Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	PHYSICS FOR ENGINEERING TECHNOLOGY
COURSE CODE	:	BWM 12603
PROGRAMME CODE	:	BNB/ BND/ BNE/ BNF/ BNN
EXAMINATION DATE	:	JUNE/ JULY 2018
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	A) ANSWER **ALL** QUESTIONS IN PART A. B) ANSWER ONLY **THREE (3)** QUESTIONS IN PART B.

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

PART A

Q1 (a) State a difference between longitudinal waves and transverse waves. Give examples for each.

(4 marks)

(b) A progressive wave is represented by the equation

$$y = 0.1 \sin (200 \pi t - 20 \pi x / 17)$$

where x and y are in metres, t in seconds. Find

(i) the frequency (f),

(ii) the wavelength (λ), and

(iii) the speed (v) of the wave

(6 marks)

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(c) Graph **Figure Q1 (c)** shows the variation of displacement with distance along the path of a progressive transverse wave of constant amplitude at time $t = 0$. The wave is travelling in the direction of the arrow. Wave B shows the same pattern at time $t = 50$ s. Determine

(i) the wavelength,

(ii) the speed of the wave,

(iii) the frequency of the vibrations producing the wave.

(iv) the wave equation for wave A.

(10 marks)

Q2 (a) Determine the factors that influence the heat lost from a glass filled with 100 °C of water.

(4 marks)

(b) When 0.15 kg of ice of 0 °C mixed with 0.30 kg of water at 50 °C in a container, the resulting temperature is 6.7 °C. Calculate the heat of fusion of ice. (specific heat of water = 4.18×10^3 J $kg^{-1} K^{-1}$)

(8 marks)

(c) A sphere of aluminium has a mass 0.047 kg is placed for sufficient time in a vessel containing boiling water, so that the sphere is at 100°C. It is then immediately transferred to 0.14 kg copper calorimeter containing 0.25 kg of water at 20 ° C. The temperature of water rises and attains a steady state at 23° C. Calculate the specific heat capacity of aluminum.

(Given specific heat for water is 4.18×10^3 Jkg^{-1} K^{-1} and specific heat capacity of copper calorimeter is 0.386×10^3 J kg^{-1} K^{-1})

(8 marks)

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PART B

Q3 (a) Find the mass and weight of the air at 1 atm and 20°C in a living room with 4.0m x 5.0m x 3.0m dimension. Given that the mass and weight of the air is equal with the volume of water.

(Given density of air, $\rho_{air} = 1.20$ kg/m^3 and water, $\rho_{water} = 1.0 \times 10^3$ kg/m^3)

(4 marks)

(b) A 74 000 kg undersea spherical research chamber with an external diameter of 5.2 m is anchored to the sea bottom by a cable. The density of the sea water is 1025 kg/m^3.

(i) How large is the buoyant force of the chamber?

(ii) What is the tension of the cable?

(10 marks)

(c) **Figure Q3 (c)** show a hydraulic chamber in which a spring of constant k = 1000 N/m is attached to the input piston and a rock of mass m = 10 kg rests on the output plunger. The piston and plunger are nearly at the same height, and each has negligible mass.

(i) Develop an expression for the compression of the spring in terms of m, g, A_1, A_2 and k only.

(ii) How much is the spring compressed from its unstrained position?

(6 marks)

Q4 (a) A rod of metal is measured at 285 K and is 3.521 m long. After certain period of heating, at 373 K the rod became 3.523 m long. Determine the value of the coefficient of linear expansion for the metal.

(4 marks)

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(b) A zinc sphere has a radius of 30.0 mm at a temperature of 20°C. If the temperature of the sphere is raised to 420°C, determine the increase in

(i) the radius,

(ii) the surface area,

(iii) the volume of the sphere.

Given the coefficient of linear expansion for zinc to be $31 \times 10^{-6} K^{-1}$.

(10 marks)

(c) A hole with a diameter of 0.85 cm is drilled into a steel plate. At 30.0°C, the hole exactly accommodates an aluminum rod of the same diameter. What is the spacing between the plate and the rod when they are cooled to 0.0°C?

(6 marks)

Q5 (a) If a physical quantity is represented as $Z = IFV^2 WL^3$ where I is moment of inertia, F force, V velocity, W work and L length. Find the dimension of Z.

(5 marks)

(b) A powerboat heads due northwest at 13 ms^{-1} relative to the water across a river that flows due north at 5.0 ms^{-1}. What is the velocity (both magnitude and direction) of the motorboat relative to the shore?

(5 marks)

(c) **Figure Q5 (c)** shows a rifle is aimed horizontally at a target 30 m away. The bullet hits the target 1.9 cm below the aiming point.

(i) What is the bullet's time of flight?

(ii) What is the bullet velocity?

(10 marks)

Q6 (a) Three masses are connected on a table as shown in **Figure Q6 (a)**. The table has a coefficient of sliding friction of 0.35. The three masses are 4.0 kg, 1.0 kg, and 2.0 kg, respectively and the pulleys are frictionless. Determine

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(i) the acceleration of each block and their directions.

(ii) the tensions in the two cords.

(10 marks)

(b) A 5.20 kg block is set into motion up an inclined plane with an initial speed of $v_i = 8.40$ m/s as shown in **Figure Q6(b)**. The block comes to rest after traveling $d = 3.0$ m along the plane, which is inclined at an angle of $\theta = 30.0^{\circ}$ to the horizontal. Determine

(i) the change in the block's kinetic energy.

(ii) the change in block's potential energy

(iii) the friction force exerted on the block (assumed to be constant).

(iv) the coefficient of kinetic friction

(10 marks)

-END OF QUESTIONS-

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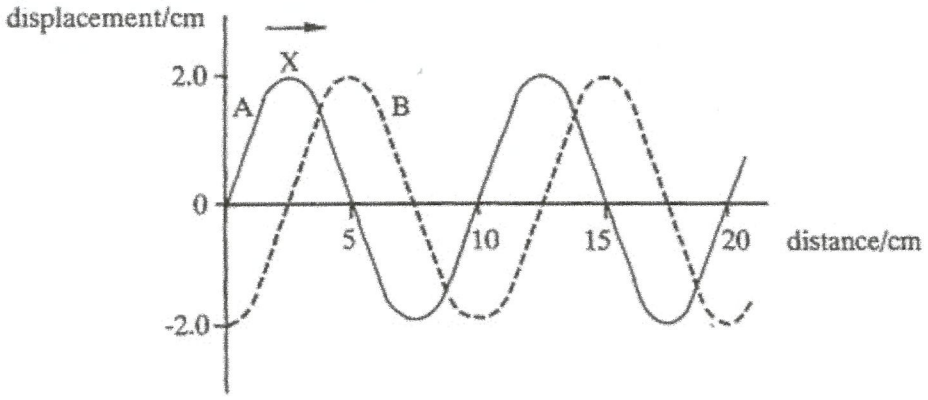

Figure Q1(c)

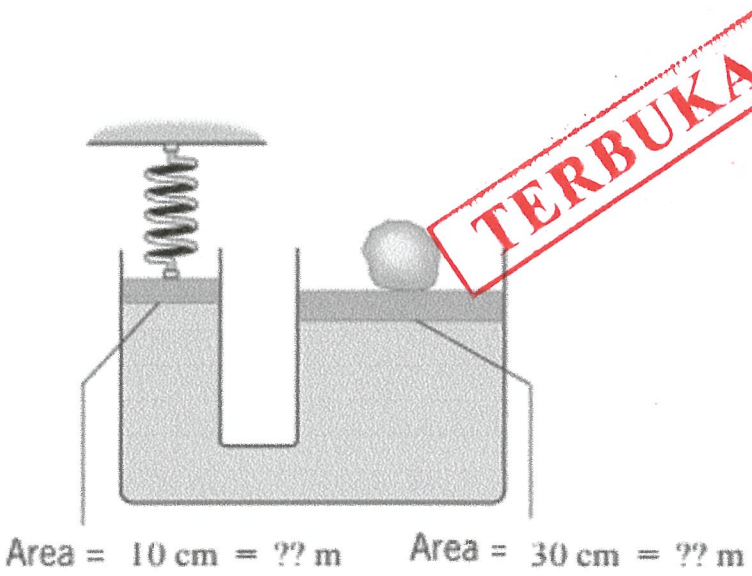

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Figure Q3(c)

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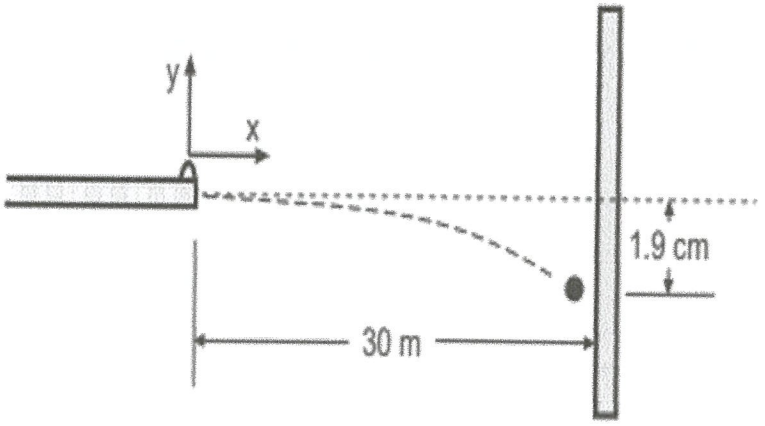

Figure Q5 (c)

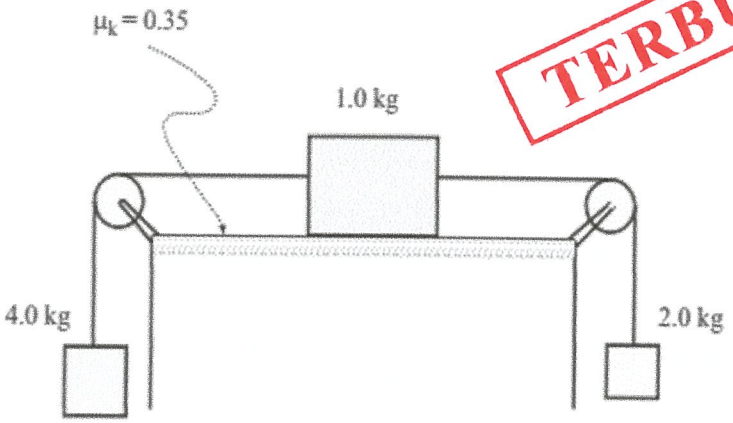

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Figure Q6(a)

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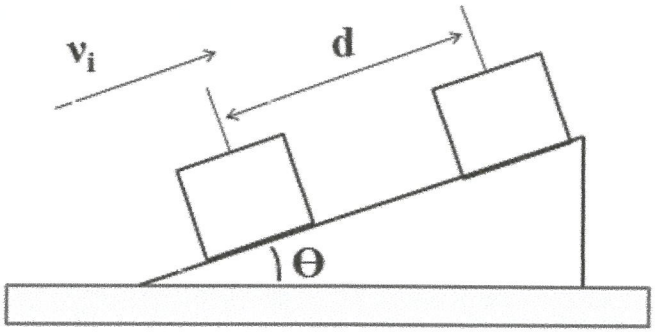

Figure Q6(b)

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LIST OF CONSTANTS AND FORMULA

Gravity acceleration, $g = 9.81\ m/s^2$	1 feet – 12 in 1 feet =30.48cm=0.3048 m 1 mi = 1.609 km	$P = m \cdot v$
$W = F \cdot s = Fs\cos\theta$	$E_u = \frac{1}{2}kx^2 = \frac{1}{2}m\omega^2 x^2$	$s = r\theta$
$K = \frac{1}{2}mv^2$	$E_J = E_k + E_u = \frac{1}{2}m\omega^2 A^2$	$v = r\omega$
$U = mgh$	$R = \sqrt{R_x^2 + R_y^2}$	$a = r\alpha$
$\Delta K = -\Delta U$	$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$	$\omega = \frac{d\theta}{dt}$
$W_n = \Delta K$	$v = u + at$	$\alpha = \frac{d\omega}{dt}$
$\frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 = -(mgh_2 - mgh_1)$	$s = ut + \frac{1}{2}at^2$	$a_c = \frac{v^2}{r} = \omega^2 r$
$a = -\omega^2 \cdot x$	$v^2 = u^2 + 2as$	$a = r\sqrt{\omega^4 + \alpha^2}$
$f = \frac{1}{T} = \frac{\omega}{2\pi}$	$\sum F = ma$	$\omega = \omega_o + \alpha t$
$v = \omega\sqrt{A^2 - x^2}$	$W = mg$	$\theta = \omega_o t + \frac{1}{2}\alpha \cdot t^2$
$E_k = \frac{1}{2}mv^2 = \frac{1}{2}m\omega^2(A^2 - x^2)$	$f_k = \mu_k N$ $f_s = \mu_s N$	$\omega^2 = \omega_o^2 + 2\alpha \cdot \Delta\theta$

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