UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	PHYSICS II
COURSE CODE	:	DAS 14203
PROGRAMME CODE	:	DAU / DAA / DAE / DAM
EXAMINATION DATE	:	JUNE 2017
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTIONS	:	**SECTION A)** ANSWER **ALL** QUESTIONS **SECTION B)** ANSWER **TWO (2)** QUESTIONS ONLY

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THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

SECTION A

Q1 (a) Plane waves travelling and reach small slits as shown in **Figure Q1 (a)**

(i) Explain briefly Huygen's Principle

(2 marks)

(ii) Sketch the pattern of the wave upon emerging from the aperture.

(3 marks)

(b) Monochromatic light is incident on a single slit of width 0.30 mm. On a screen located 2.0 m away, the width of central bright fringe is measured to be 7.8 mm.

(i) Illustrate the pattern of light appear on screen

(4 marks)

(ii) Calculate the wavelength of the incident light

(6 marks)

(c) In a Young's double slit experiment, the wavelength of a monochromatic light used is 580 nm. If the slit separation is 0.02 mm and the distance between the double slits and the screen is 1.2 m, calculate

(i) the distance of the second bright fringe from the center of the interference pattern.

(3 marks)

(ii) the distance of the fourth dark fringe from the center of interference pattern.

(3 marks)

(iii) the distance between the first and the sixth bright fringes.

(4 marks)

Q2 (a) A 1.8 m tall man standing in front of a mirror hopes of seeing his full height as shown in **Figure Q2 (a)**. If his eyes are 0.1 m from the top of his head.

(i) State **TWO (2)** characteristic of light according to Ibn al-Haytham.

(2 marks)

(ii) Distinguish between ray of light and beam of light.

(4 marks)

(iii) Compute the minimum height of the mirror.

(7 marks)

(b) An object located in front of spherical mirror with focal length of 10 cm as shown in **Figure Q2 (b)**.

(i) Sketch the image of as result by reflection from spherical mirror.

(4 marks)

(ii) Compute the distance of the image and magnification if the object distance is located 25 cm away from the mirror.

(6 marks)

(iii) Describe the characteristics of the image formed.

(2 marks)

SECTION B

Q3 (a) **Figure Q3 (a)** shows a Stress versus Strain curve for elastic cylindrical shaped rubber.

(i) Calculate Young's modulus ***Y*** of the rubber.

(3 marks)

(ii) Sketch a simple Stress versus Strain graph of mild steel after underwent a material testing. Completely label your graph to show the "Elastic Limit" and the "Ultimate Tensile Strength" on the sketched graph.

(4 marks)

(b) Suppose the object in **Figure Q3 (b)** is the brass base plate of an outdoor sculpture that experiences shear forces in an earthquake. The plate is 0.80 m square and 0.50 cm thick. Calculate the force exerted on each of its edges if the resulting displacement x is 0.16 mm.

(8 marks)

(c) A piece of aluminum with mass 1.00 kg and density 2 700 kg·m^{-3} is suspended from a string and then completely immersed in a container of water as shown in **Figure Q3 (c)(i)** and **Figure Q3 (c)(ii)**. Calculate the tension in the string

(i) before the metal is immersed.

(3 marks)

(ii) after the metal is fully immersed in the water.

(7 marks)

Q4 (a) (i) Define Heat Capacity

(2 marks)

(ii) Calculate the heat capacity of 3.00 m^3 of lead
Given: Density of lead = 11300 kg·m^3
Specific heat capacity of lead = 0.13 kJ·kg^{-1}·°C^{-1}

(3 marks)

(b) A 150 g glass container contains 300 g of water and 30 g aluminum spoon at 18 °C. A 200 g of aluminum cube at 200 °C is added to the water in the container. Assume there is no heat loss to the surrounding. Compute the final temperature of the system
Given: Specific heat capacity of water = 4186 J·kg^{-1}·°C^{-1}
Specific heat capacity of copper = 390 J·kg^{-1}·°C^{-1}
Specific heat capacity of aluminum = 900 J·kg^{-1}·°C^{-1}
Specific heat capacity of glass = 837.2 J·kg^{-1}·°C^{-1}

(8 marks)

(c) A cup containing 250 g of hot coffee at 85 °C. In order to cool the coffee to 55 °C, calculate the amount of ice (in gram) at 0 °C must be added to the coffee. Neglect the heat content of the cup and heat exchanges with the surroundings.
Given: Specific heat capacity of water = 4186 J·kg^{-1}·°C^{-1}
Latent heat of fusion of ice = 3.34 x 10^5 J·kg^{-1}

(6 marks)

(d) A copper rod of length 0.5 m and cross sectional area 6.0 x 10^{-2} m^2 is connected to an iron rod with the same cross sectional area and length 0.25 m. Copper rod is immersed in boiling water and iron rod is in an ice bath at 0 °C. Calculate the rate of heat transfer passing from the boiling water to the ice bath. Assume there is no heat loss to the surrounding.

Given: Thermal conductivity of copper = 401 $W \cdot m^{-1} \cdot K^{-1}$
Thermal conductivity of iron = 80 $W \cdot m^{-1} \cdot K^{-1}$

(6 marks)

Q5 (a) (i) Define Thermal Expansion.

(2 marks)

(ii) State **ONE (1)** type of thermal expansion.

(1 mark)

(b) A sheet of copper has a circular hole with a diameter of 3 m. If the sheet is heated and underwent a change in temperature of 50 K. Calculate

(i) the change in radius of the hole.
(ii) the new area of the hole.

Given: Coefficient of linear expansion of copper is 17 x 10^{-6} K^{-1}

(12 marks)

(c) A cylindrical brass container with a base of 75 cm^2 and height of 20 cm is filled to the brim with water when the system is at 25 °C. Calculate water that over flows when the temperature of the water and container raised to 95 °C.

Given: Coefficient of volume expansion of water, γ_{H2O} = 207 x 10^{-6} K^{-1}
Coefficient of linear expansion of brass, α_{brass} = 19 x 10^{-6} K^{-1}

(10 marks)

Q6 (a) Sketch a sinusoidal graph of displacement versus length (y-x graph) and label its wavelength and maximum displacement in your sketched graph.

(5 marks)

(b) A sinusoidal wave is represented by the equation $y(x,t) = 5sin\left(\pi t - \frac{\pi}{3}x\right)$ where y and x are in metre and t is in second. Calculate

(i) the wave number

(1 mark)

(ii) the frequency

(2 marks)

(iii) the speed of the wave

(4 marks)

(c) A string with mass 50 g and length 2.0 m is tied to a simple harmonic oscillator at one end. The string is then stretched horizontally to a pulley 1.7 m away from the oscillator. An object with mass 150 g is tied at the other end of the string as shown in **Figure Q6 (c)**. When the oscillator is oscillate at a constant rotational speed, the string is swing up and down at a frequency of 50 Hz with a maximum displacement of 12 mm. Calculate

(i) the tension of the string, wave speed on the string and the wavelength of the string.

(8 marks)

(ii) the amplitude (in SI unit), wave number, and angular frequency of the string.

(5 marks)

Q7 (a) A police siren emits a sinusoidal wave with frequency, $f = 300$ Hz. Given the speed of sound is 340 $m \cdot s^{-1}$. Calculate

(i) the wavelength of the waves if the siren is at rest in the air. (3 marks)

(ii) the wavelengths of the waves in front of and behind the source if the siren is moving at 30 $m \cdot s^{-1}$. (6 marks)

(iii) the frequency hear by the observer if he is at rest and the siren is moving away from him at 30 $m \cdot s^{-1}$. (4 marks)

(iv) the frequency hear by the observer if the siren is at rest and the observer is moving away from the siren at 30 $m \cdot s^{-1}$. (4 marks)

(v) the frequency hear by the observer if the siren is moving away from the observer with a speed of 45 $m \cdot s^{-1}$ relative to the air and the observer is moving toward the siren with a speed of 45 $m \cdot s^{-1}$ relative to the air. (4 marks)

(b) Identify clearly why a bell ringing inside a vacuum chamber cannot be heard on the outside.

(4 marks)

-END OF QUESTION-

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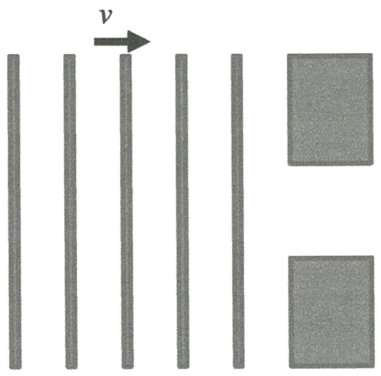

Figure Q1 (a)

Figure Q1 (c)

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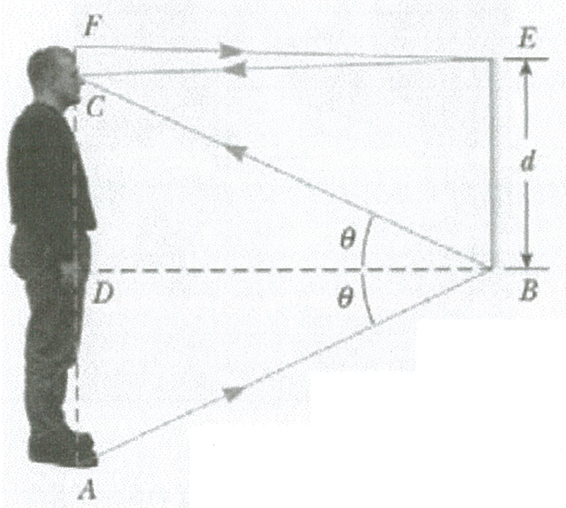

Figure Q2 (a)

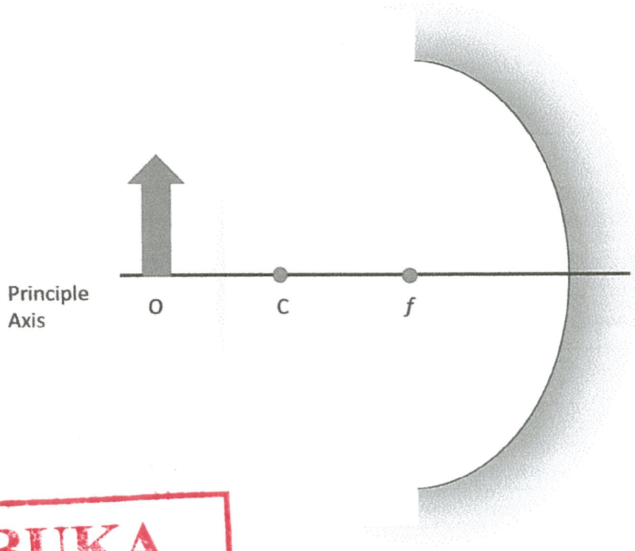

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Figure Q2 (b)

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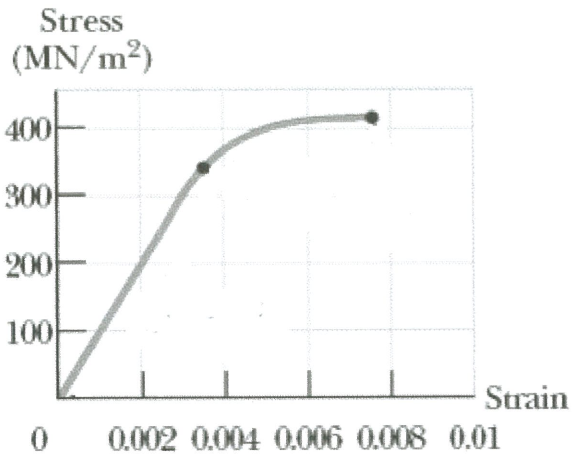

Figure Q3 (a)

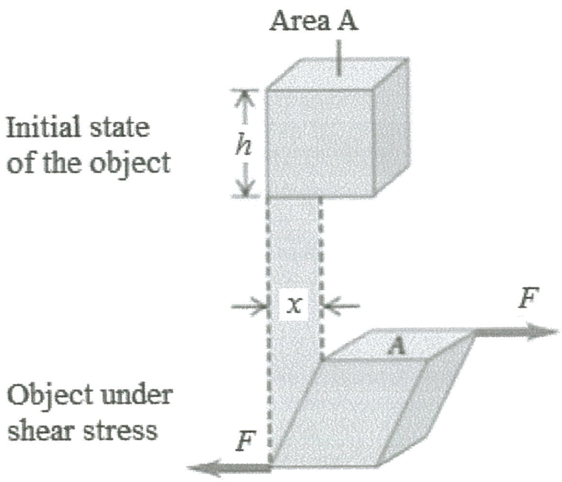

Figure Q3 (b)

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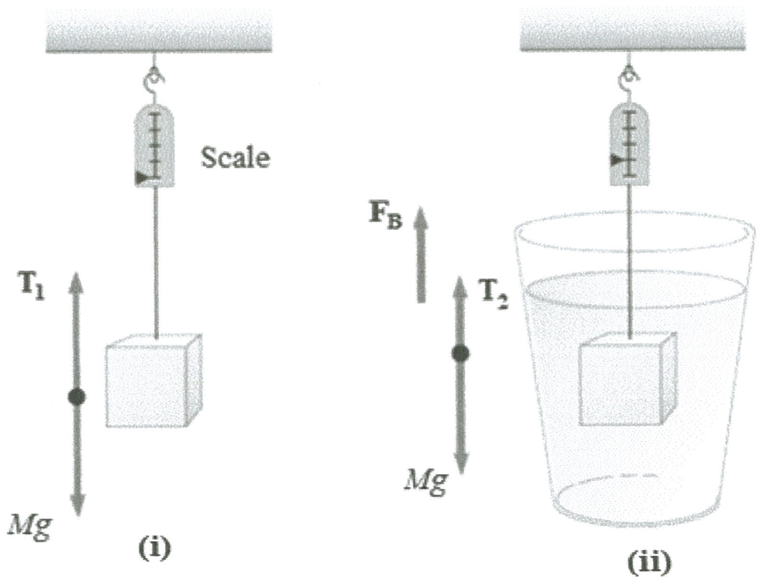

Figure Q3 (c)

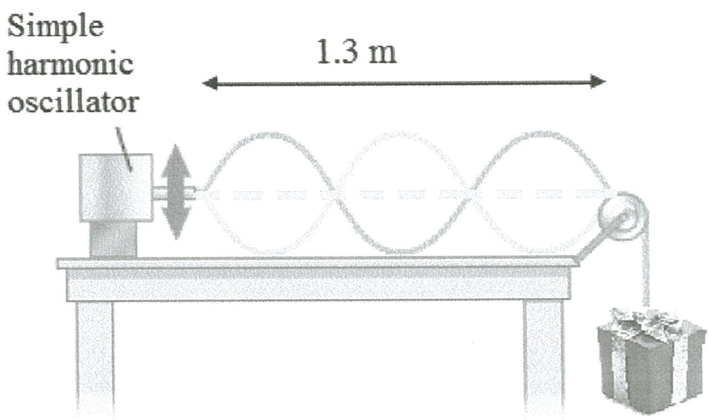

Figure Q6 (c)

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LIST OF FORMULA

$P = \frac{F}{A}$ | $P = \rho gh$ | $V = \pi r^2 h$

$\varepsilon = \frac{\Delta L}{L}$ | $P = P_{atm.} + \rho gh$ | $V = \frac{4}{3}\pi r^3$

$\rho = \frac{m}{V}$ | $F_B = \rho gV$ | $A = \pi r^2$

$T_F = 1.8T_C + 32$ | $F_B = F_2 - F_1 = mg$ | $A = 4\pi r^2$

$T_K = T_C + 273.15$ | $Q = mc(T_2 - T_1)$ | $\Delta L = L_o\alpha(T_f - T_i)$

$L = \frac{Q}{m}$ | $\frac{Q}{t} = \frac{\kappa A(T_{hot} - T_{cold})}{d}$ | $\Delta A = A_o\beta(T_f - T_i)$

$T_C = \frac{T_F - 32}{1.8}$ | $Q = C(T_2 - T_1)$ | $\Delta V = V_o\gamma(T_f - T_i)$

$P = \frac{F_1}{A_1} = \frac{F_2}{A_2}$ | $y(x,t) = A\sin(\omega t \pm kx)$ | $\gamma_{apparent} = \gamma_L - \gamma_C$

$\mu = \frac{m}{L}$ | $y(x,t) = 2A\sin\omega t\cos kx$ | $v = f\lambda = \frac{\omega}{k}$

$v = \sqrt{\frac{B}{\rho}}$ | $L = \frac{\lambda}{4}n$ | $\omega = 2\pi f$

$v = \sqrt{\frac{T}{\mu}}$ | $L = \frac{\lambda}{2}n$ | $f_n = \frac{v}{4L}n$

$v = \sqrt{\frac{Y}{\rho}}$ | $n = \frac{f_n}{f_o}$ | $f_n = \frac{v}{2L}n$

$k = \frac{2\pi}{\lambda}$ | $I = \frac{E/t}{A} = \frac{P}{A}$ | $\beta = 10\log_{10}\frac{I}{I_o}$

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$$sin\theta_c = \frac{n_2}{n_1}$$

$$M = -\frac{v}{u} = \frac{h_i}{h_o}$$

$$y_m = \frac{\lambda Lm}{d}$$

$$y_{m+½} = \frac{\lambda L}{d}(m+½)$$

$$f' = f\left(\frac{v \pm v_o}{v \pm v_s}\right)$$

$$y = \frac{\lambda L}{a}$$

$$f = \pm\frac{1}{2}R$$

$$f' = f\left(\frac{v \pm v_o}{v}\right)$$

$$\Delta y = \frac{\lambda L}{d}$$

$$sin\theta = \frac{m\lambda}{d} = \frac{y}{D}$$

$$asin\theta = m\lambda$$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$f' = f\left(\frac{v}{v \pm v_s}\right)$$

$$I = I_o cos^2\theta$$

$$n_1 sin\theta_1 = n_2 sin\theta_2$$

$$a\frac{y}{L} = m\lambda$$