Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	PHYSICS FOR CIVIL ENGINEERING
COURSE CODE	:	DAC 10603
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTIONS	:	ANSWER **TWO (2)** QUESTIONS IN SECTION A AND **THREE (3)** QUESTIONS IN SECTION B

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

SECTION A

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

(i) Explain Huygen's principle.

(2 marks)

(ii) Draw 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, and the wavelength is given by 585 nm.

(i) State the definition of monochromatic light.

(2 marks)

(ii) Calculate the width of central bright fringe.

(4 marks)

(c) A Fraunhofer double-slit experiment carried by applying incident plane wave to double-slit as shown in **Figure Q1 (c)**.

(i) Show that the bright fringes equation is given by: $d \sin \theta = m\lambda$

(4 marks)

(ii) Given the wavelength of the light is 546 nm, the slit separation d is 0.12 mm, and the slit–screen separation D is 55 cm. Calculate distance between two adjacent bright fringes.

(5 marks)

Q2 (a) State the law of reflection of a plane mirror.

(2 marks)

(b) An object located 35.70 cm from a lens forms an image 7.80 cm in front of the lens. The image is located on the same side of the object.

(i) Calculate the focal length of the lens.

(3 marks)

(ii) Determine the type of the lens ans state your reason.

(2 marks)

(iii) Determine the type of image formed and state your reason.

(2 marks)

(c) A man is standing 0.50 m from a concave mirror. If his image is upright and magnified by a factor of 3, calculate:

(i) the distance of the image formed.

(2 marks)

(ii) the radius of curvature for the mirror.

(4 marks)

(d) A ray of light is approaching a cup made of glass at an angle of 40^0 to the normal. The cup is filled with water. Given the refractive index of air is 1.00, the refractive index of water is 1.33, and the refractive index of glass is 1.50. Determine the angle of refraction of the light ray upon:

(i) entering the wall of the glass cup.

(3 marks)

(ii) leaving the wall of the glass cup and entering the water.

(2 marks)

SECTION B

Q3 (a) A metal ball weighs 0.15 N in the air. When the metal ball is suspended in water, it has weight of 0.09 N. Given the density of water is 1000 kgm^{-3}.

(i) Define apparent weight.

(1 mark)

(ii) Discuss the reason of why the apparent weight smaller than the actual weight.

(1 mark)

(iii) Find the buoyant force acting on the metal ball.

(2 marks)

(iv) Find the density of the ball.

(3 marks)

(b) A metal sphere with a diameter of 4 cm has a density of 7000 kgm^{-3}. Calculate its apparent weight when it is totally submerged in water. Given the density of water is 1000 kgm^{-3}.

(5 marks)

(c) A container contains a 20 cm layer of oil floating on water that is 40 cm deep. Given the density of the oil is $600\ kg.m^{-3}$, the density of water is $1000\ kg.m^{-3}$ and the atmospheric pressure is $101.3 \times 10^3 Pa$. Calculate:

(i) the absolute pressure at the oil-water interface.

(4 marks)

(ii) the absolute pressure at the bottom of the container.

(4 marks)

Q4 (a) A boxlike cooler has 5.0 cm thick wall made of plastic foam. Its area is 1.5 m^2. Calculate the amount of ice melts after an hour inside the cooler to hold its temperature at 0 °C when the outside temperature is 30 °C.
Given the thermal conductivities for the plastic, $\kappa = 0.04\ Wm^{-1}K^{-1}$

(6 marks)

(b) A 500 g chunk of ice at -10° C is placed in 3.0 kg of ice tea at 20 °C. Find the final temperature of the system.

(6 marks)

(c) One wall of a house consists of plywood backed by insulation as shown in **Figure Q4 (c)**. Given the thermal conductivities of the insulation and plywood are 0.030 $Wm^{-1}C^{-1}$ and 0.080 $Wm^{-1}C^{-1}$ respectively, and the area of the wall is 35 m^2.

(i) Define conduction.

(2 marks)

(ii) Find the amount of heat conducted through the wall in one hour.

(6 marks)

Q5 (a) Thermal expansion is one of naturally occured phenomena. If an aluminum rod with length exactly 1.00 m at 300 K placed into 400 °C oven. Given the linear expansion of the rod $\alpha_{al}=23 \times 10^{-6}\ K^{-1}$.

(i) Define thermal expansion.

(2 marks)

(ii) Calculate expansion made by the Aluminum rod.

(5 marks)

(iii) Find the final length of the Aluminum rod.

(4 marks)

(b) In a winter day, a truck loaded with 37000 L of diesel fuel is on journey toward the north area with temperature -5 °C. Supposed the temperature for the origin place is given as 18 °C and coefficient of volume expansion for diesel is given by $9.5 \times 10^{-4}\ °C^{-1}$. Calculate:

(i) the amount of expansion for diesel.

(4 marks)

(ii) the final amount of diesel loaded on the truck, once it reach final destination.

(5 marks)

Q6 (a) State the difference between longitudinal waves and transverse waves.

(2 marks)

(b) A progressive wave is represented by the equation

$$y(x,t) = 5\sin\left(\frac{\pi}{2}t + \frac{\pi}{3}x\right)$$

where y and x are in centimeters and t is in seconds. Determine:

(i) the amplitude.

(1 mark)

(ii) the angular frequency.

(1 mark)

(iii) the wavelength.

(2 marks)

(iv) the period.

(2 marks)

(v) Sketch a sinusoidal graph of y versus x.

(3 marks)

(c) A wave propagates in the negative x-direction with a speed of 5 ms^{-1} and has amplitude 0.50 m. If the wave has a wavelength of 0.40 m, write down the wave equation.

(9 marks)

Q7 (a) A rock band gives rise to an average sound level of 105 dB at a distance of 20 m from the centre of the band. As an approximation, assume that the band radiates sound equally into a hemisphere, where the area of hemisphere is given as $4\pi r^2$.

(i) Describe the phenomena for the intensity of a high sound.

(2 marks)

(ii) Determine the sound power output of the band.

(6 marks)

(b) The siren of a police car at rest emits at a predominant frequency of 1600 Hz. The police car is moving at a speed of 25 ms^{-1}.

(i) State the principle for Doppler Effect.

(2 marks)

(ii) Find the frequency in the sound that the observer hears if the police car moving away from stationary observer.

(3 marks)

(iii) Find the frequency in the sound that the observer hears if the police car moving towards stationary observer.

(3 marks)

(iv) If the source transmitted sound wave with an output power 80 W and its intensity level is measured as 100 dB by the listener, calculate the distance between the source and listener.

(4 marks)

- END OF QUESTION-

SEMESTER / SESSION	: SEM II / 2018/2019	PROGRAMME CODE	: DAA
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LIST OF FIGURES

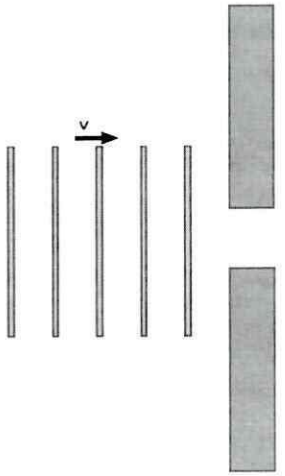

Figure Q1 (a)

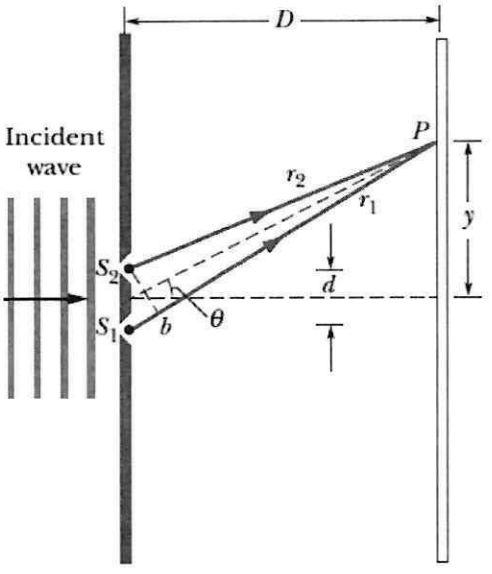

Figure Q1 (c)

SEMESTER / SESSION	: SEM II / 2018/2019	PROGRAMME CODE	: DAA
COURSE NAME	: PHYSICS FOR CIVIL ENGINEERING	COURSE CODE	: DAC 10603

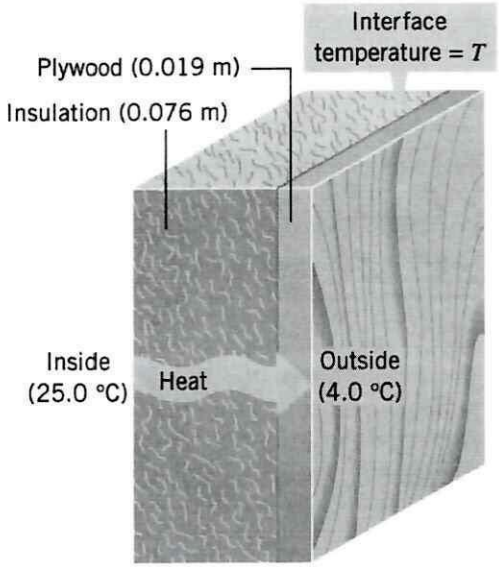

Figure Q4 (c)

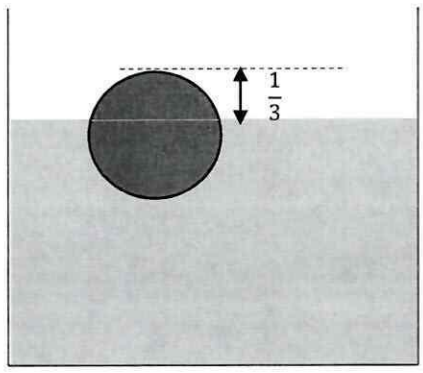

Figure Q6 (b)

SEMESTER / SESSION	: SEM II / 2018/2019	PROGRAMME CODE	: DAA
COURSE NAME	: PHYSICS FOR CIVIL ENGINEERING	COURSE CODE	: DAC 10603

LIST OF FORMULA

$y(x,t) = Asin(kx \pm \omega t)$	$v = f\lambda$	$\text{Power} = \frac{\text{Energy}}{\text{time}}$
$\varphi = k(x_2 - x_1)$	$v = \sqrt{\frac{T}{m/L}}$	$\beta = 10log_{10}\frac{I}{I_o}$
$\Delta V = V_o(\gamma_{\text{liquid}} - \gamma_{\text{container}})\Delta T$	$f_1 = \frac{v}{2L}$	$f' = f\left(\frac{v \pm v_o}{v \pm v_s}\right)$
$k = \frac{2\pi}{\lambda}$	$f_1 = \frac{v}{4L}$	$tan\theta = \frac{y_m}{D}$
$T = \frac{1}{f}$	$\text{Intensity}, I = \frac{\text{Power}}{4\pi r^2}$	$\text{SG} = \frac{\rho_{substance}}{\rho_{reference}}$
$P = \frac{F}{A}$	$P = \rho gh$	$P_2 = P_1 + pgh$
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$	$\frac{F_1}{A_1} + \rho gh = \frac{F_2}{A_2}$	$F_B = m_o g$
$W_{\text{apparent}} = W - F_B$	$\rho = \frac{m}{V}$	$F_B = \rho_f g V_f$
$\Delta L = L_o\alpha(T_f - T_i)$	$\omega = 2\pi f$	$\beta = 2\alpha;\ \gamma = 3\alpha$
$T_K = T_C + 273.15$	$T_F = 1.8T_C + 32$	$T_C = \frac{T_F - 32}{1.8}$
$L = L_o(1 + \alpha\Delta T)$	$A = A_o(1 + \beta\Delta T)$	$V = V_o(1 + \gamma\Delta T)$
$Q = mc(T_f - T_i)$	$\Sigma Q_{gain} = \Sigma Q_{loss}$	$Q = mL$
$sin\theta = \frac{\Delta L}{d}$	$\Delta y = \frac{\lambda L}{d}$	$n_1 \sin\theta_1 = n_2 \sin\theta_2$
$y_m = \frac{m\lambda L}{d}$	$\Delta y_c = \frac{2\lambda L}{a}$	$\theta_c = \sin^{-1}\frac{n_2}{n_1}$
$y_m = \frac{(m + ½)\lambda L}{d}$	$I = I_o cos^2\theta$	$\text{M} = -\frac{d_i}{d_o} = \frac{h_i}{h_o}$

SEMESTER / SESSION	: SEM II / 2018/2019	PROGRAMME CODE	: DAA
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$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$	$f = \frac{R}{2}$	$I = I_o 10^{(\beta/10)}$
$dsin\theta = m\lambda$	$tan\theta = \frac{y_m}{L}$	$A_i = 4\pi r^2$

LIST OF CONSTANT

$g = 9.81\ \text{ms}^{-2}$

$P_{atm} = 1.01 \times 10^5 \text{Pa}$

$I_o = 10^{-12} \text{Wm}^{-2}$

$\rho_w = 1000\ \text{kgm}^{-3}$

$v_{sound\ in\ air} = 343\ m/s$