UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	ENGINEERING MECHANICS
COURSE CODE	:	BDX 10603
PROGRAMME	:	BDX
EXAMINATION DATE:		JULY 2021
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWERS **FIVE (5)** QUESTIONS **ONLY** FROM **SIX (6)** QUESTIONS GIVEN

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1. **Figure Q1** shows a belting assembly of air compressor. At the instant $\omega_A = 5$ rad/s, pulley A is given an angular acceleration $\alpha = (0.8u)$ rad/s^2, where θ is in radians. Pulley C has an inner hub which is fixed to its outer one and turns with it.

(a) Examine the magnitude of acceleration of point B on pulley C when A rotates 3 revolutions. (C4).

(10 marks)

(b) Examine the magnitude of acceleration of point B on pulley C when A rotates 2 revolutions if pulley A is given a constant angular acceleration $\alpha_A = 6$ rad/s^2. (C4).

(10 marks)

Q2 The 30-kg disk is originally at rest (**figure Q2**), and the spring is unstretched. A couple moment of M = 80 Nm is then applied to the disk as shown. The disk rolls without slipping.

(a) Calculates angular velocity when its mass center G has moved 0.5 m along the plane (C4)

(13 marks)

(b) Examine how far the center of mass of the disk travels along the plane before it momentarily stops (C4)

(7 marks)

Q3 (a) The 40-kg disk is rotating at $\omega = 100$ rad/s shown in **figure Q3(a)**. When the force P is applied to the brake as indicated by the graph. If the coefficient of kinetic friction at B is $\mu_k = 0.3$, calculate the time t needed to stay the disk from rotating. Neglect the thickness of the brake. (C4)

(12 marks)

(b) The 30-kg gear A shown in **figure Q3(b)** has a radius of gyration about its center of mass O of $k_O = 125$ mm. If the 20-kg gear rack B is subjected to a force of P = 200 N, examine the time required for the gear to obtain an angular velocity of 20 rad/s, starting from rest. The contact surface between the gear rack and the horizontal plane is smooth. (C4)

(8 marks)

Q4 (a) Illustrate the differential equation of motion of the 3-kg block shown in **figure Q4(a)** when it is displaced slightly and released. The surface is smooth, and the springs are originally unstretched. (C3)

(5 marks)

(b) If the block-and-spring model shown in **figure Q4(b)** is subjected to the periodic force $\Gamma = F_0 \cos \omega t$, show that the differential equation of motion is $\ddot{x} + (k/m)x = (F_0/m) \cos \omega t$ where x is measured from the equilibrium position of the block. Deduce the general solution of this equation? (C4)

(15 marks)

Q5 (a) The girl has a mass of 40 kg and center of mass at G as shown in **figure Q5(a)**. If she is swinging to a maximum height defined by u = 60-, determine the force developed along each of the four supporting posts such as AB at the instant u = 0-. The swing is centrally located between the posts. (C3)

(8 marks)

(b) The roller coaster car has a mass of 700 kg, including its passenger as shown in **figure Q5(b)**. If it is released from rest at the top of the hill A, determine the minimum height h of the hill crest so that the car travels around both inside the loops without leaving the track. Neglect friction, the mass of the wheels, and the size of the car. What is the normal reaction on the car when the car is at B and when it is at C? Take r_B = 7.5 m and r_C = 5 m. (C3)

(12 marks)

Q6 (a) From **figure Q6**, determine the reaction force at position A and F of the structure. the force in members ED

(5 marks)

(b) Examine the force in members ED, EH, and GH of the truss, whether the members are in tension or compression.

(15 marks)

-END OF QUESTION-

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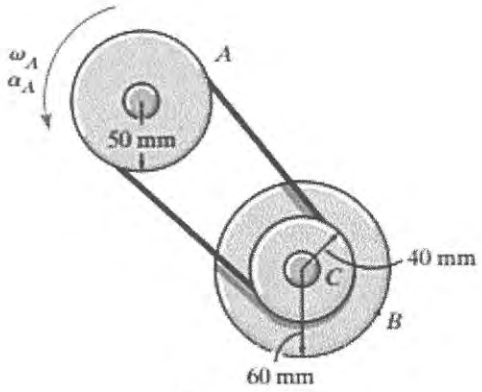

Figure Q1

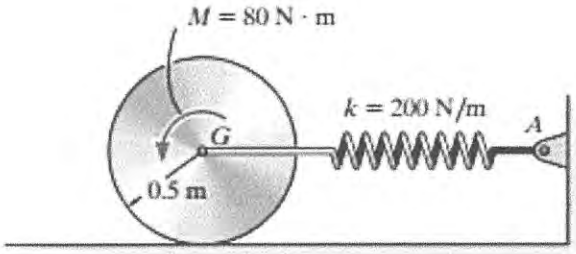

Figure Q2

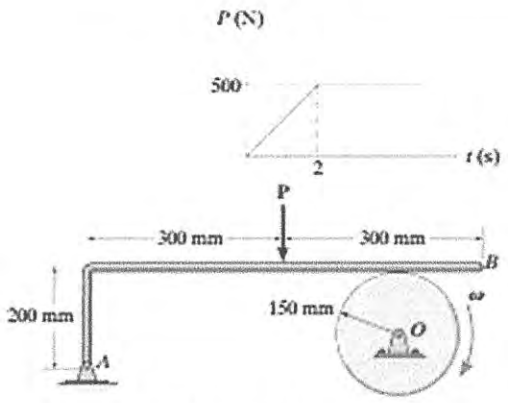

Figure Q3(a)

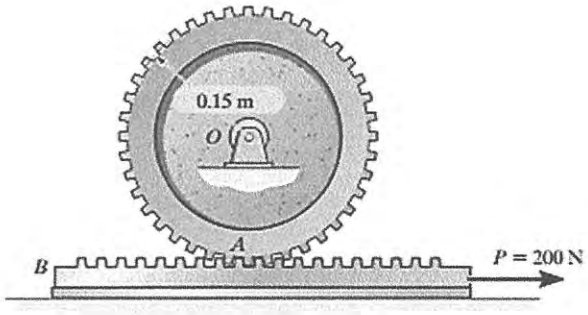

Figure Q3(b)

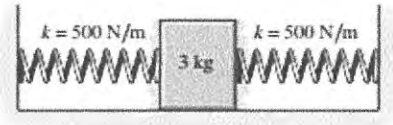

Figure Q4(a)

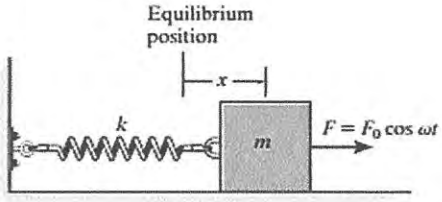

Figure Q4(b)

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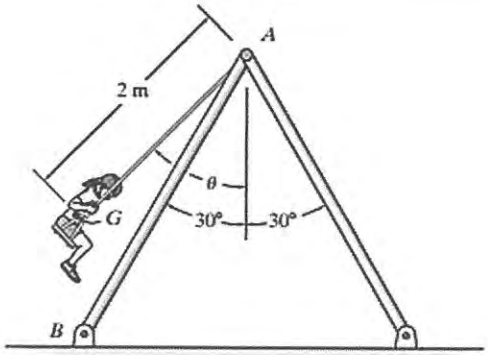

Figure Q5(a)

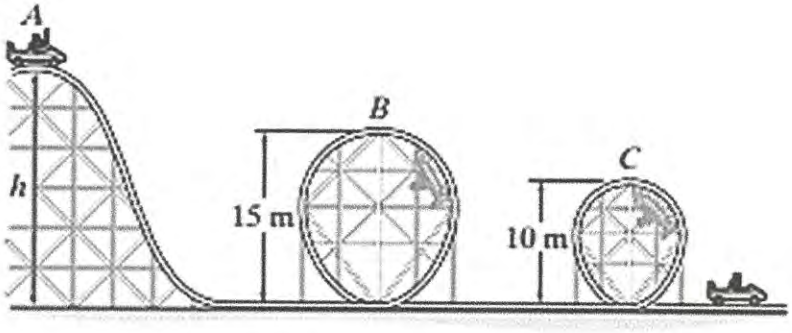

Figure Q5(b)

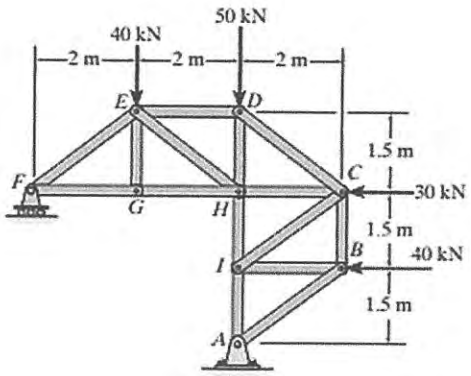

Figure Q6