Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	PHYSICS FOR ENGINEERING TECHNOLOGY
COURSE CODE	:	BNP12603/BNQ10703
PROGRAMME CODE	:	BNN, BNC, BNA
EXAMINATION DATE	:	JULY / AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**. 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Two forces, F_1 and F_2, act on an object at angles of 30° and 150° to the positive x-axis, respectively. If F_1 has a magnitude of 8.0 N and F_2 has a magnitude of 6.0 N, calculate:

(i) The x and y components of the net force acting on the object

(6 marks)

(ii) The magnitude of the net force

(2 marks)

(iii) The angle the net force makes with the positive direction of the x-axis.

(2 marks)

(b) A block of mass 2.0 kg is suspended from the ceiling with ropes, as shown in **Figure Q1(b)**. The left rope makes an angle of 60° with the horizontal, and the right rope makes an angle of 30° with the horizontal. The block is in equilibrium.

Calculate;

(i) The tension in the left rope.

(4 marks)

(ii) The tension in the right rope.

(4 marks)

(iii) The magnitude and direction of the gravitational force acting on the block.

(2 marks)

Q2 (a) A crate of mass 50 kg is pulled along a rough surface with a force of 250 N at an angle of 30° to the horizontal. The coefficient of kinetic friction between the crate and the surface is 0.2. The crate displaces by 10 m. Calculate:

(i) The work done by the pulling force on the crate.

(3 marks)

(ii) The work done by the friction on the crate.

(3 marks)

(iii) The net work done on the crate.

(2 marks)

(iv) The final speed of the crate, assuming it starts from rest.

(4 marks)

(b) A cubic rubber block has a bulk modulus of 1.2×10^8 Nm^{-2}. If a pressure of 2.5×10^6 Nm^{-2} is applied uniformly at all its faces. Estimate the percentage of the change in the volume.

(4 marks)

(c) A spring has a spring constant of 200 Nm^{-1}.

(i) The force of 50 N is applied to the spring, calculate the extension on the spring

(2 marks)

(ii) Estimate the force required to strect the spring by 5 cm.

(2 marks)

Q3 (a) A 1 m steel scale is to be prepared such that the millimetre (mm) intervals are to be accurate within 5×10^{-4} mm at a certain temperature. Determine the maximum permissible temperature variation during the ruling of the mm mark. Given $\alpha_{steel} = 13.22 \times 10^{-6}\ ^{\circ}C^{-1}$.

(7 marks)

(b) A ball of mass 10 kg is held under the surface of a pool. The instant it is released, it has an instantaneous acceleration of 4 ms^{-2} toward the bottom of the pool. Determine the volume of the ball. Where $g = 10\ ms^{-2}$, and $\rho_{water} = 1.0\ kgl^{-1}$

(7 marks)

(c) Estimate the length of steel and copper rod when the length of the steel rod is 5cm longer than the copper rod at all the temperatures ($\alpha_{copper} = 1.7 \times 10^{-5}\ ^{\circ}C^{-1}$, $\alpha_{steel} = 1.1 \times 10^{-5}\ ^{\circ}C^{-1}$).

(6 marks)

Q4 (a) Briefly explain the concept of expansion produced by heat.

(5 marks)

(b) The concrete roof of a house's thickness of 20 cm has an area of 200 m^2. The temperature inside the house is 15°C, and the outside is 35°C. Calculate the rate at which thermal energy will be conducted through the roof. The value of k for concrete is 0.65 $Wm^{-1}K^{-1}$.

(5 marks)

(c) A ship in a sea sends SONAR waves straight down into the seawater from the bottom of the ship. The signal reflects from the deep bottom bedrock and returns to the ship after 3.5 s. After the ship moves to 100 km, it sends another signal which returns after 2s. Calculate the depth of the sea in each case and compute the difference in height between the two cases.

(10 marks)

- END OF QUESTIONS -

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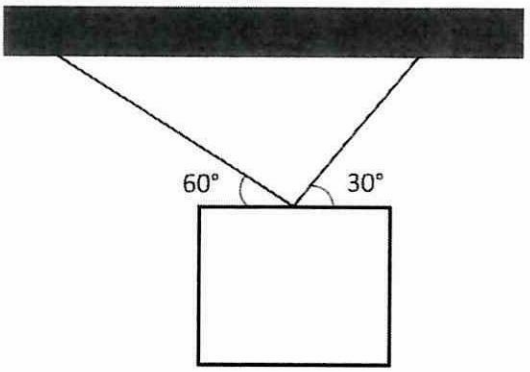

Figure Q1(b)

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List of Equations

$$R = \sqrt{R_x + R_y}$$

$$\theta = tan^{-1}\frac{R_y}{R_x}$$

$$\Sigma F = ma$$

$$W = mg$$

$$f_k = \mu N$$

$$stress = \frac{F}{A}$$

$$strain = \frac{\Delta L}{L}$$

$$Y = \frac{stress}{strain}$$

$$W = Fscos\theta$$

$$K = \frac{1}{2}mv^2$$

$$W_{net} = K_f - K_i$$

$$P = mgh$$

$$W_{net} = P_f - P_i$$

$$E = K + P$$

$$f = \frac{1}{T}$$

$$v = \frac{\lambda}{T} = f\lambda$$

$$P = \frac{W}{t}$$

$$\rho = \frac{m}{v}$$

$$P = \frac{F}{A}$$

$$P = \rho gh$$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$\Delta L = \alpha L \Delta T$$

$$\Delta A = 2\alpha A \Delta T$$

$$\Delta V = \beta V \Delta T$$

$$PV = nRT$$

$$Q = mc\Delta T$$

$$Q = mL_v$$

$$Q = mL_f$$

$$\frac{Q}{t} = \frac{kA(T_2 - T_1)}{d}$$

$$\frac{Q}{t} = \sigma e A T^4$$

$$F = -kx$$