Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER I
## SESSION 2018/2019

TERBUKA

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|---|---|---|
| COURSE NAME | : | PHYSICS FOR ENGINEERING TECHNOLOGY |
| COURSE CODE | : | BWM 12603 |
| PROGRAMME CODE | : | BNA/BNB/BNC/BND/BNN |
| EXAMINATION DATE | : | DECEMBER 2018 / JANUARY 2019 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **ALL** QUESTIONS IN PART A AND SELECT **THREE (3)** QUESTIONS IN PART B |

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

**PART A**

**Q1** (a) Define tranverse waves.

(2 marks)

(b) A guitar's E-string has a length of 65 cm and is stretched to a tension of 82 N. If it vibrates with a fundamental frequency of 329.64 Hz, what is the mass of the string?

(4 marks)

(c) Sam, a train engineer, blows a whistle that has a frequency of $4.0 \times 10^2$ Hz as the train approaches a station. If the speed of the train is 25 $ms^{-1}$, what frequency will be heard by a person at the station? Given: Speed of sound in air is 340 $ms^{-1}$.

(4 marks)

(d) A travelling wave is described by the equation:

$$y(x, t) = (0.003) \cos (20x + 200t)$$

where $y$ and $x$ are measured in meters and $t$ in seconds.

Find:

(i) Direction of the wave travelling.
(ii) Angular wave number and wavelength.
(iii) Angular frequency and frequency.
(iv) Period and wave speed.
(v) Amplitude.

(10 marks)



**Q2** (a) Define specific heat capacity.

(2 marks)

(b) How much heat must be absorbed by ice of mass $m$ = 720 g at -10 °C to take it to liquid state at 15°C?
(Given: specific heat of ice: 2220 J $kg^{-1}$ $K^{-1}$, specific heat of liquid: 4190 J $kg^{-1}$ $K^{-1}$ and heat of fusion: 333 kJ $kg^{-1}$)

(8 marks)

(c) Describe heat transfer process through conduction.

(4 marks)

(d) **Figure Q2(d)** shows the cross section of a wall made of white pine of thickness $L_a$ and brick of thickness $L_d = 2.0\ L_a$, sandwiching two layers of unknown material with identical thickness and thermal conductivities. The thermal conductivities of the pine is $k_a$ and that of the brick is $k_d = 5.0\ k_a$. The face area of the wall is unknown. Thermal conduction through the wall has reached the steady state. The only known interface temperature are $T_1$ = 25°C, $T_2$ = 20°C and $T_5$ = −10°C. Calculate the interface temperature $T_4$.

(6 marks)

**PART B**

**Q3** (a) State **ONE (1)** difference between scalar and vector quantity. Give **ONE (1)** example for each.

(4 marks)

(b) Convert:

(i) 0.35 $mm^2$ to $m^2$

(2 marks)

(ii) 0.000008 m to μm

(2 marks)

(iii) 39 $kgm^{-3}$ to $gcm^{-3}$

(2 marks)

(c) A certain physical quantity, $R$, is calculated using the formula: $R = 4a^2\ (b - c)$ where $a$, $b$, and $c$ are distances. What is the SI unit for $R$?

(2 marks)

(d) Given the resultant vector of the coplanar forces system as shown in **Figure Q3(d)**, $F_4$ has components $F_{4X}$ = 80 N and $F_{4Y}$ = 90 N. Determine the magnitude and direction of vector $F_3$.

(8 marks)

**Q4** (a) State Newton's First Law of Motion



(2 marks)

(b) **Figure Q4(b)** shows a force, $F$ = 28 N applies on a 0.95 kg block at rest on a frictionless surface. Calculate acceleration of the block.

(3 marks)

(c) State one of the condition for an object to be in static equilibrium.

(1 mark)

(d) **Figure Q4(d)** shows two cables $T_1$ and $T_2$ used to hang an object, $W$ of weight 600 N and $T_2$ makes an angle of 35° with vertical wall. Determine the tension in both cables if the system is in equilibrium.

(5 marks)

(e) In **Figure Q4(e)**, a 100N box (initially at rest) is pushed 10.0 m up a rough ramp by a horizontal applied force of 150 N. The ramp is inclined at an angle of 25° and the coefficient of kinetic friction between the box and the ramp is 0.1. Compute the net work done on the box.

(5 marks)

(f) A ball of mass 5 kg rolls on the smooth surface as shown in **Figure Q4(f)**. If the ball starts from rest at point A, calculate its speed at point B.

(4 marks)

**Q5** (a) State the Archimedes' principle.

(2 marks)

(b) (i) A students measures the mass of five steel nuts be 96.2 g. The nuts displace 13 ml of water. Calculate the density of the steel in the nuts.

(4 marks)

(ii) A reservoir has a surface area of 50.0 $km^2$ and an average depth of 40.0 m. What mass of water is held behind the dam?
(Given: Densities of various substances is $1.000 \times 10^3$ $kg/m^3$)

(4 marks)

(c) (i) Calculate the buoyant force on 10 000 metric tons ($1.00 \times 10^7$kg) of solid steel completely submerged in water and compare this with the steel's weight. (Given: Density of steel, $\rho_{steel}$ : $7.8 \times 10^3$ $kg/m^3$ and density of water, $\rho_{water}$ : $1.0 \times 10^3$ $kg/m^3$)

(6 marks)

(ii) What is the maximum buoyant force that water could exert on this same steel if it were shaped into a boat that could displace $1.00 \times 10^5$ $m^3$ of water?

(4 marks)

**Q6** (a) The main span of San Francisco's Golden Gate Bridge is 1275 m long at its coldest. The bridge is exposed to temperature ranging from –15 °C to 40 °C. What is its change in length between these temperatures? Assume that the bridge is made entirely of steel, where the coefficient of linear expansion, $\alpha$ for steel is $12 \times 10^{-6}$ °$C^{-1}$.

(4 marks)



(b) Prove $\Delta V = 3\alpha V \Delta T$.

(8 marks)

(c) Consider a 2 m long brass rod and a 1 m long aluminum rod. When the temperature is 22 °C, there is a gap of $1.0 \times 10^{-3}$ m separating their ends. No expansion is possible at the other end of their rod. At what temperature will the two bars touch?
(Given: coefficient linear expansion of brass, $\alpha_{brass} = 19 \times 10^{-6}$ °$C^{-1}$ and coefficient linear expansion of aluminium, $\alpha_{aluminium} = 23 \times 10^{-6}$ °$C^{-1}$)

(8 marks)

**– END OF QUESTIONS –**

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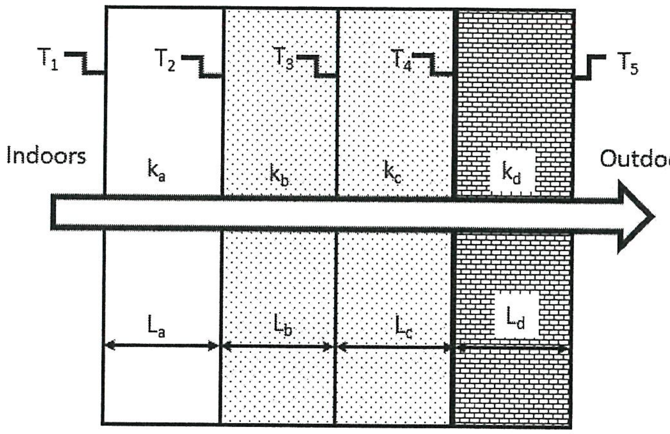


**Figure Q2(d)**

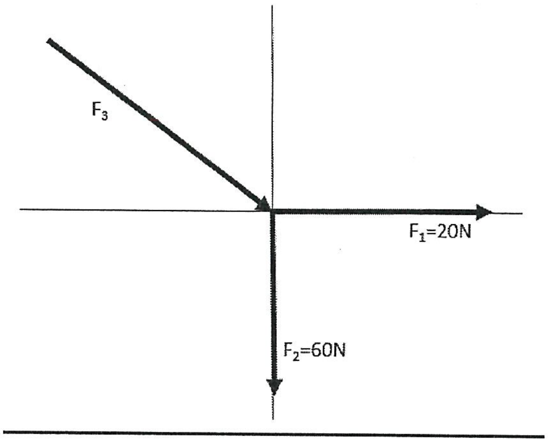


**Figure Q3(d)**

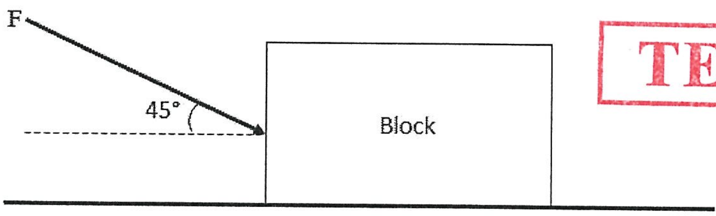


**Figure Q4(b)**

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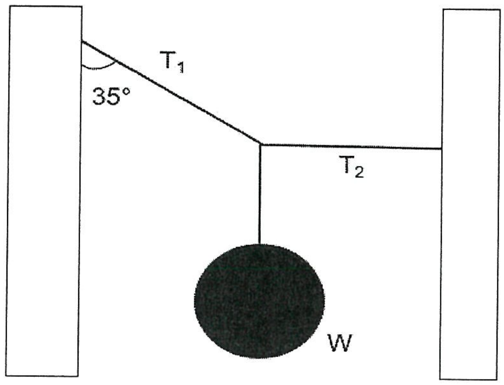


**Figure Q4(d)**

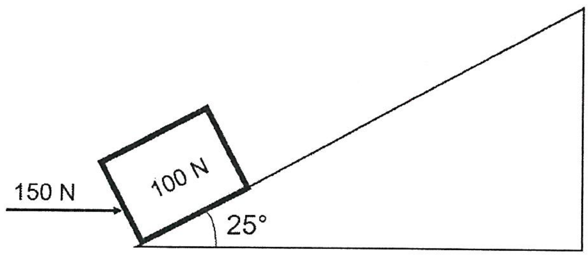


**Figure Q4(e)**

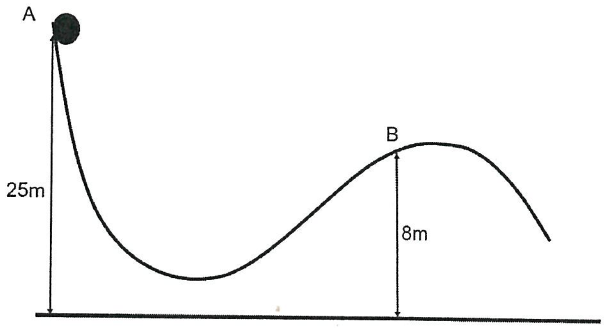


**Figure Q4(f)**