Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	STATICS
COURSE CODE	:	BDA 10203
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. PART A (OPTIONAL) ANSWER **ONE (1)** QUESTION ONLY 2. PART B (COMPULSORY) ANSWER **ALL** QUESTIONS 3. THIS FINAL EXAMINATION IS A PHYSICAL ASSESSMENT AND CONDUCTED CLOSE BOOK

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

PART A (OPTIONAL)

Q1 **Figure Q1** shows a Warren truss.

(a) Draw the free body diagram (FBD) of the truss.

(5 marks)

(b) Determine the reaction force at supports *A* and *E*.

(5 marks)

(c) Determine the force in members **BC**, **CG** and **GF** of the truss. Indicate if the members are in tension or compression.

(10 marks)

Q2 A woman exerts 20 N forces to the pliers as shown in **Figure Q2**.

(a) Draw the free body diagram (FBD) of the problem.

(5 marks)

(b) Determine the magnitude of the forces the pliers exert on the bolt at *B*.

(5 marks)

(c) Determine the magnitude of the force the members of the pliers exert on each other at the pinned connection *C*.

(10 marks)

PART B (COMPULSORY)

Q3 A force, **F** = 3 kN acts on the pole in the direction as shown in **Figure Q3**.

(a) Explain a condition that the Earth can be considered as a particle

(2 marks)

(b) Explain **two (2)** applications of the dot product in mechanics.

(3 marks)

(c) Determine the magnitude of the components of the force acting parallel and perpendicular to the axis of the pole and express it in Cartesian vector form.

(10 marks)

(d) Determine the angle θ between the force and the axis of the pole.

(5 marks)

Q4 **Figure Q4** shows a crane boom *AB* which has a mass of 650 kg and center of gravity at *G*. The boom is supported by a pin at *A* and cable **BC**. If the suspended load attached from cable at **B** has a mass of 1250 kg, and the crane is in equilibrium:

(a) Draw a free-body diagram (FBD) of the crane boom **AB**.

(5 marks)

(b) Determine the tension of cable **BC**.

(7 marks)

(c) Determine the magnitude and angle of force reaction at *A*.

(8 marks)

Q5 The composite plate is made from both steel (A) and brass (B) segments as shown in **Figure Q5**. Given the density of steel, $\rho_A = 7.85$ Mg/m^3 and brass, $\rho_B = 8.74$ Mg/m^3.

(a) Determine the total mass of the plate.

(8 marks)

(b) Determine the location $(\bar{x}, \bar{y}, \bar{z})$ of its mass center G.

(12 marks)

Q6 The three bars have a weight of $\mathbf{W_A} = 20$ N, $\mathbf{W_B} = 40$ N, and $\mathbf{W_C} = 60$N, respectively. If the coefficients of statics friction at the surfaces of contact are as shown in **Figure Q6**:

(a) Determine the smallest horizontal force need to move blocks A and B together.

(10 marks)

(b) Determine the smallest horizontal force need to move blocks A only.

(10 marks)

Free body diagram (FBD) must be included to generate equation of equilibrium and friction in the system.

- END OF QUESTIONS -

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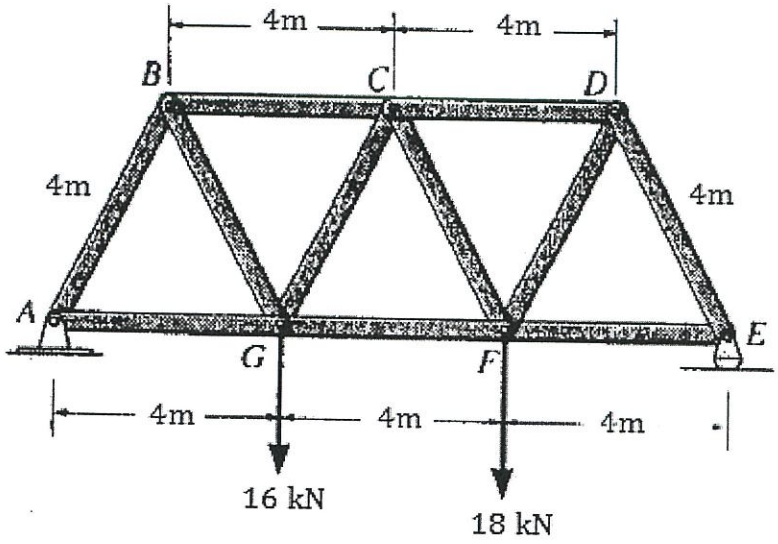

Figure Q1

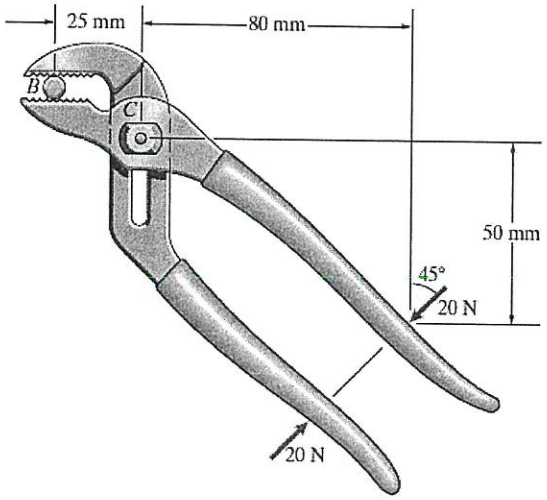

Figure Q2

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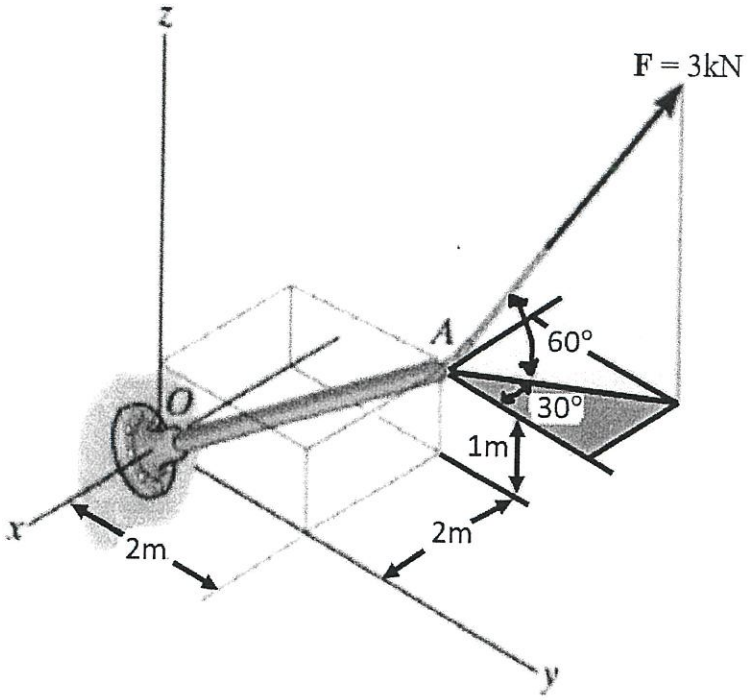

Figure Q3

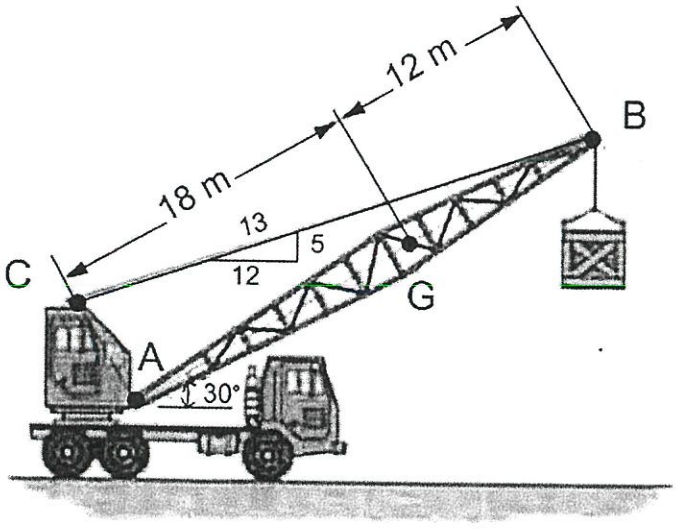

Figure Q4

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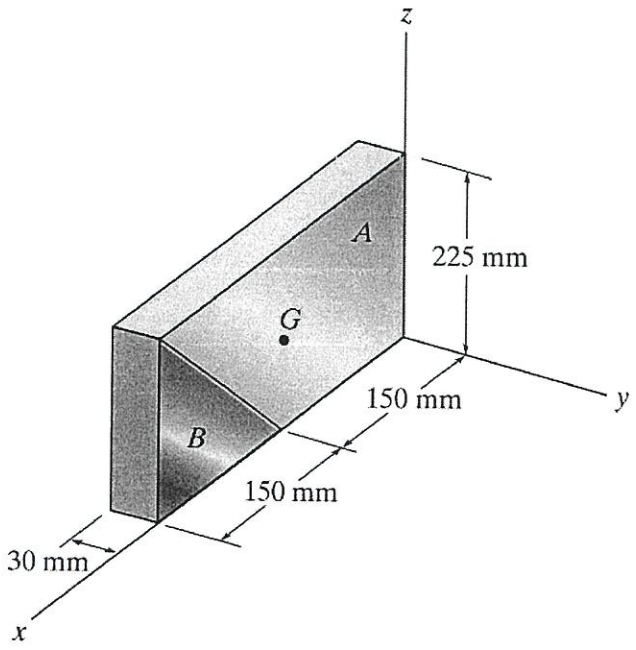

Figure Q5

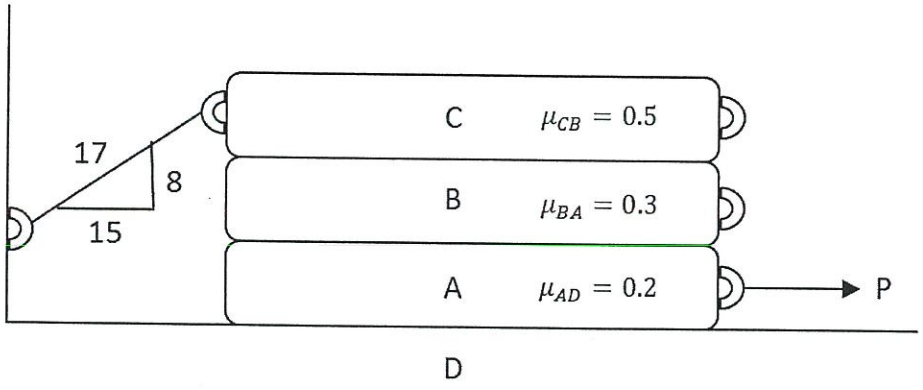

Figure Q6