

**CONFIDENTIAL**



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2019/2020**

COURSE NAME : STATICS  
COURSE CODE : BNJ 10203  
PROGRAMME CODE : BNG / BNL / BNM  
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER FIVE (5) QUESTIONS ONLY

**TERBUKA**

THIS QUESTION PAPER CONSISTS OF EIGHT (8) PAGES

**CONFIDENTIAL**

- Q1** (a) **Figure Q1(a)** shows a block at  $D$  is supported by using several spring cords which in equilibrium state. Determine the mass of the block at  $D$  if unstretched length of spring cords  $AB$  is 3 m. (7 marks)
- (b) **Figure Q1(b)** shows a box and its contents have a total weight of 20 kg. This equilibrium system is supported by three cables which are  $OA$ ,  $OB$  and  $OC$ . Each spring has a stiffness of  $k = 360$  N/m.
- (i) Draw a free body diagram of the system. (3 marks)
- (ii) Calculate the force in the supporting cables which are  $F_{OA}$ ,  $F_{OB}$  and  $F_{OC}$ . (7 marks)
- (iii) Calculate elongation of spring  $S_{OA}$  and  $S_{OB}$ . (3 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)

TERBUKA

- Q3** (a) **Figure Q3(a)** shows a frame hanging at point  $A$ . Calculate an equivalent resultant force,  $F_R$  and its angle,  $\theta$ . 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 beam of negligible weight is supported horizontally by two springs.
- (i) Draw a free body diagram (FBD) of the beam. (3 marks)
- (ii) Calculate the force acting on spring  $CA$ ,  $F_A$  and spring  $DB$ ,  $F_B$  after the distributed load of  $600 \text{ N/m}$  was applied. (5 marks)
- (iii) Calculate the angle,  $\theta$  of beam tilt angle based on **Q3(b)(ii)**. Assume the beam is horizontal and the spring are unstretched before the distributed load is apply. (5 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), compression (C) or zero. The trusses is illustrated as in **Figure Q4(b)**.
- (i) Calculate the force in member  $AC$  and  $AB$ . (5 marks)
- (ii) Calculate the force in member  $BD$  and  $BC$ . (3 marks)
- (iii) Calculate the force in member  $CD$  and  $CE$ . (4 marks)
- (iv) Calculate the force in member  $DE$ ,  $DF$  and  $EF$ . (6 marks)

TERBUKA

- 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 the automobile has a mass of 2000 kg and center of mass at  $G$ . Determine the towing force,  $F$  required to move the car if the back brakes are locked, and the front wheels are free to roll. Take  $\mu_s = 0.3$ .
- (i) Draw the free body diagram of the vehicle. (5 marks)
- (ii) Calculate minimum towing force,  $F$  required to move the vehicle. (8 marks)
- (iii) Calculate the reaction force occurred at tire  $A$ , tire  $B$  and frictional force exert at  $B$ ,  $F_B$ . (3 marks)

TERBUKA

-END OF QUESTIONS -

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020

PROGRAMME CODE : BNG / BNL / BNM

COURSE NAME : STATICS

COURSE CODE : BNJ 10203

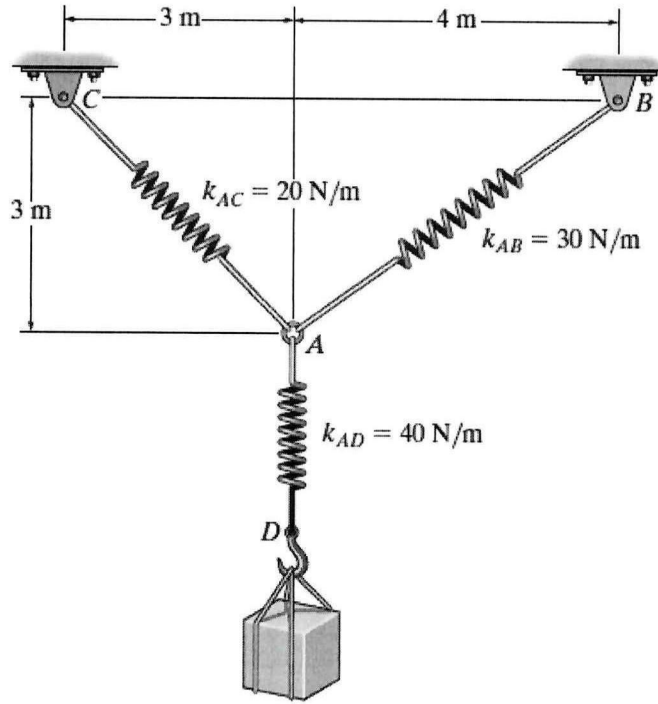


Figure Q1(a)

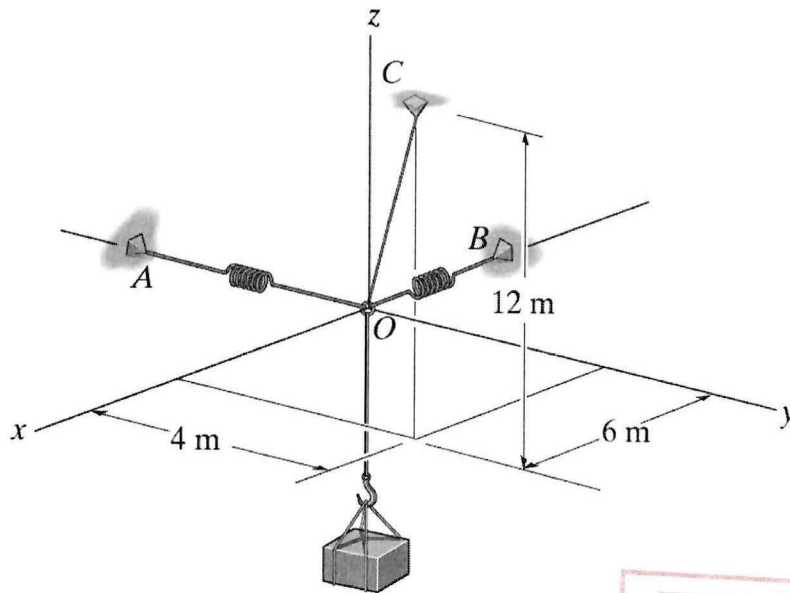


Figure Q1(b)

TERBUKA

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020

PROGRAMME CODE : BNG / BNL / BNM

COURSE NAME : STATICS

COURSE CODE : BNJ 10203

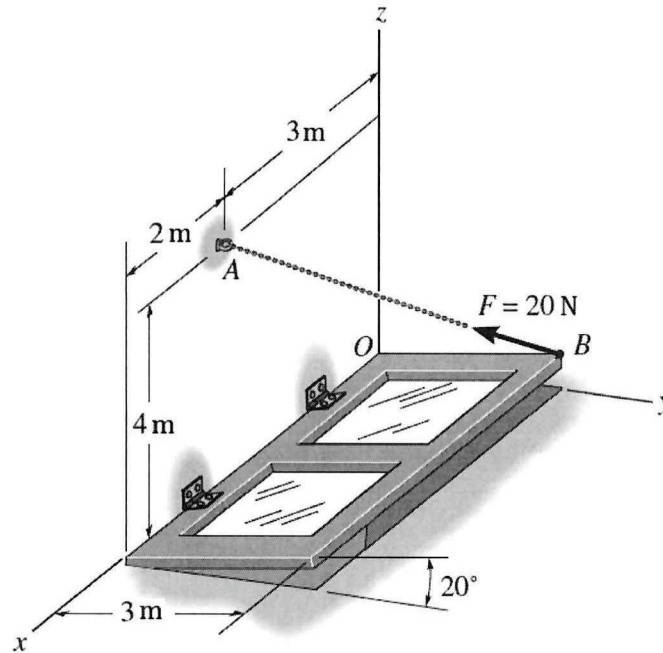


Figure Q2(b)

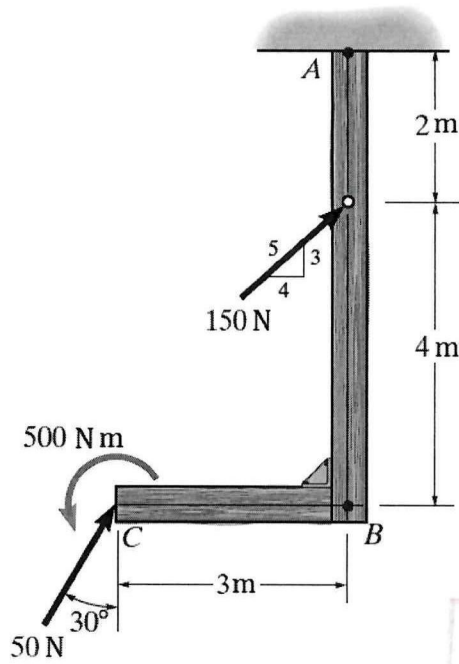


Figure Q3(a)

TERBUKA

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020

PROGRAMME CODE : BNG / BNL / BNM

COURSE NAME : STATICS

COURSE CODE : BNJ 10203

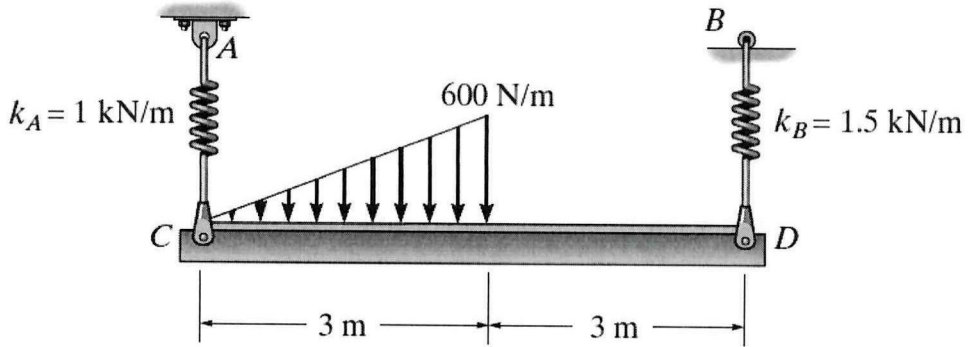


Figure Q3(b)

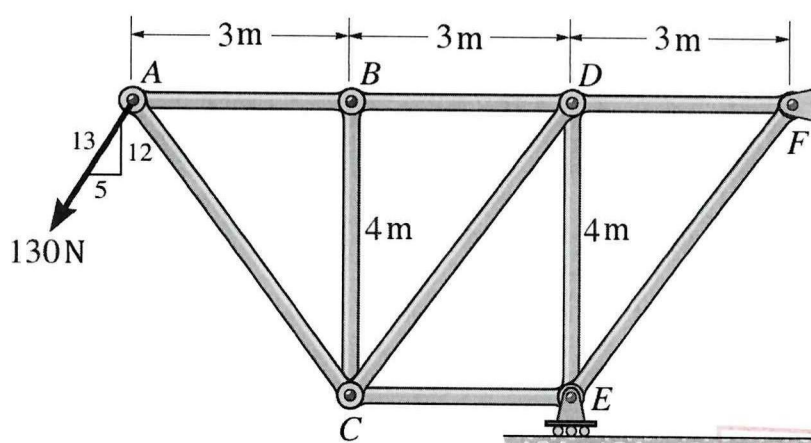


Figure Q4(b)

TERBUKA  
TERBUKA

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020

PROGRAMME CODE : BNG / BNL / BNM

COURSE NAME : STATICS

COURSE CODE : BNJ 10203

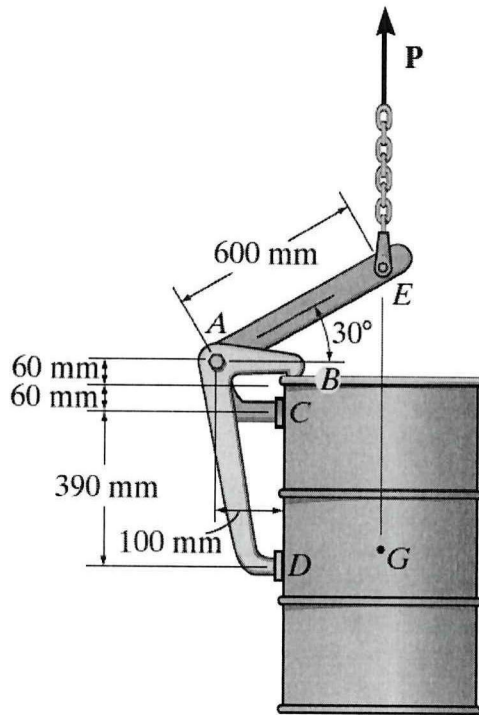


Figure Q5(b)

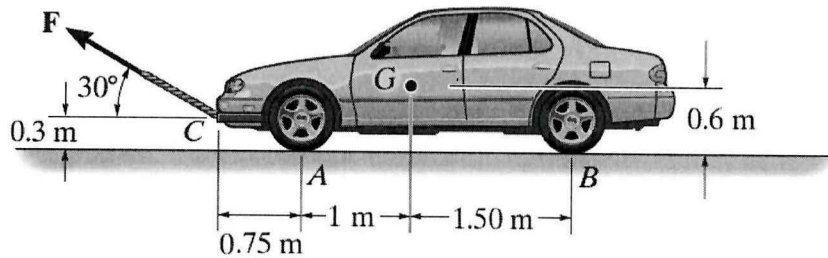


Figure Q6(b)

TERBUKA