Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2023/2024

COURSE NAME	:	MECHANICS OF MATERIALS
COURSE CODE	:	BFC 20903
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JANUARY/FEBRUARY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ 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 **FIVE (5)** PAGES

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ANSWER ALL QUESTIONS

Q1 (a) List **THREE (3)** types of support and draw the free body diagram of each support.

(5 marks)

(b) Determine the reaction of beam stressed with the loads as shown in **Figure Q1.1**.

(5 marks)

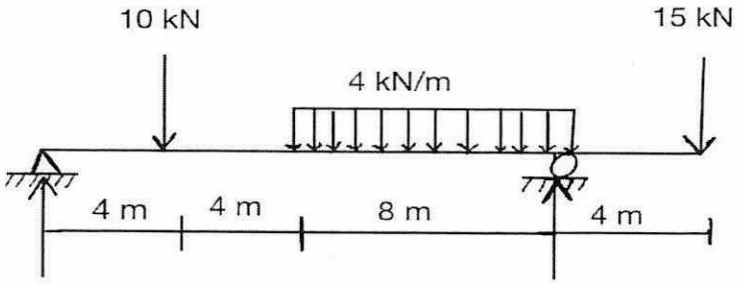

Figure Q1.1

(c) **Figure Q1.2** shows a simply supported beam. Draw the share force diagram and the bending moment diagram using cut-section method.

(15 marks)

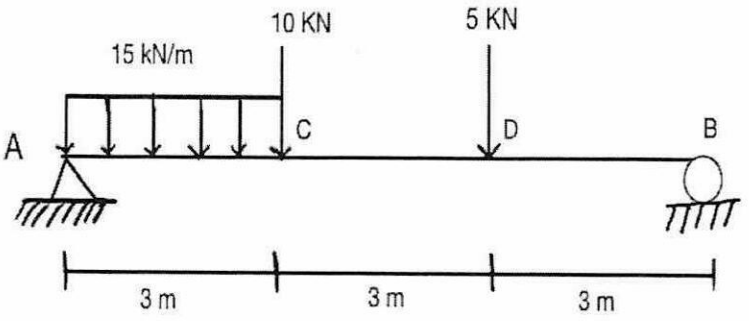

Figure Q1.2

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Q2 (a) A rectangular beam shown in **Figure Q2.1** is subjected to maximum bending moment of 600 kNm. Calculate the maximum bending stress of the beam.

(8 marks)

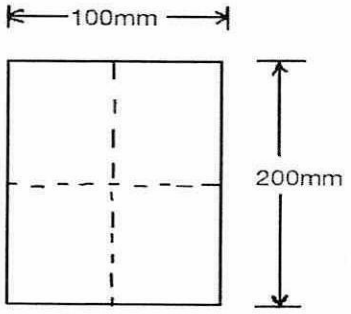

Figure Q2.1

(b) A beam and its cross-section is shown in **Figure Q2.2** and **Figure Q2.3,** respectively. Plot the shear stress distribution of the beam's cross-section and calculate the maximum shear stress.

(17 marks)

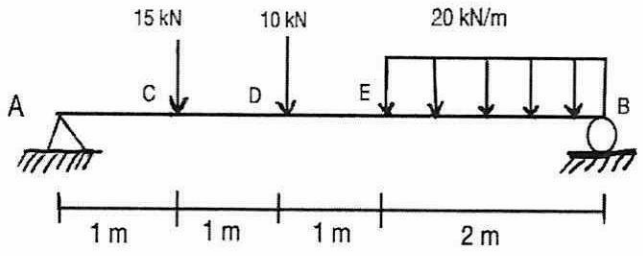

Figure Q2.2

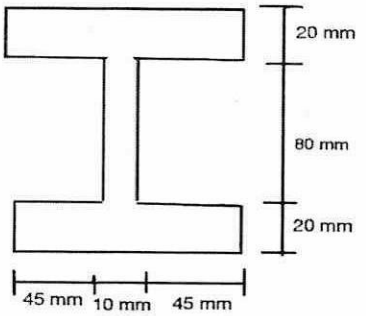

Figure Q2.3

Q3 For the beam and loading shown in **Figure Q3.1**, use the double integration method to determine the following by taking *EI* is constant for the beam.

(a) The equation of the elastic curve for segment AB of the beam.

(13 marks)

(b) The deflection midway between the two supports.

(4 marks)

(c) The slope at A.

(4 marks)

(d) The slope at B.

(4 marks)

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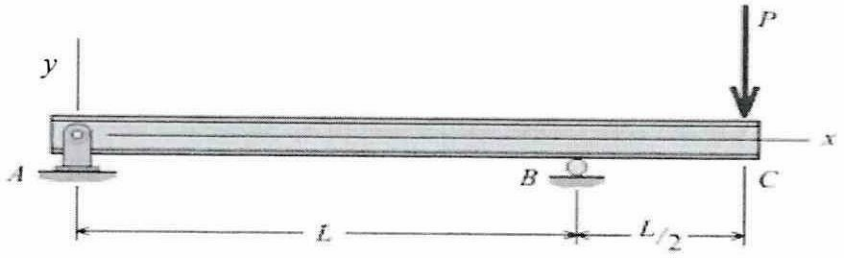

Figure Q3.1

Q4 (a) A long, slender structural aluminum [E = 70 GPa] flanged shape given in **Figure Q4.1** is used as a 7- m-long column. The column is pinned at ends A and C. Lateral support is provided to the column so that deflection in the x– z plane is restrained at mid-height B. However, the column is free to deflect in the x–y plane at B (see **Figure Q4.2**). Determine the maximum compressive load P the column can support if a factor of safety of 2.5 is required. In your analysis, consider the possibility that buckling could occur about either the strong axis (i.e., the z axis) or the weak axis (i.e., the y axis) of the aluminum column.

(13 marks)

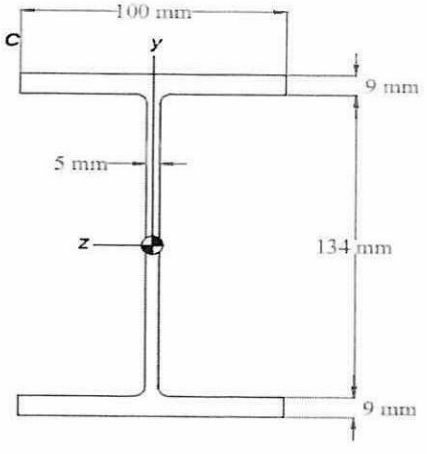

Figure Q4.1

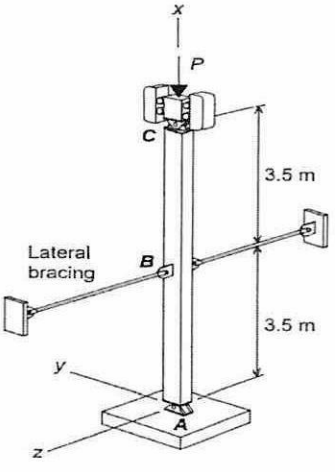

Figure Q4.2

(b) A compound shaft as shown in **Figure Q4.3** consists of brass segment (1) and aluminum segment (2). Segment (1) is a solid brass shaft with an outside diameter of 18 mm and an allowable shear stress of 42 MPa. Segment (2) is a solid aluminum shaft with an outside diameter of 14 mm and an allowable shear stress of 62 MPa. Determine the magnitude of the largest torque T_C that may be applied at C.

(12 marks)

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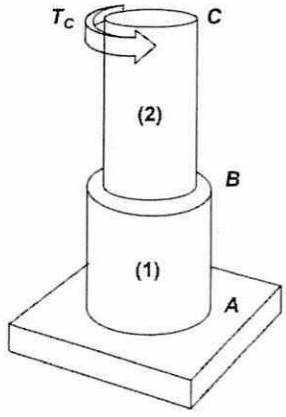

Figure Q4.3

- END OF QUESTIONS -

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