain in the wire. If Poisson's ratio = 0.25, **what** is the strain in the radial direction? $E_s = 12x10^{11}\ Pa$. *(5 marks)*

2-a- Figure P.2-a is a plot of the potential energy of a mass-spring system $m = 0.30\ kg$. The total mechanical energy E of the system = 0.50 J. Find (i) the maximum speed and the maximum acceleration of this oscillation? (ii) the potential energy U and the kinetic energy K at x = 0.08m. (iii) Write the equations of motion of the oscillating block *(5 marks)*

2-b- What are the intensity and the sound level, of the sound wave at distance $r = 2\ m$ from a source if the source emits energy at the rate $P = 25.0\ w$? Taking v =340 m/s. $I_o = 10^{-12}\ W/m^2$. *(4 marks)*

2-c- A train moving at a speed of *50 m/s* sounds its whistle, which has a frequency of *700 Hz*. Determine the frequencies heard by a stationary observer as the train approaches and then recedes from the observer. ($v = 343\ m/s$) *(5 marks)*

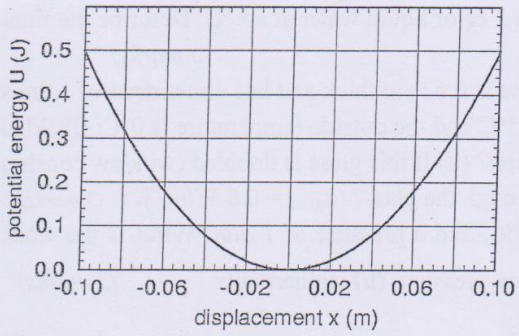

Figure P.2-a

انظر الخلف

ثانيا: الحرارة أبدا الأجابة من الجهة الأخرى.. ممنوع الكتابة أو الرسم فى صفحة الرسم البيانى

($\alpha_s = 11x10^{-6}\ K^{-1}$, $E_s = 12x10^{11}\ Pa$), $C_w = 4200\ J/kg\ °C$, $C_{ice} = 2100 J/kg\ °C$, $C_{st} = 2010\ J/kg\ °C$, $L_f = 3.3x10^5 J/kg$, $L_v = 2.2x10^6 J/kg$. $\sigma = 5.67x10^{-8}\ W/m^2\ K^4$

Question three: heat

3-Heat-a- ***Define:*** *Absolute* Zero , temperature, and heat. *(2 marks)*

3-Heat-b- A constant-volume gas thermometer registers an absolute pressure of *33 kPa* where it is at a temperature of *350 °C*. What is the temperature when the pressure is *105 kPa*? *(2 marks)*

3-Heat-c- A circle hole 9.0 cm in radius is cut in a sheet of copper. (a) Calculate the change in the area of this hole if the temperature of the sheet is decreased by 30.0 K.(b) Does this change represent an increase or a decrease in the area enclosed by the hole? $\alpha_{cop} = 17 \times 10^{-6}\ °C^{-1}$. *(2 marks)*

Question four: heat

4-Heat-a- ***- i-*** Write only the theory of operation of bimetallic thermometer.

ii- Write only the advantages of thermocouples thermometer. *(2 marks)*

4-Heat-b- A thin square steel plate, *20 cm* on a side, is heated to a temperature of *600°C*. What is the total rate of radiation of energy? ($e_{steel} = 0.6$) *(2 marks)*

4-Heat-c- *Define: Perfect reflector, thermal stress* *(2 marks)*

Question five: heat

5-Heat-a- A *0.2-kg* of steam at *120 °C* is added to *3 kg* of liquid water at *25 °C*. Describe the final state of the system. *(5 marks)*

5-Heat-b- A glass windowpane (زجاج النافذة) in a home is 0.62 cm thick and has dimensions of 1.0m x 2.0 m. On a certain day, the indoor temperature is 25°C and the outside temperature is 0°C. (i) What is the rate of heat flow through the glass by conduction? (ii) If this glass is doubled (window consists of two glass layers), What is the rate of heat flow through the glass? ($k_{glass} = 0.8\ W/m\ °K$) *(5 marks)*

5-Heat-c- Three moles of helium are initially at *30°C*, and a pressure of *1 atm*. **What** is the work done by the gas if the volume is *doubled* **(i)** at constant pressure, **(ii)** isothermally *(3 marks)*