Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION

SEMESTER II

SESSION 2014/2015

COURSE NAME	:	MECHANICAL SCIENCES
COURSE CODE	:	BEF 25903
PROGRAMME	:	BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY.

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) Explain the definition of friction and give examples of its application

(4 marks)

(b) **FIGURE Q1 (b)** shows the a – t graph of motorcyclist travels along a straight road for 10s duration. If it starts from rest;

(i) Draw the v – t graph that describes the motion

(10 marks)

(ii) Determine the distance traveled, s for the time interval

(6 marks)

Q2 (a) Define the following terms:

(i) Newton's First Law

(ii) Newton's Second Law

(iii)Newton's Third Law

(6 marks)

(b) **FIGURE Q2 (b)** shows a water jet discharging from the orifice. Given the velocity of the water jet discharging can be obtained from $v = \sqrt{2gh}$, where $h = 2m$ is the depth of the orifice from the free water surface, determine:

(i) the time for a particle of water leaving the orifice to reach point B

(4 marks)

(ii) the horizontal distance x where it hits the surface

(10 marks)

Q3 (a) Define relationships between force and acceleration as described by motion equation, and further explain the direction of particle that is acted upon by a series of forces.

(5 marks)

(b) **FIGURE Q3 (b)** shows the 5kg block A at inclined plane. Suppose it slides down the plane with a constant velocity when the angle is 35°, $\theta = 35°$;

(i) Draw the Free Body Diagram (FBD) of the system

(3 marks)

(ii) Calculate the required kinetic friction μ_k

(6 marks)

(iii) Determine acceleration of the block when angle is 45°, $\theta = 45°$

(6 marks)

Q4 (a) Define the following terms:

(i) Density

(ii) Specific weight

(iii)Specific gravity

(iv)Kinematic viscosity

(4 marks)

(b) Explain the working principle of manometer with the help of suitable sketch

(6 marks)

(c) Refer to **FIGURE Q4 (b)** find the pressure difference between tank A and tank B.

(10 marks)

Q5 (a) Define and explain the meaning of stagnation pressure.

(3 marks)

(b) With the help of suitable sketch, explain how flow rate is measured using a static Pitot tube

(5 marks)

(c) A static Pitot tube is used to measure air velocity. If a manometer connected to the instrument indicates a difference in pressure head between the tappings is 15 mm of water and the pipe diameter is 90 mm, calculate the air flow rate assuming the coefficient of the Pitot tube to be unity. Take the density of air = 1.2 kg/m^3.

(12 marks)

Q6 (a) Explain the working principle of centrifugal pump with the help of suitable sketch. Label the main pump components on the sketch

(8 marks)

(b) Water flows from a lake as shown in **FIGURE Q6 (b)** at a rate of 0.113 m^3/s

(i) State the required device inside the building is either a pump or turbine? Explain your answer.

(ii) Determine the horsepower of the device if the friction factor is 0.025 and the device efficiency is 90% with all the minor losses are neglected.

(12 marks)

- END OF QUESTION –

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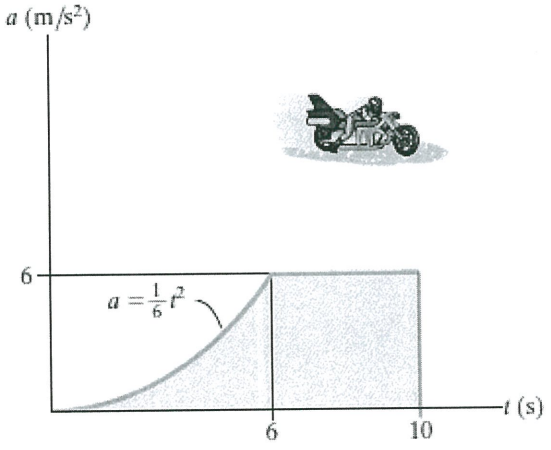

FIGURE Q1 (b)

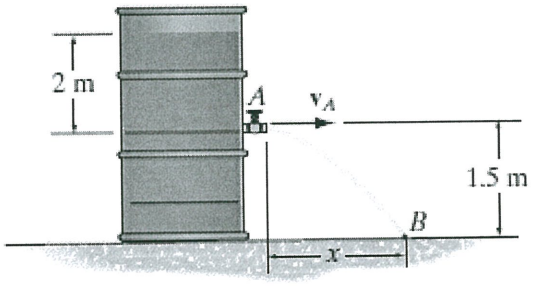

FIGURE Q2 (b)

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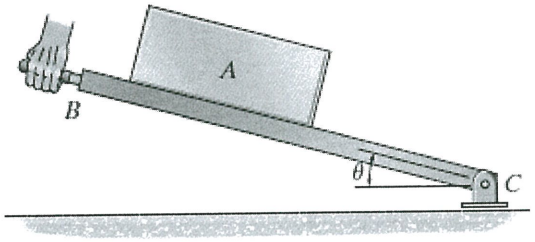

FIGURE Q3 (b)

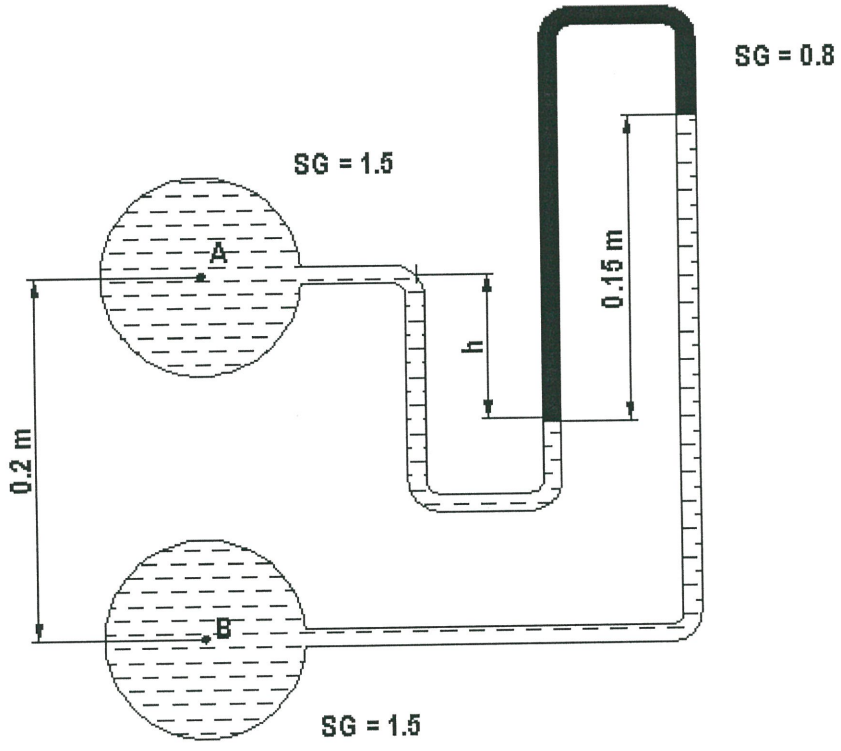

FIGURE Q4 (b)

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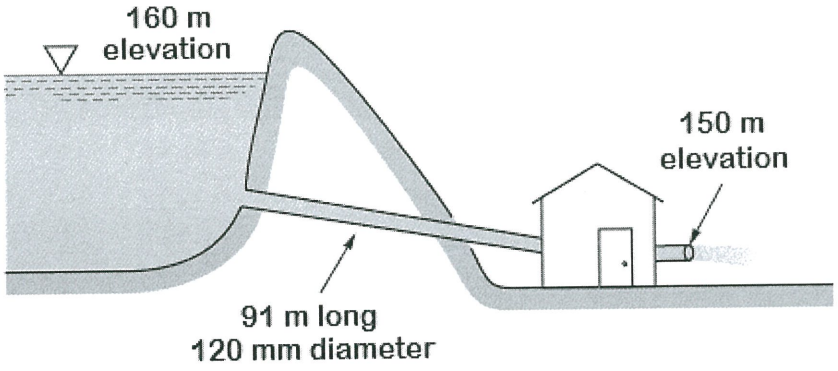

FIGURE Q6 (b)

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USEFULL FORMULAS

$$s = s_0 + v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

$$v^2 = v_0^2 + 2as$$

$$\mathbf{a} = \mathbf{a}^n + \mathbf{a}^t$$

$$\mathbf{a}^n = r\omega^2 = \frac{v^2}{r}$$