Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	STATIC AND DYNAMIC
COURSE CODE	:	BFC 10103
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS. 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSE BOOK**.

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

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Q1 (a) **Figure Q1(a)** shows the forces of F_1 and F_2 are 900N and 600N, respectively. The angle between F_1 and x-axis is 35° and the angle between F_1 and F_2 is 40°.

(i) Label the forces and their angles acting on the system using parallelogram or triangle. Show also the resultant of the forces.

(5 marks)

(ii) Determine the magnitude and direction from x-axis of the resultant of the **TWO (2)** forces by employing the laws of Cosines and Sines.

(8 marks)

(b) The rope in **Figure Q1(b)** applies a force with magnitude of 300N at point B on the top of the pole. Determine the magnitude of the moment produced by this force about point A.

(12 marks)

Q2 (a) Draw the free body diagram and label all the force and dimension of structure in **Figure Q2(a)(i)** to **Figure Q2(a)(iii)**.

(6 marks)

(b) A uniform steel beam with a mass $m_1 = 4.5 \times 10^2$ kg is held up by a steel cable that is connected to the beam at distance L = 11m from the wall, at an angle $\theta = 35^\circ$ as shown in **Figure Q2(b)**. The beam is bolted to the wall with an unknown force, F exerted by the wall on the beam. An object of mass $m_2 = 6.5 \times 10^1$ kg, resting on top of the beam, is placed at distance d = 4.0m from the wall. Use $g = 9.8 ms^{-2}$ for the gravitational acceleration.

(i) Construct the equations of static equilibrium for the beam.

(4 marks)

(ii) Calculate the tension force in the cable.

(4 marks)

(iii) Find the horizontal and vertical components of the force that the wall exerts on the beam.

(6 marks)

(c) A four-wheel drive car shown in **Figure Q2(c)** has a mass of 3000 kg with passengers. The roadway is inclined at an angle θ with the horizontal. If the coefficient of friction between tire and road is 0.3, approximate the maximum inclines θ that can be climbed.

(5 marks)

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Q3 (a) **Figure Q3(a)** shows the cross section of an I-beam with different flange geometry. Analyse the centroid for the area with assumed reference axis.

(10 marks)

(b) Prove the equation for moment of inertia for **Figure Q3(b)** against axis x and y as;

$I_x = bh^3/36$

$I_y = hb^3/36$

(10 marks)

(c) Elaborate TWO (2) differences between center of gravity and centroid.

(5 marks)

Q4 (a) Fahmi will travel from UTHM to golf club to play golf. Two routes of A and B can be used to reach the Golf Club with the distance is 26.9 km and 34.7 km, respectively.

(i) If he drives based on the speed limit, determine which route should he takes to reach the golf club within 35 minutes? Discuss your outcome. Assume the speed limit on route A is 40 km/h and route B is 70 km/h.

(5 marks)

(ii) Define the meaning of kinetic energy. Calculate the kinetic energy of the car on both route, if the car weight is 2200 kg.

(5 marks)

(iii) If Fahmi choose Route B, the car has to climb a 30 degree slope road. Calculate the displacement and velocity of the car after 5 minutes of climbing the slope. Assume a constant velocity of 70 km/h and $g = 9.81\ m/s^2$.

(5 marks)

(iv) Sketch the free body diagram of the friction force of the car if the car stops on the slope and calculate the force required to restrain the car from slipping down. Given friction coefficient, $\mu = 0.5$.

(10 marks)

-END OF QUESTIONS –

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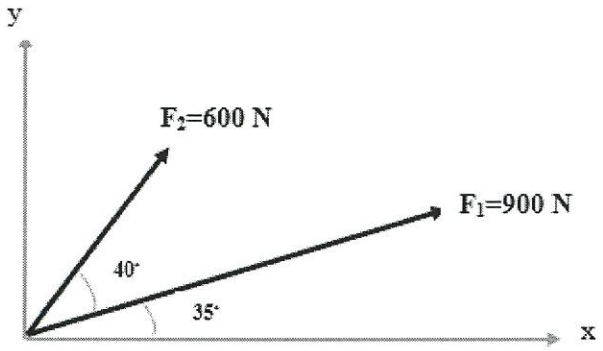

FIGURE Q1(a)

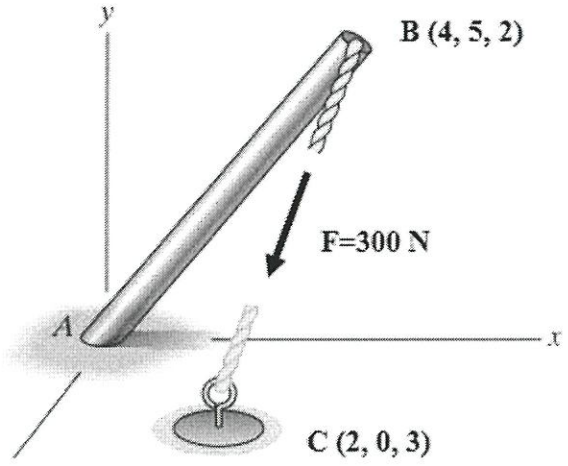

FIGURE Q1(b)

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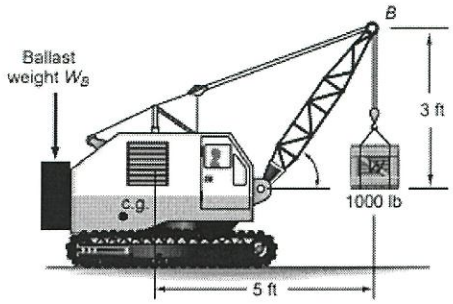

FIGURE Q2(a)(i)

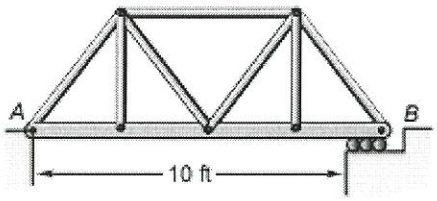

FIGURE Q2(a)(ii)

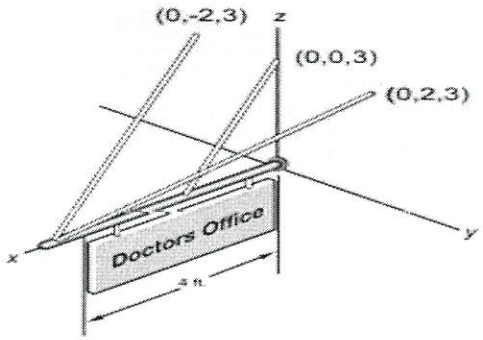

FIGURE Q2(a)(iii)

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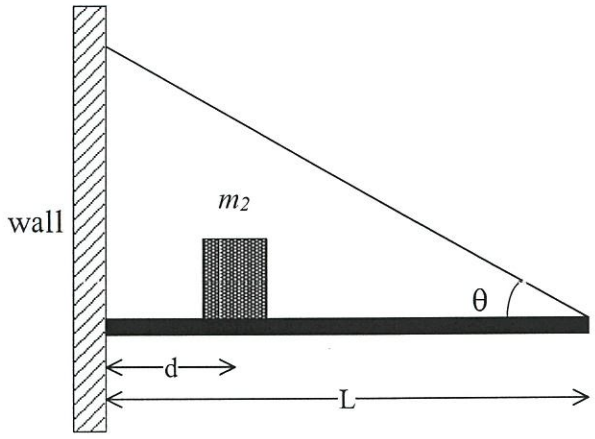

FIGURE Q2(b)

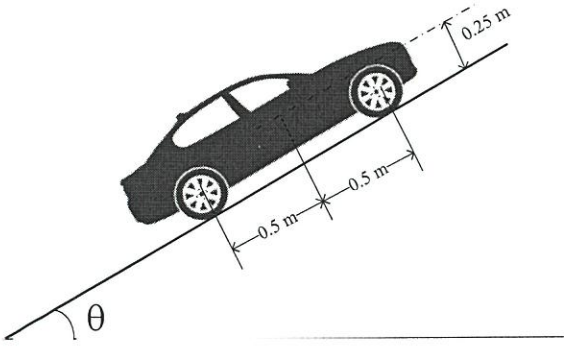

FIGURE Q2(c)

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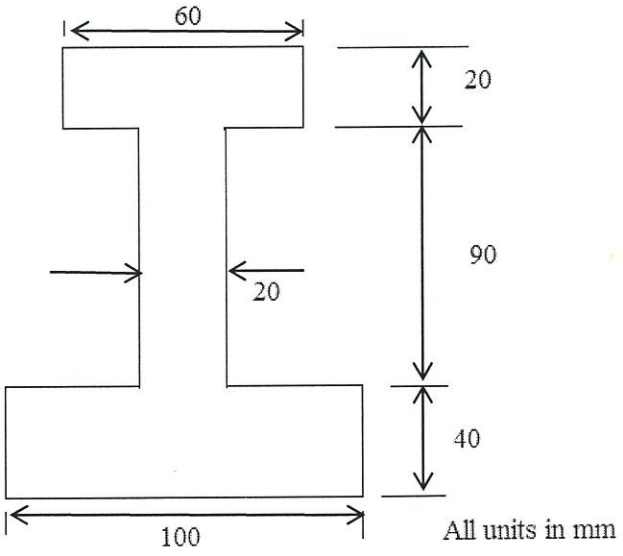

FIGURE Q3(a)

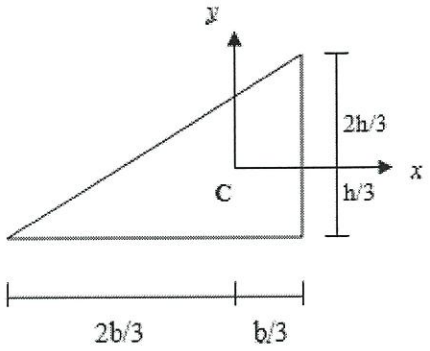

FIGURE Q3(b)

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