Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	SOLID MECHANICS
COURSE CODE	:	DAM 23303
PROGRAMME CODE	:	DAM
EXAMINATION DATE	:	JULY / AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER **FIVE (5)** 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 **SIX (6)** PAGES

Q1 (a) Differentiate between statics and kinematics.

(4 marks)

(b) Consider the structure shown in **Figure Q1. (b)**, which was design to support a 50 kN load. It consist a boom AB with a 35 X 55 mm rectangular cross section and a rod BC with a 25 mm diameter circular cross section. The boom and the rod are connected by a pin at B and are supported by a pin and brackets at A and C, respectively. Determine the forces in the members of FAB and FBC.

(16 marks)

Q2 (a) Explain the following points and sections on the stress-strain curve for mild steel shown in **Figure Q2. (a).**

(i) point A

(2 marks)

(ii) point B

(2 marks)

(iii) section OA

(2 marks)

(iv) section OB

(2 marks)

(v) section C, and

(2 marks)

(iv) section D

(2 marks)

(b) A square aluminum bar should not stretch more than 1.4 mm when it is subjected to a tensile load. Knowing that E = 70 GPa (70,000,000,000 Pa) and that the allowable tensile strength is 120 MPa (120,000,000 Pa), determine:

(i) the maximum allowable length of the pipe,

(4 marks)

(ii) the required dimensions of the cross section if the tensile load is 28 kN (28,000 N).

(4 marks)

Q3 (a) What is an example of a thin pressure vessel?

(4 marks)

(b) A cylindrical pressure vessel as shown in **Figure Q3. (b)** is fabricated from steel plating that has a thickness of 20 mm. The diameter of the pressure vessel is 450 mm and its length is 2.0 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa, and the circumferential stress is limited to 60 MPa.

(16 marks)

Q4 (a) What is torsion in strength of materials?

(4 marks)

(b) A solid steel shaft in a rolling mill transmits 20 kW of power at 2 Hz. Determine the smallest safe diameter of the shaft if the shear stress τ_w is not to exceed 40 MPa and the angle of twist θ is limited to 6°in a length of 3 m. Use G = 83 GPa.

(16 marks)

Q5 (a) What is moment of inertia with example?

(4 marks)

(b) A square box beam is made of two 18 X 76 mm planks and two 18 X 112 mm planks, nailed together as shown in **Figure Q5. (b)**. Knowing that the spacing between nails is 44 mm and that the beam is subjected to a vertical shear of magnitude V = 2.5 kN, determine the shear force in each nail.

(16 marks)

Q6 (a) What are the **FOUR (4)** types of stress in engineering?

(4 marks)

(b) For the state of plane stress in **Figure Q6. (b)**, determine:

(i) the principinal planes,

(4 marks)

(ii) the principal stresses,

(4 marks)

(iii) the maximum shearing stress, and

(4 marks)

(iv) the corresponding normal stress

(4 marks)

- END OF QUESTIONS –

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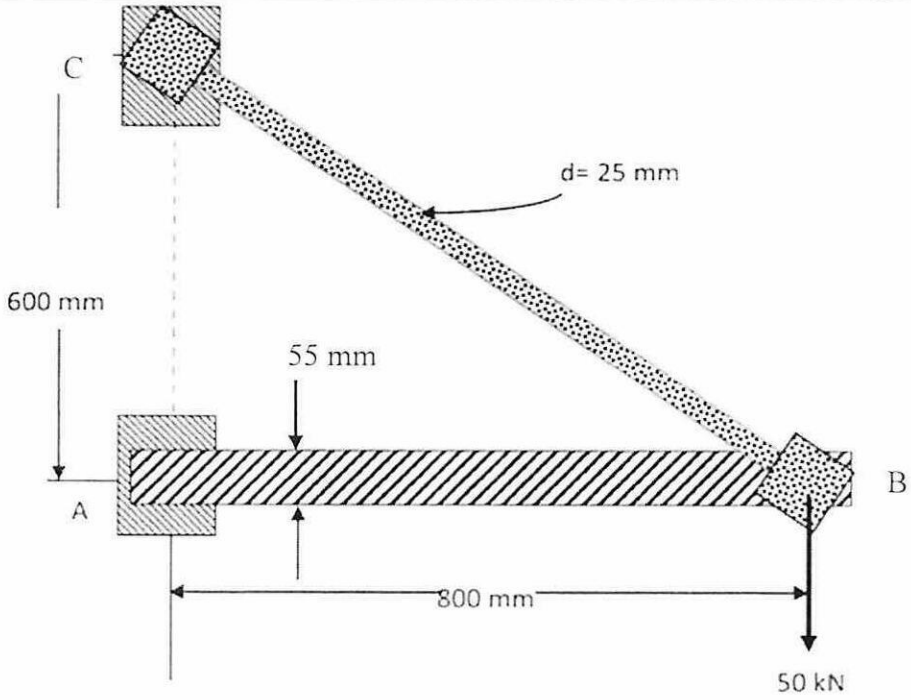

Figure Q1. (b)

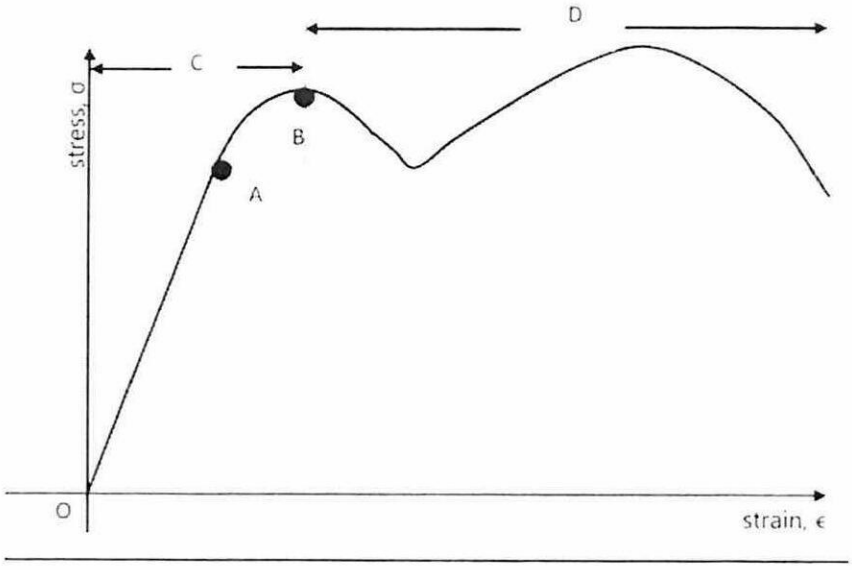

Figure Q2. (a)

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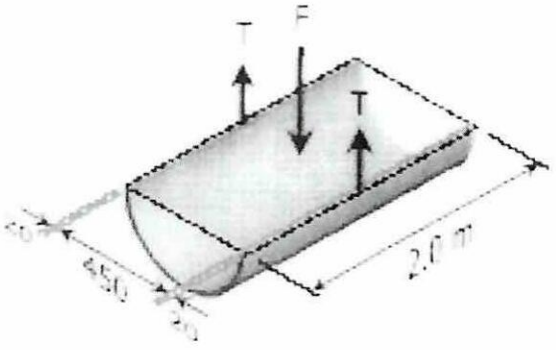

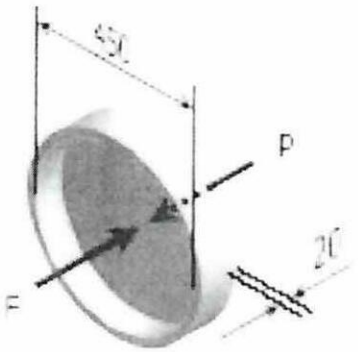

Figure Q3. (b)

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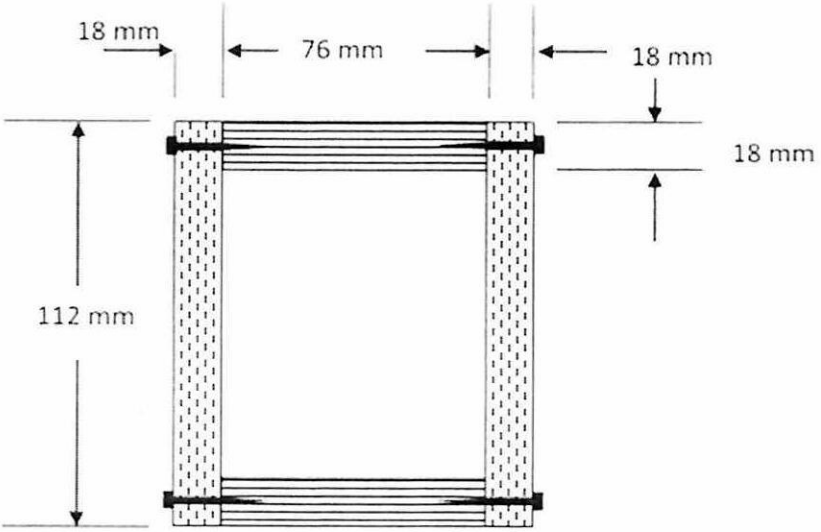

Figure Q5. (b)

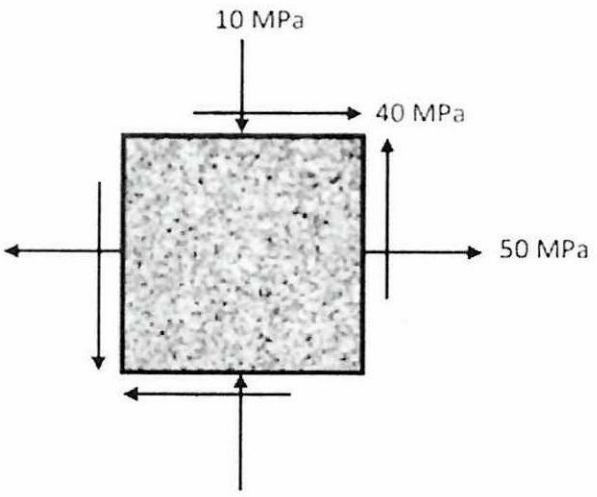

Figure Q6. (b)