Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	STATICS
COURSE CODE	:	BNJ 10203
PROGRAMME CODE	:	BNM
EXAMINATION DATE	:	JULY/ AUGUST 2023
DURATION	:	3 HOURS

INSTRUCTIONS

1. ANSWER ALL QUESTIONS
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

Q1 (a) Given $FA = 10\ kN$ and $FB = 8\ kN$ and θ is an angle for the connecting member A to the plate and 40° is an angle for connecting member B to the plate for **Figure Q1(a).** By applying Parallelogram method:

(i) Determine angle θ so that the resultant force of F_A and F_B is directed horizontally to the right.

(6 marks)

(ii) Calculate the magnitude of the resultant force, F_R.

(2 marks)

(b) The 25 kg pipe is supported at A by a system of five cords according to **Figure Q1(b)** and the condition of the body is in equilibrium.

(i) Draw FBD for point A and point B.

(2 marks)

(ii) Determine the cord for AE and AB.

(5 marks)

(iii) Determine the cord for BD and BC.

(5 marks)

Q2 (a) **Figure Q2(a)** shows force with vector F = {300**i** - 500**j** + 200**k**} N.

(i) Determine the unit vector for the cable BA.

(2 marks)

(ii) Determine the magnitude of the projected component of the force, F acting along the cable BA.

(3 marks)

(iii) Determine the angle θ between the cables AB and AC.

(8 marks)

(b) The right-hand rule is a useful tool for determining the direction of the vector resulting from a cross product. With the aid of diagram, draw the right-hand rule that represents the cross-product vector.

(2 marks)

(c) The pipe assembly as shown in **Figure Q2(c)** is subjected to the force of $\mathbf{F} = \{600\mathbf{i} + 800\mathbf{j} - 500\mathbf{k}\}$ **N**. Determine the moment of this force about point *A*.

(5 marks)

Q3 (a) Replace the force system acting on the post as shown in **Figure Q3(a)** by a resultant force, and specify where its line of action intersects the post *AB* measured from point *A*.

(7 marks)

(b) Declare number of unknowns for fixed support reactions in 3D cases and draw the FBD to support the answer.

(4 marks)

(c) The truss, used to support a balcony, is subjected to the loading shown in **Figure Q3(c).** Approximate each joint as a pin and determine the force in member *AB, AD, BC*, and *BD*. State whether the members are in tension or compression. Set ***P_1 = 800 kN, P_2 = 600 kN.***

(9 marks)

Q4 (a) Determine the location $\bar{y}$ of the centroid of the beam's cross-sectional area as referred in **Figure 4(a)**. Neglect the size of the corner welds at A and B for the calculation.

(7 marks)

(b) **Figure 4(b)** shows the bracket consists of two parts: vertical face and horizontal base is made from sheet metal which has a mass of 25 kg/m^2. The material of the horizontal base has a mass of 40 kg/m^2, and the steel shaft has a density of 7.83 Mg/m^3. Determine the location of the center of mass of the bracket-and-shaft combination.

(13 marks)

Q5 (a) In designing a brake system for a bicycle, car, or any other vehicle, it is important to understand the frictional forces involved.

(i) State dry friction definition

(2 marks)

(ii) Give **ONE (1)** example of application of dry friction and draw its free body diagram.

(2 marks)

(b) **Figure Q5(b)** shows a system of block moving to the right. The coefficient of friction under each block is 0.10 and the pulleys are assumed to be frictionless.

(i) Draw the free body diagram system of the block.

(4 marks)

(ii) Calculate the weight W to start the system of blocks.

(12 marks)

-END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2022/2023
COURSE NAME : STATICS
PROGRAMME CODE : BNM
COURSE CODE : BNJ 10203

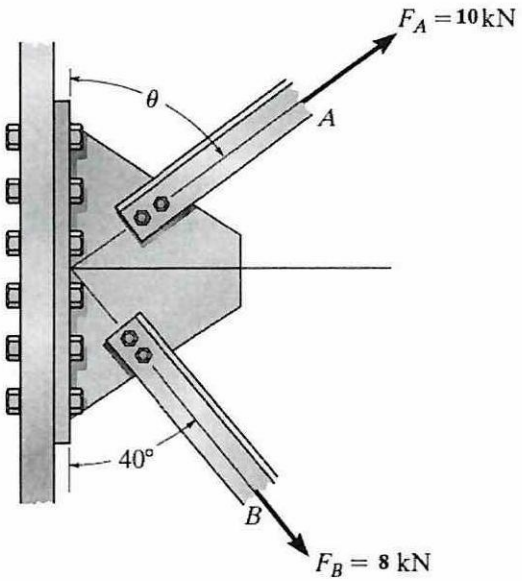


Figure Q1(a)

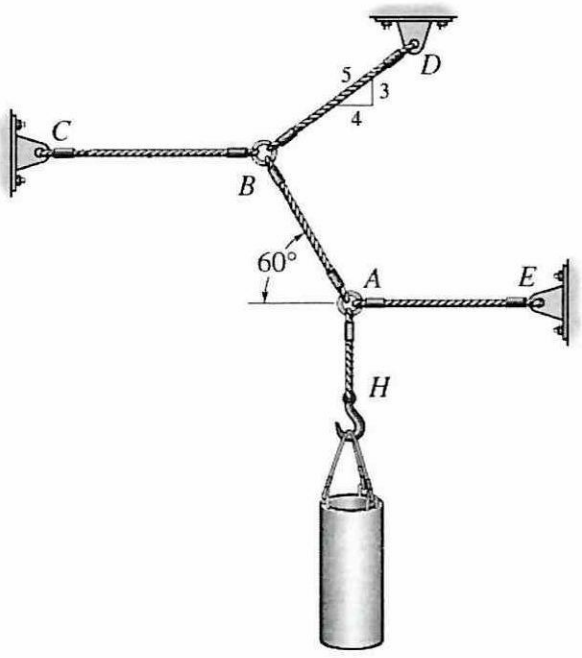


Figure Q1(b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2022/2023
COURSE NAME : STATICS
PROGRAMME CODE : BNM
COURSE CODE : BNJ 10203

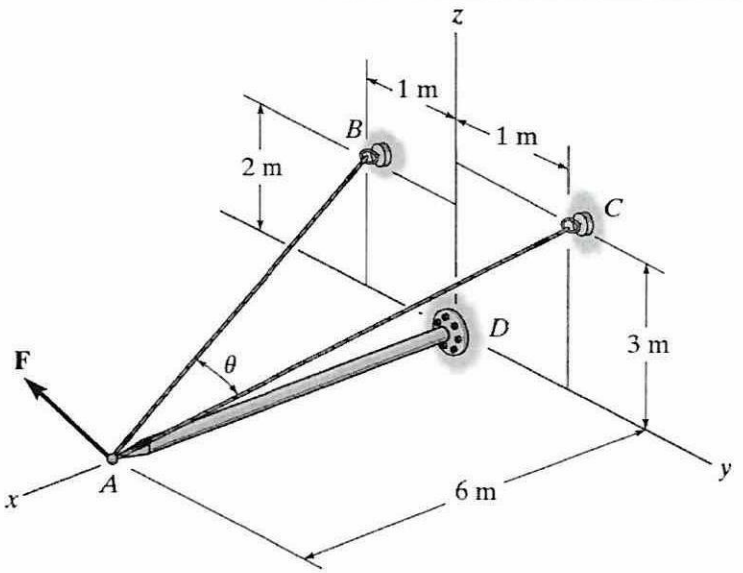


Figure Q2(a)

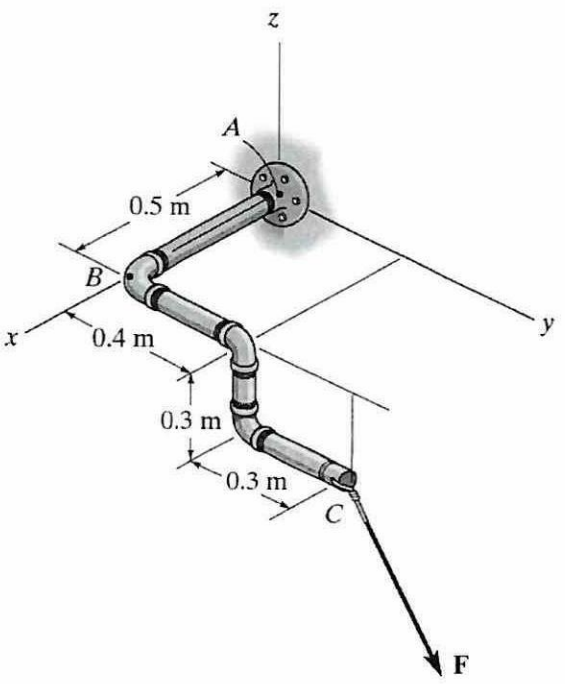


Figure Q2(c)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2022/2023
COURSE NAME : STATICS
PROGRAMME CODE : BNM
COURSE CODE : BNJ 10203

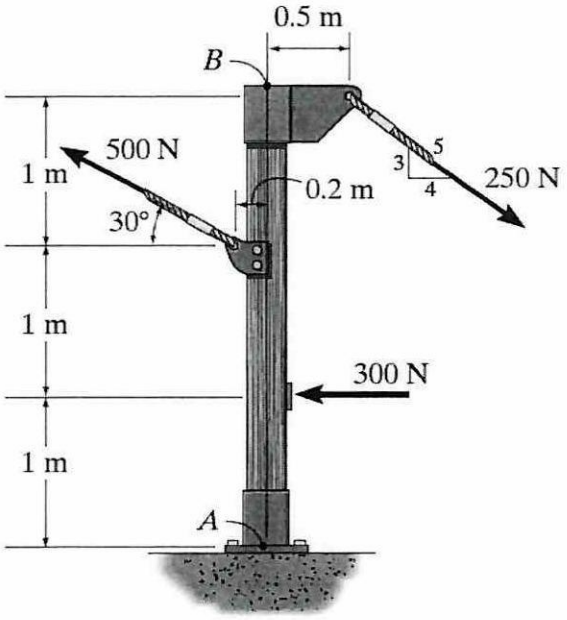


Figure Q3(a)

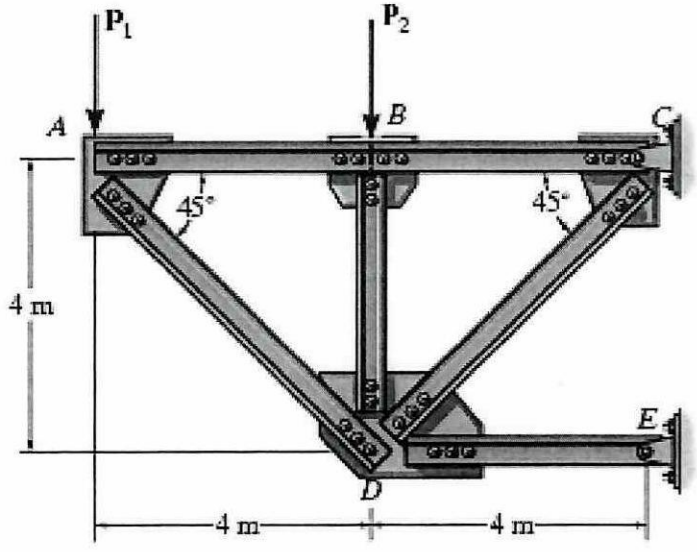


Figure Q3(c)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2022/2023
COURSE NAME : STATICS
PROGRAMME CODE : BNM
COURSE CODE : BNJ 10203

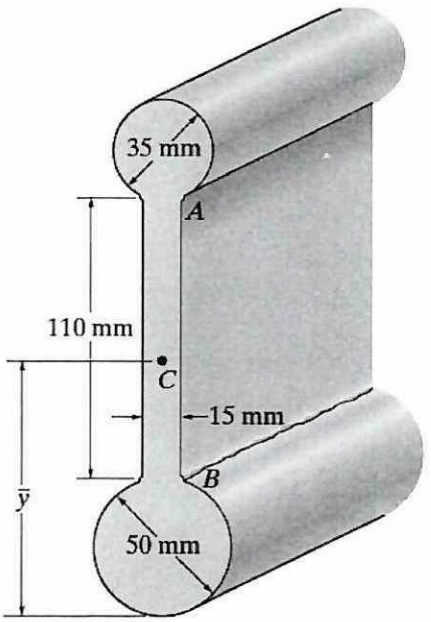
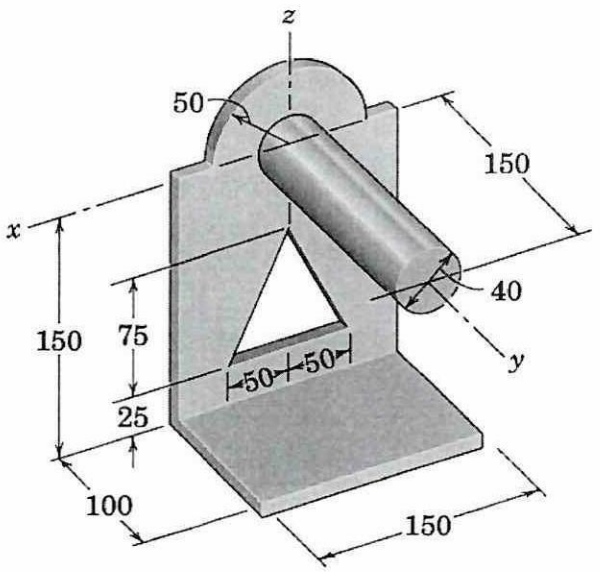


Figure Q4(a)



Dimensions in millimeters

Figure Q4(b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2022/2023
COURSE NAME : STATICS
PROGRAMME CODE : BNM
COURSE CODE : BNJ 10203

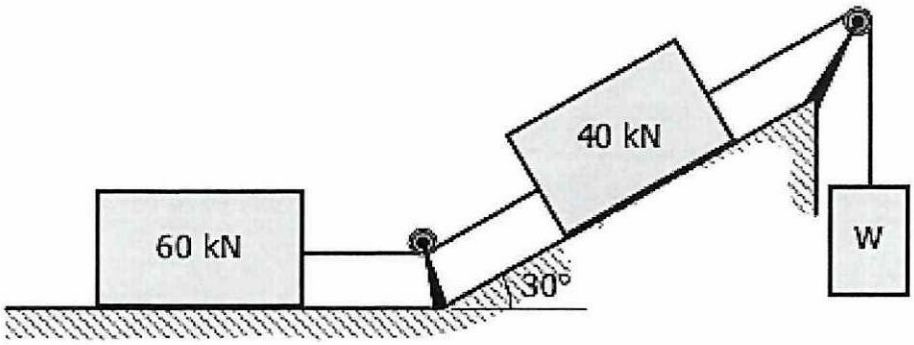


Figure Q5(b)