Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	MECHANICAL SCIENCES
COURSE CODE	:	BEF25903
PROGRAMME	:	BEV
EXAMINATION DATE	:	JUNE/ JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS **ONLY** OUT OF SIX (6) QUESTIONS

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

Q1 (a) Give two examples of engineering applications from Equilibrium of Rigid Body topic.

(4 marks)

(b) Systems (i) and (ii) in **Figure Q1(b)** are the examples of rigid body system. Draw the Free Body Diagram (FBD) for each system.

(6 marks)

(c) **Figure Q1(c)** shows beam ABC of 200 kg mass. Suppose the beam is in equilibrium;

i) draw the corresponding Free Body Diagram (FBD),

(4 marks)

ii) determine support reactions at points A and B.

(6 marks)

Q2 (a) Explain the difference between average and instantaneous velocities.

(5 marks)

(b) **Figure Q2(b)** shows a truck travelling along a straight line with the velocity described by the given v–t graph. Knowing that s=0 when t=0:

i) construct the s–t and a–t graphs for the same time interval,

(10 marks)

ii) determine the time when the truck is 143 m away from its origin,

(2 marks)

iii) determine total distance travelled between t=30 and t=55.

(3 marks)

Q3 (a) Give two conditions of any object to be considered as a particle.

(4 marks)

(b) **Figure Q3(b)** shows example of A1 Circuit used by car A and car B for preparation before the actual championship. Car B is moving along the curved lap with a velocity 18 ms^{-1} and decelerates at a rate of 2 ms^{-2}. In front of this car, car A is travelling along a straight part of the circuit with a velocity 35 ms^{-1} and has a decrease in speed of 5 ms^{-2} due to transmission issue. At this instant, determine:

i) the velocity of car B relative to car A, $v_{B/A}$,

(8 marks)

ii) the acceleration of car B with respect to car A, $a_{B/A}$.

(8 marks)

Q4 (a) Differentiate between centroid and center of pressure with the help of an appropriate illustration.

(2 marks)

(b) The magnitude of hydrostatic force on the submerged surface depends strongly on three main factors or variables. List down those three main factors.

(3 marks)

(c) The rigid L-shaped gate, OAB as shown in **Figure Q4(c)** is hinged at O and rests against a rigid support at B. The back of the gate is exposed to the atmosphere. By neglecting the weight of the gate and friction in the hinge, calculate the minimum horizontal force, P required to hold the gate closed if its width is 3 m.

(15 marks)

Q5 (a) Write three (3) forms of Bernoulli equation and state the dimensions or units for each equation.

(5 marks)

(b) A venturi meter having a throat diameter d_2 of 100 mm is fitted into a pipeline which has a diameter d_1 of 250 mm through which oil with specific gravity 0.9 is flowing. The pressure difference between the entry and the throat tapping is measured by a U-tube manometer, containing mercury. If the difference of level indicated by the mercury in the U-tube is 0.63 m, calculate the theoretical volume rate of flow through the venturi meter.

(15 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 at a rate of 0.113 m^3/s is shown in **Figure Q6(b)**.

i) Define either the device inside the building a pump or a turbine? Explain.

ii) Determine the horsepower of the device if the friction factor is 0.025 and the device efficiency is 90 percent. Neglect all the minor losses.

(12 marks)

- END OF QUESTION -

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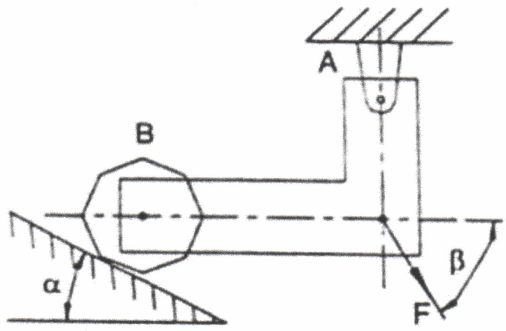
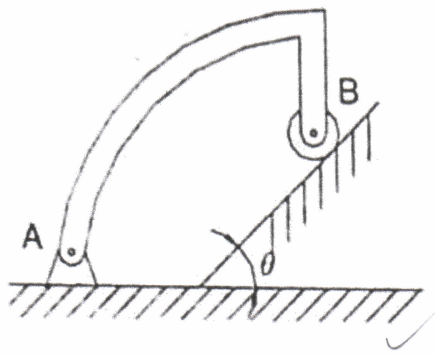


(i)



(ii)

Figure Q1(b)

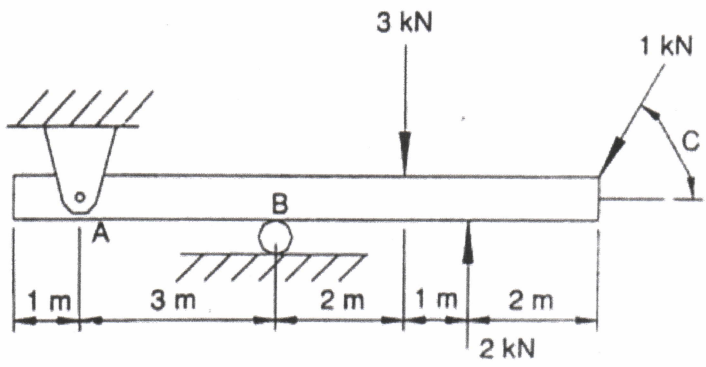


Figure Q1(c)

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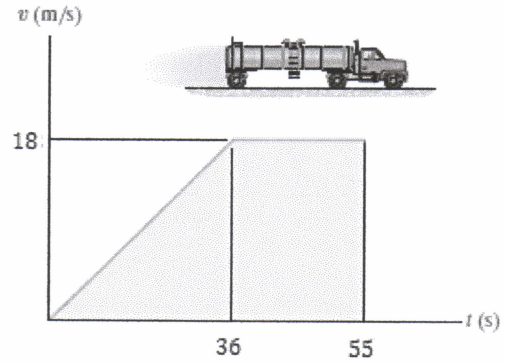

Figure Q2(b)

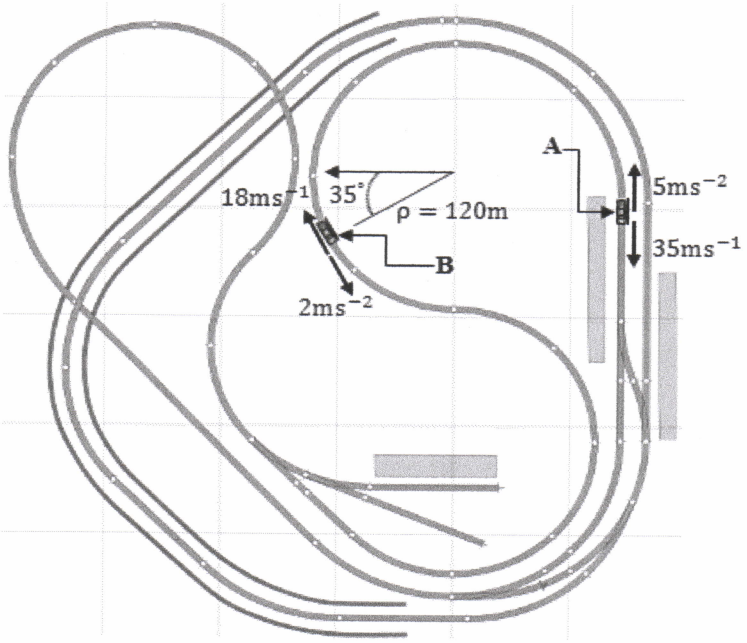

Figure Q3(b)

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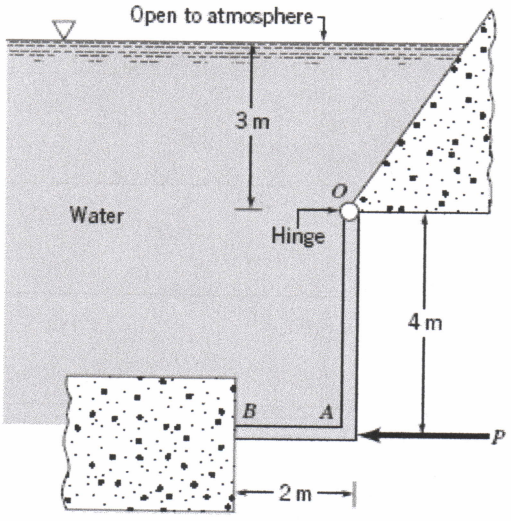

Figure Q4(c)

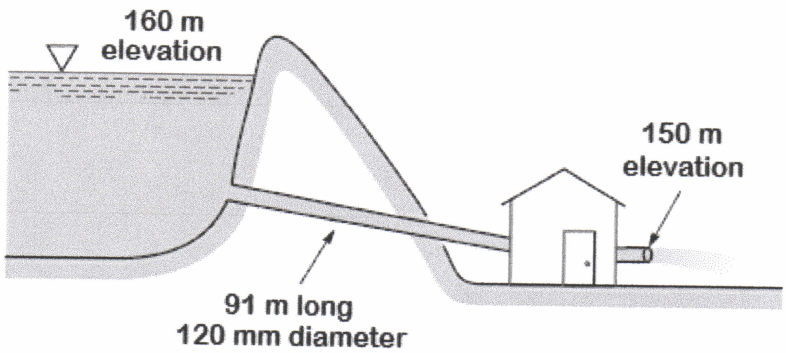

Figure Q6(b)

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Formula:

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

$$v = v_0 + at$$

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