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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019**

COURSE NAME : STATICS
COURSE CODE : BNJ 10203 / BNT 10303
PROGRAMME CODE : BNL / BNT
EXAMINATION DATE : JUNE / JULY 2019
DURATION : 3 HOURS
INSTRUCTION : **ANSWER FIVE (5) QUESTIONS ONLY**

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

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- Q1** (a) **Figure Q1(a)** shows a lamp of weight 20 kg is supported by using several cords which in equilibrium state. Calculate the tension developed in cords DE , DC , CA and CB .
(7 marks)
- (b) **Figure Q1(b)** shows a pot and its contents have a total weight of 50 kg. It is supported by three cables which are AB , AC and AD .
- (i) Draw a free body diagram of the system
(3 marks)
- (ii) Calculate the unit vector u_{AB} , u_{AC} and u_{AD} along three points on that line.
(6 marks)
- (iii) Calculate the force in the supporting cables of F_{AB} , F_{AC} and F_{AD} when the system is in equilibrium.
(4 marks)
- Q2** (a) Define the meaning of a varignon's theorem on 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)

- Q3** (a) **Figure Q3(a)** shows a truck with the weights of the various components.
- (i) Calculate the equivalent resultant force. (3 marks)
 - (ii) Calculate the location of equivalent resultant force measured from point B . (3 marks)
- (b) **Figure Q3(b)** shows the articulated crane boom has a weight of 125 kg and acting at the center of gravity at G . It is supported a load of 600 kg.
- (i) Draw a free body diagram (FBD) of the crane boom. (4 marks)
 - (ii) Calculate the force acting at the pin A and the force in the hydraulic cylinder BC . (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 or compression. Set $P_1 = 0$ kN and $P_2 = 20$ kN. The trusses is illustrated in **Figure Q4(b)**. (*hint: apply method of joint, assume: pin G acting force only at x -axis*).
- (i) Calculate the force in member GB , AF and AB . (8 marks)
 - (ii) Calculate the force in member BF and BC . (2 marks)
 - (iii) Calculate the force in member FC and FE . (2 marks)
 - (iv) Calculate the force in member ED , EC and DC . (3 marks)
 - (v) State whether all the members are in tension (T) or compression (C). (3 marks)

- 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 tractor boom supports the uniform mass of 700 kg in the bucket which has a center of mass at G and this system is in equilibrium. The boom supported by two hydraulic cylinders which are hydraulics AB and CD . (*hint: The load is supported equally on each side of the tractor by a similar mechanism*).
- (i) Draw a free body diagram of a bucket only. (2 marks)
- (ii) Draw a free body diagram of the whole boom system. (2 marks)
- (iii) Calculate the force in hydraulic cylinder AB and resultant force at pin E . (6 marks)
- (iv) Calculate the force in hydraulic cylinder CD and resultant force at pin F . (6 marks)
- Q6** (a) Define a wedge in friction principle and describe **ONE (1)** example application of wedge and draw its free body diagram. (4 marks)
- (b) **Figure Q6(b)** shows the man tried to pulls a cord with a force large enough to just to move the crate. The crate weighted of 80 kg and the coefficient of static friction between floor and crate is $\mu_s = 0.3$. (*hint: The pulleys are frictionless*).
- (i) Draw the free body diagram of the cables and the crate. (5 marks)
- (ii) Calculate the angle, θ between the crate and the cord B . (8 marks)
- (iii) Calculate the reaction force at cord B and determine the smallest force, F_H the man must exert. (3 marks)

-END OF QUESTIONS -

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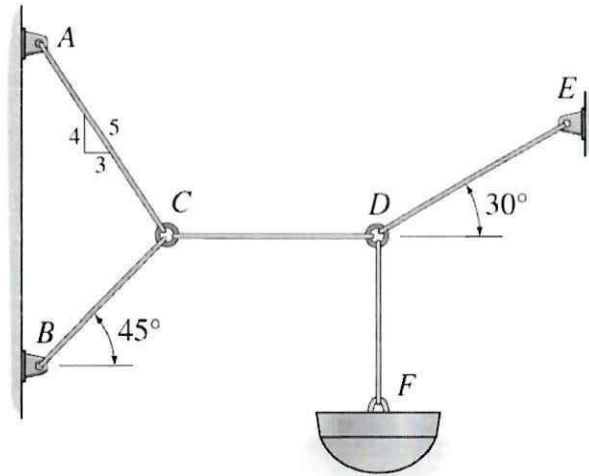


Figure Q1(a)

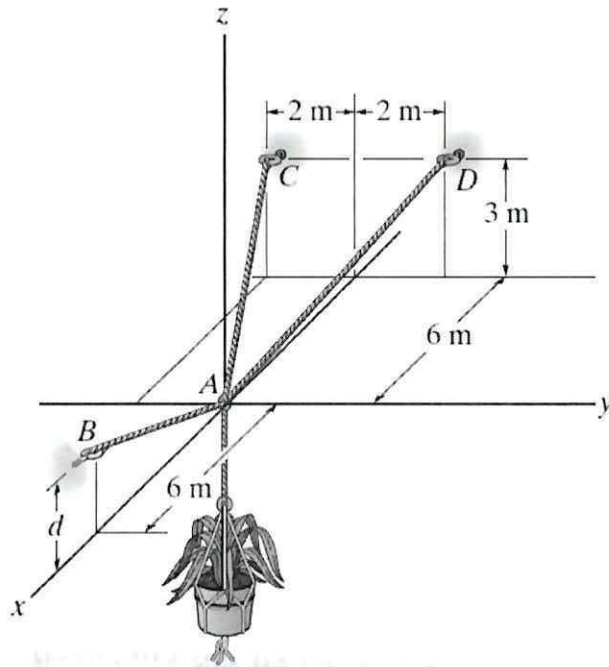


Figure Q1(b)

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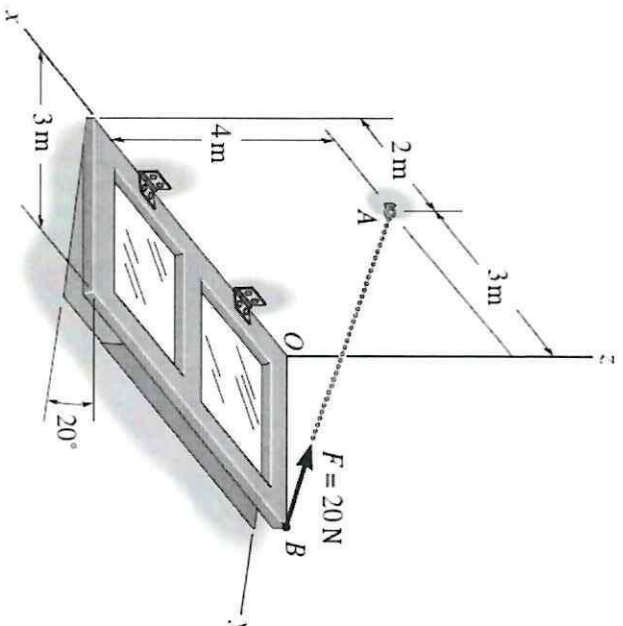


Figure Q2(b)

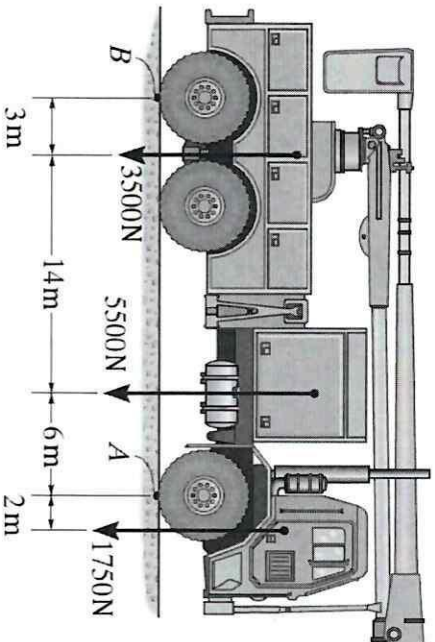


Figure Q3(a)

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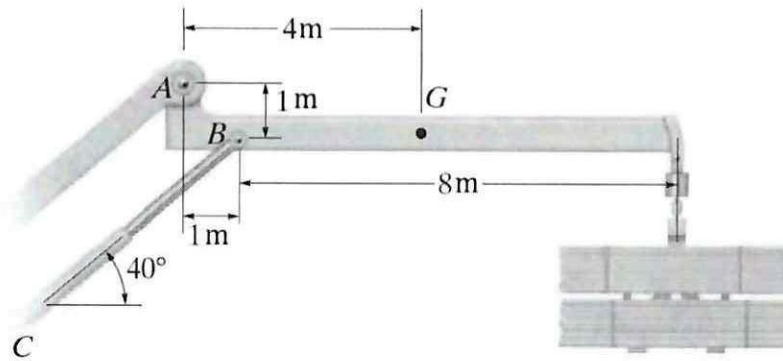


Figure Q3(b)

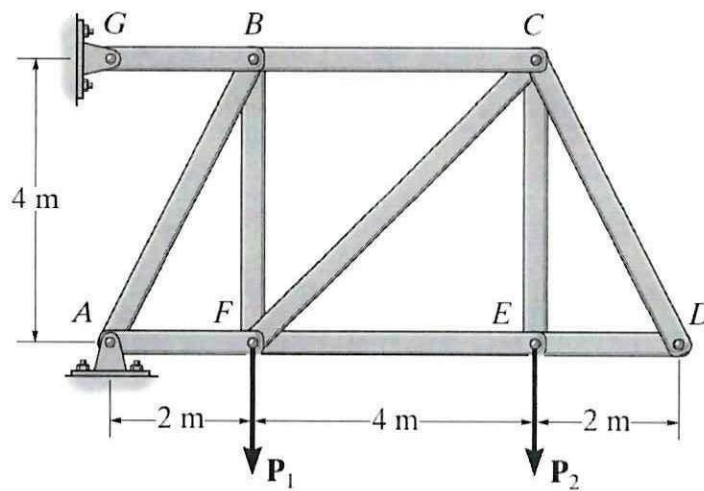


Figure Q4(b)

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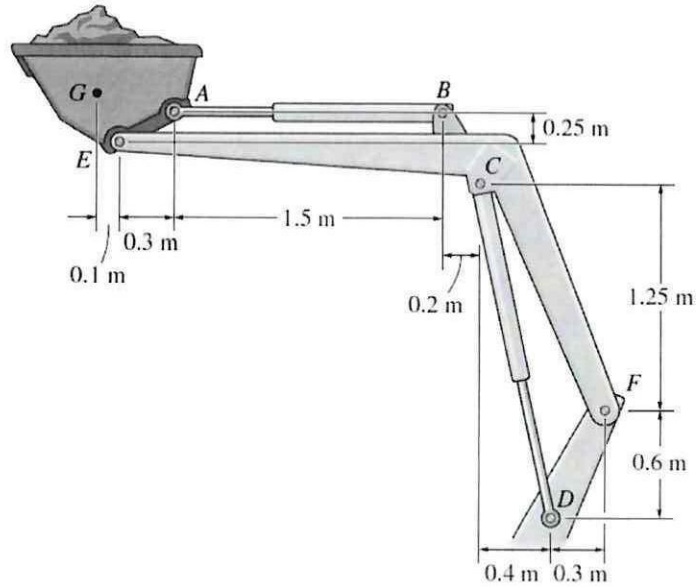


Figure Q5(b)

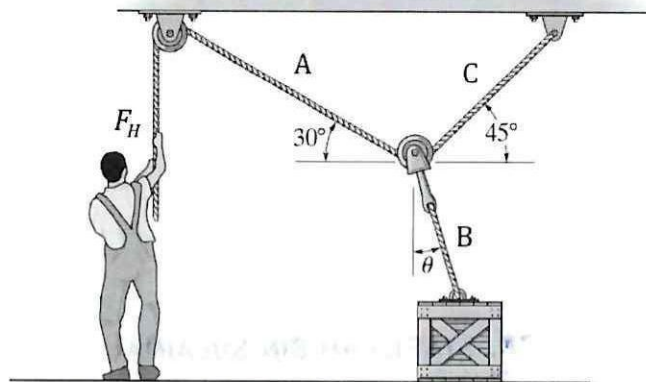


Figure Q6(b)