UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	MECHANICAL SCIENCES
COURSE CODE	:	BEF25903
PROGRAMME	:	BEV
EXAMINATION DATE	:	DECEMBER 2016/JANUARY 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS **ONLY**

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

Q1 (a) Find the definition moment of a force about a point and give the example of its application.

(5 marks)

(b) **Figure Q1(b)** shows a continuous frame ABC subjected to three 3 concentrated loadings. The frame has a fixed support at point A. Calculate the moment of each of the three forces about point A.

(15 marks)

Q2 (a) Find the definition of

(i) Kinematics

(ii) Kinetics

(4 marks)

(b) The motor bike travels along a straight road from rest with a velocity shown in **Figure Q2(b)**. Knowing that $s = 0$ m at $t = 0$ s:

(i) Sketch the s–t graph for the given time interval.

(5 marks)

(ii) Calculate total distance travelled until the motor bike stops.

(2 marks)

(c) A ball is thrown off from the top of a cliff as shown in **Figure Q2(c)**. If the ball is thrown horizontally at 17 m/s and the height of the cliff is 40 m, calculate:

(i) The duration, t in seconds for the ball to reach the bottom of the cliff.

(5 marks)

(ii) The horizontal distance, s_x the ball strikes the ground, measured from the base of the cliff.

(4 marks)

Q3 (a) Explain the following laws of motions:

(i) Newton's First Law

(ii) Newton's Second Law

(4 marks)

(b) **Figure Q3(b)** shows example of F1 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 of 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, calculate:

(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) Describe the non-Newtonian fluid and gives **two (2)** examples of this type of fluid.

(3 marks)

(b) The manometer in **Figure Q4(b)** contains carbon tetrachloride (SG = 1.59). Initially the pressure differential between pipes *A* and *B*, which contain a brine (SG = 1.1) is zero as illustrated in the **Figure Q4(b)**. It is desired that the manometer gives a differential reading of 30.5 cm (measured along the inclined tube) for a pressure differential of 0.7 kPa.

(i) Illustrate the rise of the manometric fluid by using a clear sketch.

(ii) Calculate the required angle of inclination θ.

(10 marks)

(c) An inverted 0.1 m diameter circular cylinder is partially filled with water and held in place as shown in **Figure Q4(c)**. A force of 20 N is needed to pull the flat plate from the cylinder. Calculate the air pressure within the cylinder. The plate is not fastened to the cylinder and has negligible mass.

(7 marks)

Q5 (a) Define and explain the 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) List down **two (2)** types of turbines and state the head and flowrate requirement needed to run the turbines.

(4 marks)

(b) The suction line of a piping system pumping seawater (SG=1.04) at a rate of 80liter/s. At asuction pipe linewith a diameter of 200 mm, a pressure gauge located at 2 m below the centreline of the pump reads –15 kPa. Another pressure gauge is tapped in the discharge line with a pipe diameter of 150 mm. This pressure gauge which is located 3 m above the centerline of the pump, reads 120 kPa. With a pump efficiency 60%, calculate the power input to the pump if:

(i) Neglecting losses,

(ii) Considering losses if the head loss between the two gauges is 5 m.

(16 marks)

- END OF QUESTION -

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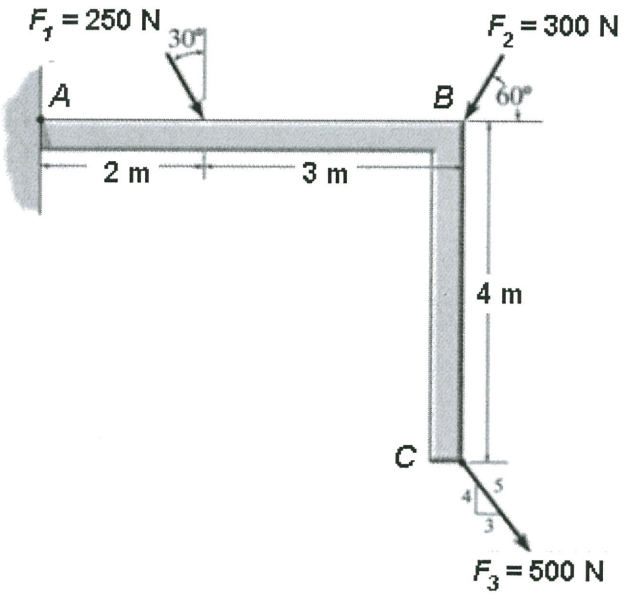
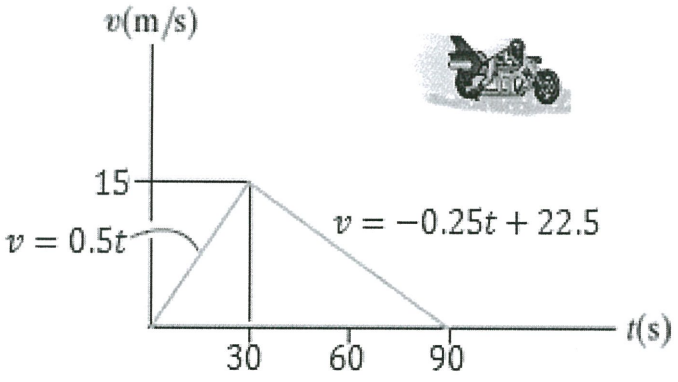


FigureQ1(b)



FigureQ2(b)

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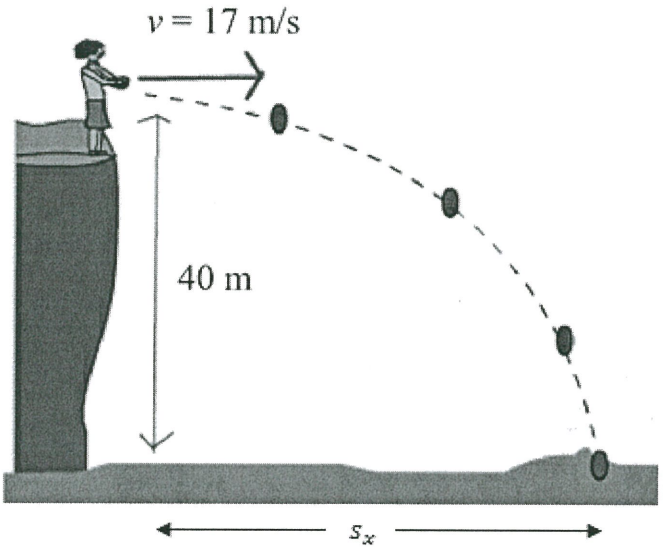
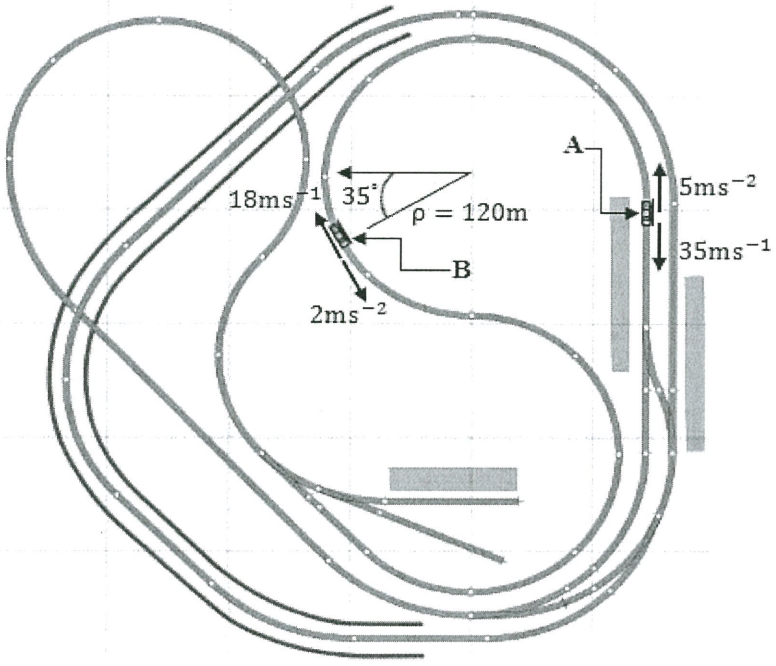


Figure Q2(c)



FigureQ3(b)

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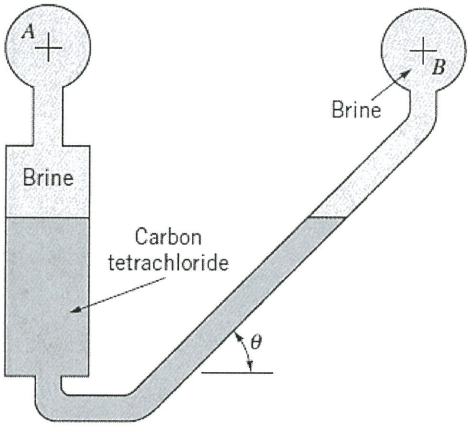

FigureQ4(b)

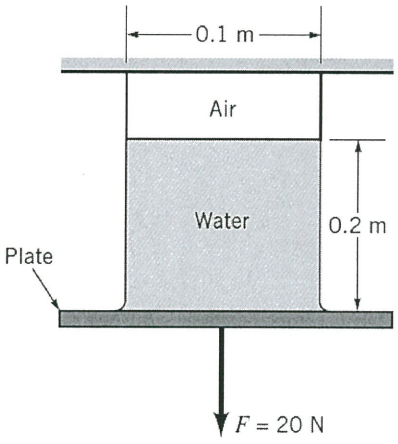

Figure Q4(c)

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Formula:

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

$$v = v_0 + at$$

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