



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(TAKE HOME)  
SEMESTER I  
SESSION 2020/2021**

**COURSE NAME** : **STATICS**  
**COURSE CODE** : **BNJ 10203**  
**PROGRAMME CODE** : **BNG, BNM**  
**EXAMINATION DATE** : **JANUARY/FEBRUARY 2021**  
**DURATION** : **3 HOURS**  
**INSTRUCTION** : **ANSWER FIVE (5) QUESTIONS ONLY**

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

- Q1** (a) **Figure Q1(a)** shows a block at  $D$  is supported by using several spring cords which in equilibrium state. Given that  $F=kx$ , determine the stretch in each spring for the equilibrium of the 2 kg block. (7 marks)
- (b) **Figure Q1(b)** shows a crate with a total weight of 100 kg. This equilibrium system is supported by three cables which are  $AB$ ,  $AC$  and  $AD$ .
- (i) Draw a free body diagram of the system. (3 marks)
- (ii) Represent each of the force on the free body diagram in Cartesian vector form (4 marks)
- (iii) Calculate the force in the supporting cables which are  $F_{AB}$ ,  $F_{AC}$  and  $F_{AD}$ . (6 marks)
- Q2** (a) Define the meaning of a couple moment concept and give **ONE (1)** example. (3 marks)
- (b) **Figure Q2(b)** shows a door supported by a chain  $BA$ . The chain  $BA$  exerted a force of 20 N.
- (i) Calculate the force unit vector,  $u_{BA}$  and its force,  $F_{BA}$  in Cartesian vector. (10 marks)
- (ii) Calculate the moment of force  $F_{BA}$  about point  $O$  in Cartesian vector. (4 marks)
- (iii) Calculate magnitude of the moment about the  $x$  axis using triple scalar product. (3 marks)

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- Q3** (a) **Figure Q3(a)** shows a post fixed at point  $A$ . Calculate an equivalent resultant force,  $F_R$  and its angle,  $\theta$  of the force system acting on the post. Finally specify the resultant's force line of action,  $d$  intersects on member  $AB$ , measured from point  $A$ . (7 marks)
- (b) **Figure Q3(b)** shows the smooth pipe rests against the opening at the points of contact  $A$ ,  $B$ , and  $C$ . By neglecting the pipe's thickness in the calculation
- (i) Draw a free body diagram (FBD) of the pipe. (3 marks)
- (ii) Calculate the reaction force acting at contact points of  $A, B$  and  $C$  needed to support the force of 300 N (10 marks)
- Q4** (a) Define zero force members in simple trusses model. (2 marks)
- (b) Determine the force in each member of truss and state if the members are in tension (T) or compression (C). Set  $P = 8\text{kN}$ . The trusses is illustrated as in **Figure Q4(b)**.
- (i) Calculate the force in member  $DC$  and  $DE$  at joint  $D$ . (5 marks)
- (ii) Calculate the force in member  $CE$  and  $CB$  at joint  $C$ . (5 marks)
- (iii) Calculate the force in member  $BE$  and  $BA$  at joint  $B$ . (5 marks)
- (iv) Calculate the force in member  $EA$  at joint  $E$ . (3 marks)

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- Q5** (a) Draw an example of reaction force on a pin type support and define a two-force member. (4 marks)
- (b) **Figure Q5(b)** shows a 300 kg drum has a center of mass at point  $G$ . The grip at  $B$  on member  $DAB$  resists both horizontal ( $x$ -axis,  $F_{Bx}$ ) and vertical ( $y$ -axis,  $F_{By}$ ) components of force at the rim of the drum.
- (i) Draw a free body diagram of member  $CAE$ . (3 marks)
- (ii) Draw a free body diagram of member  $DAB$ . (3 marks)
- (iii) Calculate the force normal force at point  $C$ ,  $N_C$  and component force at pin  $A$ . (8 marks)
- (iv) Calculate the force normal force at point  $D$ ,  $N_D$ . (2 marks)
- Q6** (a) State dry friction definition; and show **ONE (1)** example application of dry friction and draw its free body diagram. (4 marks)
- (b) **Figure Q6(b)** shows a man try to pull a crate. The coefficient of static friction between the 120 kg crate and the ground is  $\mu_S = 0.4$ , while the man weight is 75 kg.
- (i) Draw the free body diagram of the crate and the man separately. (4 marks)
- (ii) Calculate minimum required force to pull the crate. (5 marks)
- (iii) Determine the minimum coefficient of static friction between the man's shoes and the ground so that the man can move the crate. (7 marks)

-END OF QUESTIONS -



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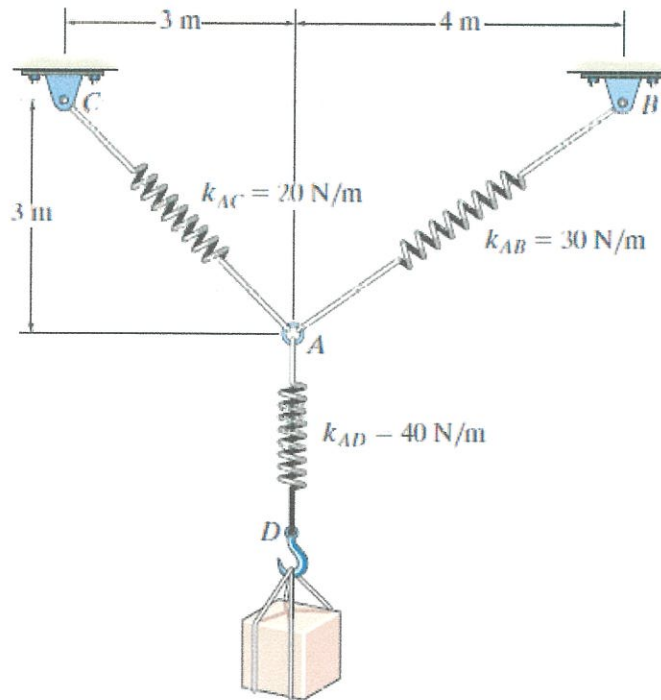


Figure Q1(a)

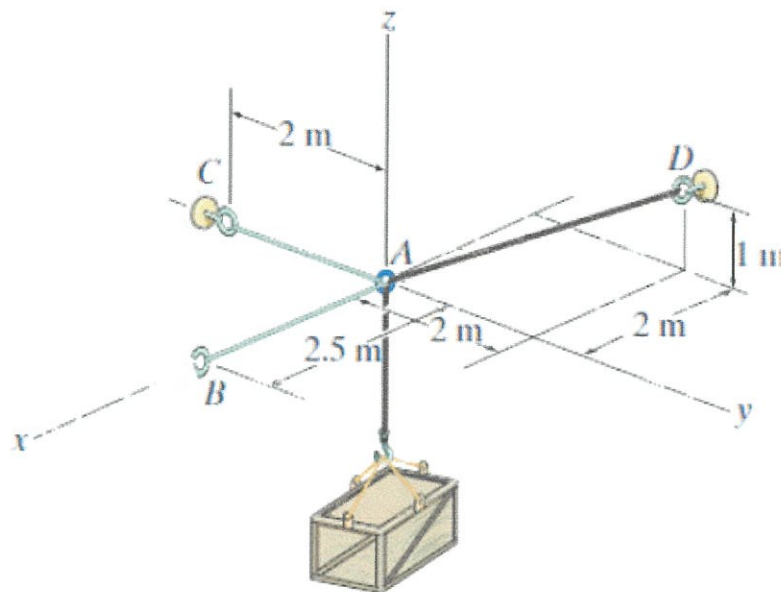


Figure Q1(b)

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Handwritten text in Russian: "Решение задачи по статике"

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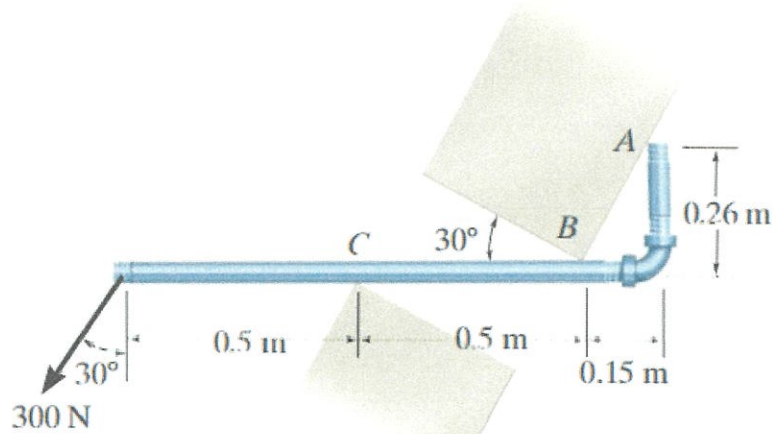


Figure Q3(b)

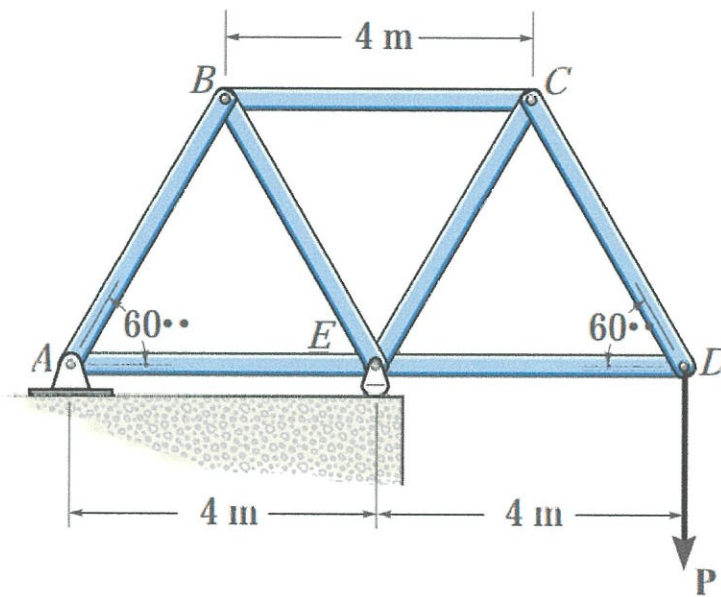


Figure Q4(b)

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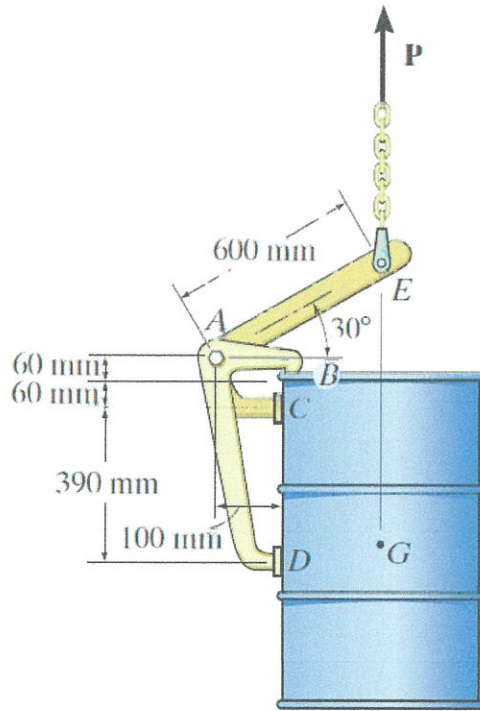


Figure Q5(b)

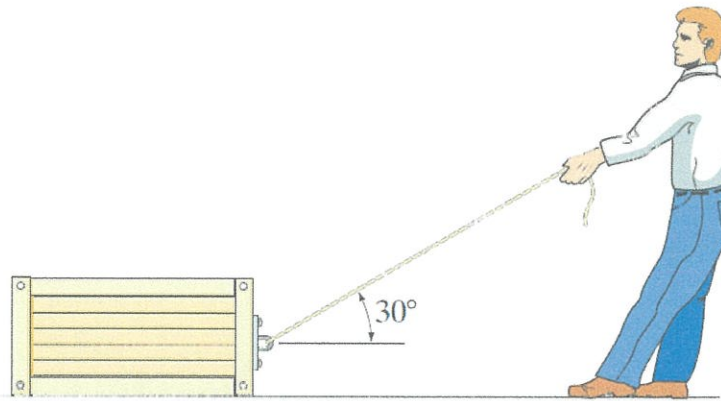


Figure Q6(b)

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