Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER I
## SESSION 2022/2023

| | | |
|---|---|---|
| COURSE NAME | : | STATICS |
| COURSE CODE | : | DAM 13403 |
| PROGRAMME CODE | : | DAM |
| EXAMINATION DATE | : | FEBRUARY 2023 |
| DURATION | : | 3 HOURS |
| INSTRUCTIONS | : | 1. ANSWER **FIVE** QUESTIONS **ONLY**. |
| | | 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.** |
| | | 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK |

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES



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**Q1** (a) Define a free body diagram (FBD).

(2 marks)

(b) The unstretched length of spring AB is 3 m. The block is held in the equilibrium position shown in **Figure Q1(b)**. Draw a free-body diagram for point A. Determine the mass of the block at D.

(8 marks)

(c) Distributed loading on the bar is shown in **Figure Q1(c)**. Replace the distributed loading with an equivalent resultant force and specify its location, measured from point A. Draw a free-body diagram of the bar.

(10 marks)

**Q2** (a) Describe the condition of a particle in equilibrium.

(2 marks)

(b) Determine the magnitude of $F_1$ and the angle $\Phi$ in **Figure Q2(b)** if the magnitude of the resultant force acting on the eyebolt is 600 N and its direction measured clockwise from the positive *x-axis* is $\theta = 30°$.

(8 marks)

(c) A chandelier in **Figure Q2(c)** is in a state of equilibrium supported by four wires. If the tension developed in each of the wires is not allowed to exceed 600 N, determine the maximum mass of the chandelier that can be supported.

(10 marks)

**Q3** (a) Define the terminology of a couple of moments.

(2 marks)

(b) A wrench in **Figure Q3(b)** is used to tighten the nut at A. If the wrench does not turn when the load is applied to the handle, determine the moment applied, $M_A$ and the resultant force, $F_{RA}$ on the nut.

(8 marks)

(c) Two couples act on the cantilever beam as shown in **Figure 3(c)**. If F = 6 kN, determine the resultant couple moment.

(10 marks)



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**Q4** (a) List **two (2)** methods of analyzing trusses.

(2 marks)

(b) Determine the horizontal and vertical components of reaction at the pin A and the reaction at the roller B required to support the truss in **Figure Q4(b)**. Set F = 600 N.

(8 marks)

(c) The bridge truss is subjected to the loading shown in **Figure Q4(c)**. Calculate the force in members HD, CD, and GD, and state if the members are in tension or compression.

(10 marks)

**Q5** (a) Define the centre of gravity.

(2 marks)

(b) Determine the coordinates of the centroid and the area of the shaded area shown in **Figure 5(b)** by using the integration method.

(8 marks)

(c) Compute the centroid $(x, y)$ of the shaded area shown in **Figure 5(c)** by using the method of composite areas.

(10 marks)

**Q6** (a) Briefly explain the difference between static friction and kinetic friction.

(3 marks)

(b) State and explain a real-life application of friction.

(3 marks)

(c) **Figure Q6(c)** shows the crate A weighs 600 N. Between all contacting surfaces, $\mu_s = 0.32$ and $\mu_k = 0.30$ and neglect the weights of the wedges. Calculate the magnitude of force, F needed to start A moving to the right at a constant rate.

(14 marks)

**– END OF QUESTIONS –**



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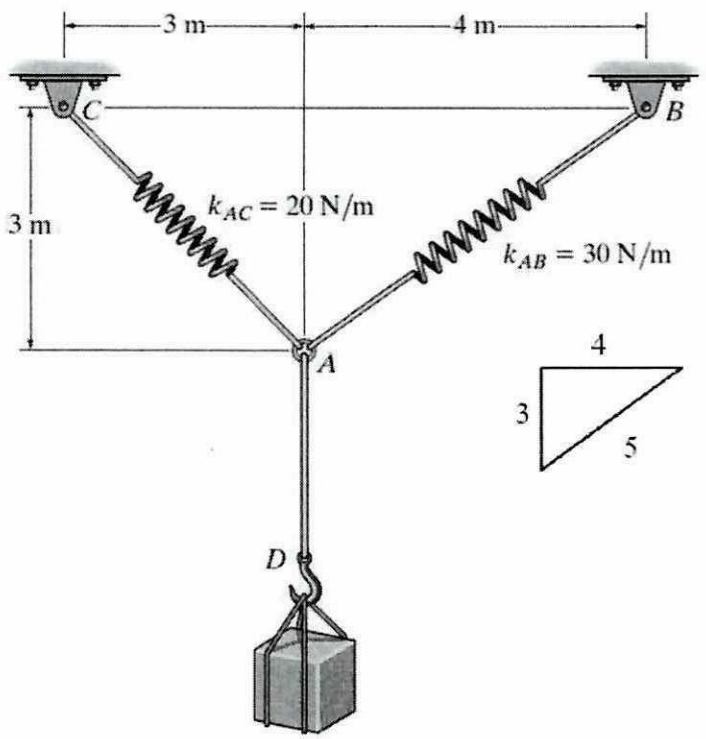


**Figure Q1(b)**

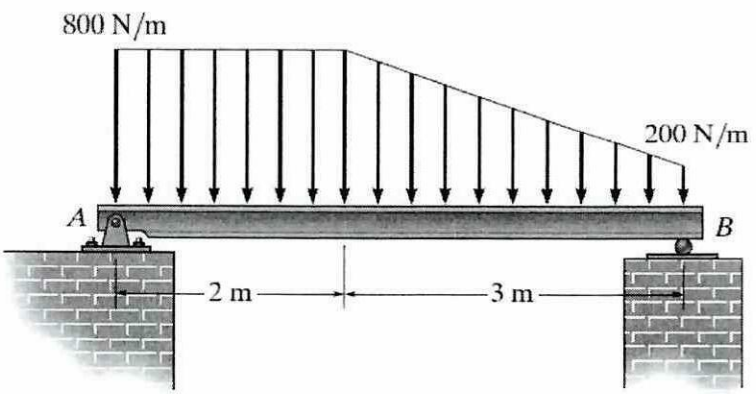


**Figure Q1(c)**



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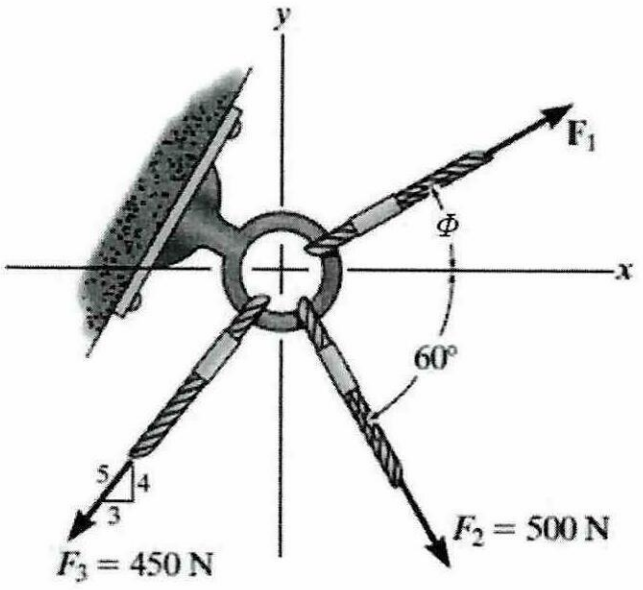


**Figure Q2(b)**

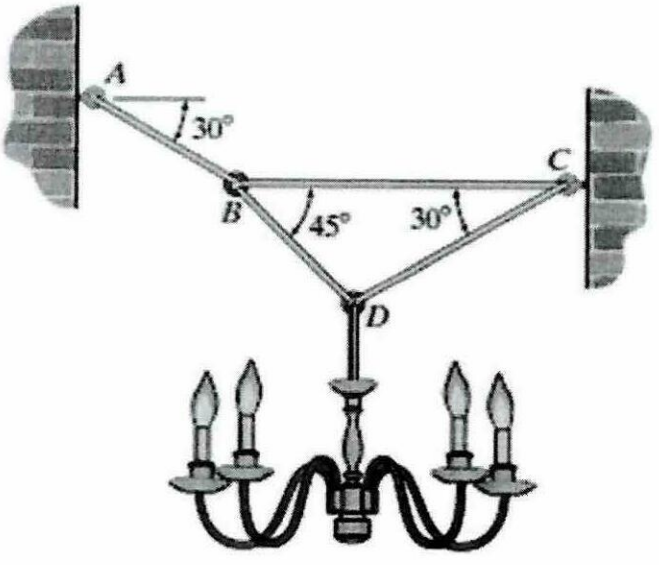


**Figure Q2(c)**



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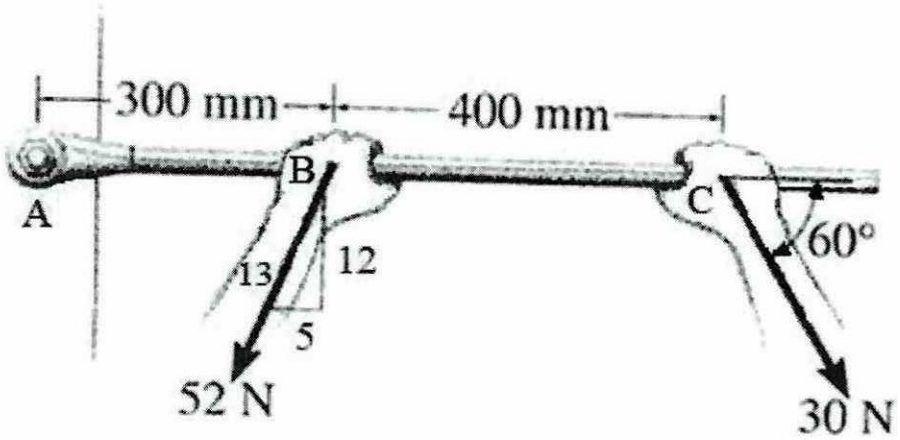


**Figure Q3(b)**

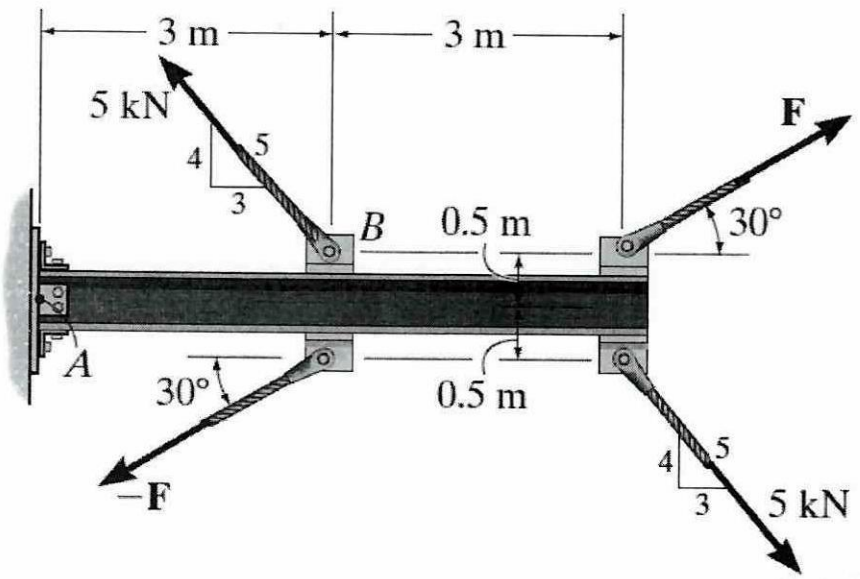


**Figure Q3(c)**



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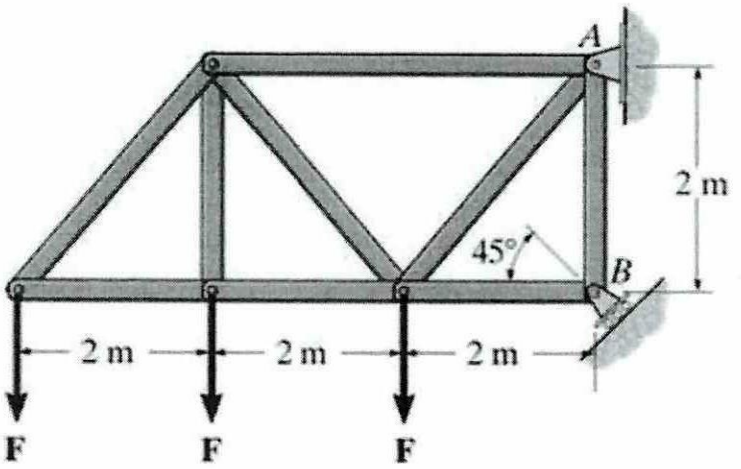


**Figure Q4(b)**

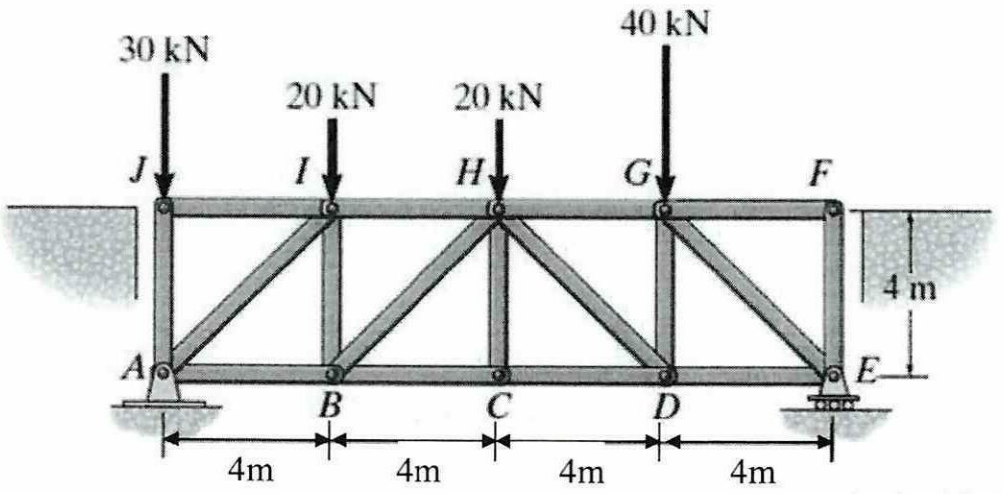


**Figure Q4(c)**



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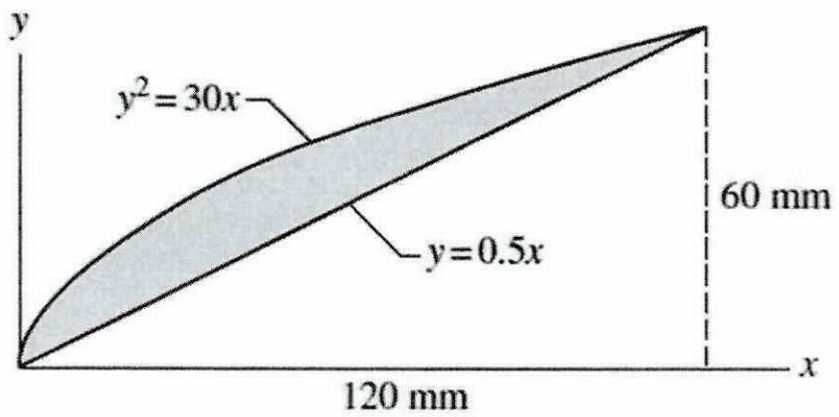
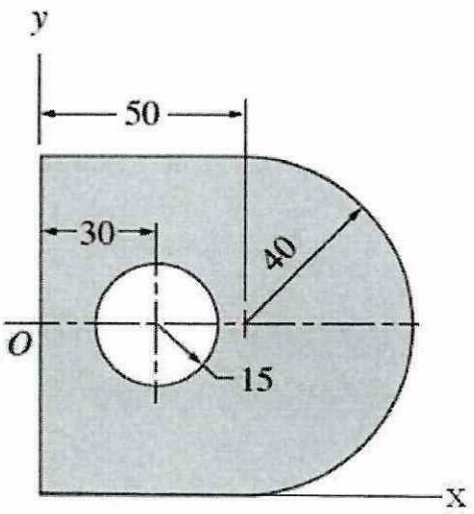



**Figure Q5(b)**




Dimensions in mm

**Figure Q5(c)**



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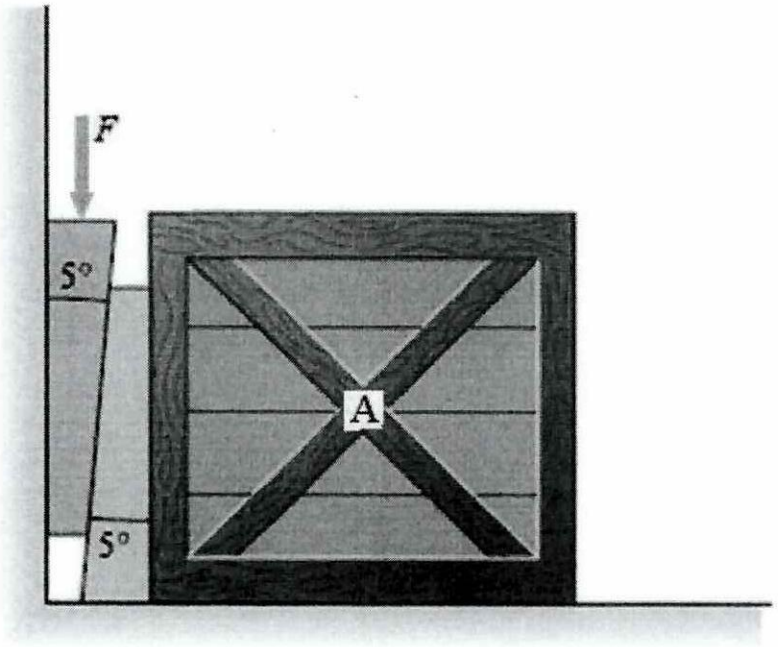


**Figure Q6(c)**



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