Mansoura University
Faculty of Engineering
BCE Department
Level 000
2nd Semester 2019-2020

Course Title: Physics 1
Course Code: BAS-1012
Final Exam (2 Pages)
Due Date: Tuesday 14-7-2020
Time Allowed: 2 Hours
Total Mark: 70 (20 midterm + 50 final term)

ATTEMPT ALL QUESTIONS

Q1: (Midterm question) (10 marks)

1- (a) Find the dimensions of A and ω in the following equation, $X = A \sin(\omega t + \Phi)$, where: (X) is the displacement, (A) is the amplitude, (ω) is the angular frequency and (Φ) is the phase constant. (4 marks)

(b) A 2 m steel wire has a cross sectional area of (0.04) cm^2. Its yielding stress is 2.4×10^8 N/m^2. Calculate (i) The strain due to yielding stress. (ii) The working stress if the safety factor is taken 1.2. (iii) Poisson's ratio for the steel. ($E_{steel} = 20 \times 10^{10}$ N/m^2, $G_{steel} = 7.5 \times 10^{10}$ N/m^2). (6 marks)

Q2 (15 marks)

2- (a) Draw the stress – strain curve. (3 marks)

(b) The period (p) of a simple pendulum is the time for one complete swing. How does (p) depends on the mass (m) of the bob, the length (l) of the string and the acceleration due to gravity (g)? (6 marks)

(c) A telephone wire (120) m long and (2.2) mm in diameter is stretched by a force of (380) N. (i) What is the longitudinal stress? (ii) If the length after stretching is 120.1 m, what is the longitudinal strain? (iii) Determine young's modulus for the wire. (6 marks)

Q3 (10 marks)

3- (a) A mass attached to a spring completes one oscillation every 2 s. At t = 0 the mass is released from rest with the spring stretched (0.08) m from its equilibrium position. Determine: (i) the displacement of the cart at t = 0.1 s and (ii) the acceleration of the cart at t = 0.6 s. (6 marks)

(b) A 1 kg block is attached to a spring for which k =100 N/m. It is held at an extension of 0.06 m and then released at t =0. Find: (i) the displacement as a function of time. (ii) The acceleration when x = + A/2. (4 marks)

Q4: (Midterm question) (10 marks)

4- (a) Calculate the amount of heat needed to change 500 g of ice at – 20 ^{0}C to water at 40 ^{0}C. Take the specific heats for ice is 2100 J/kg. ^{0}C and for water 4186 J/kg. ^{0}C and the latent heat of fusion for ice is 3.337×10^5 J/kg. (6 marks)

(b) A beaker made of glass Pyrex 20 cm deep has an internal capacity of 1 liter at 25 ^{0}C. It is completely filled with glycerin, and then warmed to 55 ^{0}C. How much glycerin overflows? Neglect the expansion of the glass Pyrex. Take the volume expansion coefficient of glycerin $\gamma = 4.85 \times 10^{-4}\ ^0C^{-1}$. (4 marks)

Q5 (15 marks)

5- (a) Draw heating curve of water. (3 marks)

(b) A steel rod of 2 cm^2 in cross section is heated to 500 ^{0}C and fixed between two rigid supports. It is then cooled after that to 20 ^{0}C. (i) What is the type of stress developed in the rod? (b) Calculate the magnitude of this stress. Take the thermal expansion coefficient for steel ($\alpha = 11 \times 10^{-6}\ ^0C^{-1}$) and Young's modulus is (E= 2×10^{11} Pa). (6 marks)

(c) A 5-g piece of copper at 30 ^{0}C drops a vertical distance of 100 m to the ground. If about 50 % of its potential energy of copper goes into increasing its internal energy, find the final temperature of the copper. Take the specific heat of copper equals 387 J/kg. ^{0}C (6 marks)

Q6 (10 marks)

6- (a) A glass window has an area of 3 m^2 and a thickness of 6 mm . If the temperature difference between its faces is 15^{0}C, how much heat flows through the window per hour? The thermal conductivity K (glass) = 0.8 W/m. ^{0}C. (4 marks)

(b) A bar of gold is in thermal contact with a bar of silver of the same length and area as shown in the figure. One end of the compound bar is maintained at 80 ^{0}C while the opposite end is at 30 ^{0}C. When the heat flow reaches steady state, find the temperature at the junction. Consider the thermal conductivity for the gold and silver are 314 W/m ^{0}C and 427 W/m ^{0}C, respectively. (6 marks)