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(422)

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	MECHANICS OF MATERIAL
COURSE CODE	:	BFC20903
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JANUARY 2021/ FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

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Q1 (a) With aided of sketches give definition and related equations for:

(i) Normal stress
(ii) Shear stress
(iii) Bearing stress
(iv) Thermal stress

(8 marks)

(b) Derive the bending stress equation of $\sigma_m = My/I$ for a flexural member. Provide clear sketches, label and mathematical processes in you derivation.

(6 marks)

(c) Describe an application of torsion in civil engineering. Use sketches and appropriate label to illustrate the mechanism.

(5 marks)

(d) A slender column in **Figure Q1** unable to satisfy the allowable axial compressive stress. You are not allowed to change the dimension size and column length. Provide an alternative idea with specific sketches to overcome this problem

(6 marks)

Q2 For the following questions, please refer to **Figure Q2**.

(a) Analyse all stresses of σ_x, σ_y and τ_{xy} from the origin element if it requires to rotate Θ_p= clock wise 15° to achieve the maximum stress. Sketch the orientation of the element. Sketch the orientation of the origin element. You are allowed to use any Mohr's Circle methods for this question.

(6 marks)

(b) From similar Mohr's Circle of **Q2 (a)**, identify the maximum shearing stress. Sketch the orientation of the element.

(4 marks)

(c) By using general transformation equations, compare the values of transformed stresses and element orientations obtained from **Q2 (a)** and **Q2 (b).** Sketch the orientation of all elements.

(15 marks)

Q3 **Figure Q3** shows an overhanging with a point load acting at point C.

(a) Sketch the shear force and bending moment diagrams. Show all calculations to complete this question. Take W = 35 kN, L = 3 m and d = 1.5 m in your calculation.

(6 marks)

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(b) If a steel rectangular hollow section beam of 130 mm x 260 mm with 8 mm thickness is assigned on this beam, sketch the distribution of bending stress and shear stress. Afterward, identify the whether these applied stress satisfy the allowable bending stress of 135 MPa, and allowable shear stress of 11 MPa.

(9 marks)

(c) By using any slope and deflection methods, determine the maximum deflection at point C. Take E_{st} = 205 GPa.

(10 marks)

Q4 (a) **Figure Q4 (a)** shows a monitoring platform supported by 3 meters height of square hollow section of steel poles. The base of the poles is fixed in concrete footings, and the top is laterally tighten to the platform deck in both horizontal directions by bolts.

(i) Using Euler buckling equation, analyse the suitable thickness of t if the P_{cr} = 2454 kN is provided. Take E_{st} = 205 GPa.

(5 marks)

(ii) Examine the compressive stress if σ_y = 250 N/mm^2.

(5 marks)

(b) **Figure Q4 (b)** is made of an aluminum tube. If T = 25 Nm and L = 1200 mm,

(i) Calculate the maximum shear stress either occurs in the top edge or side edge of the tube.

(5 marks)

(ii) Determine the angle of twist at point B.

(3 marks)

(iii) If the allowable shear stress if only allow for 0.05 MPa, analyse an appropriate size to satisfy this limit.

(7 marks)

– END OF QUESTIONS –

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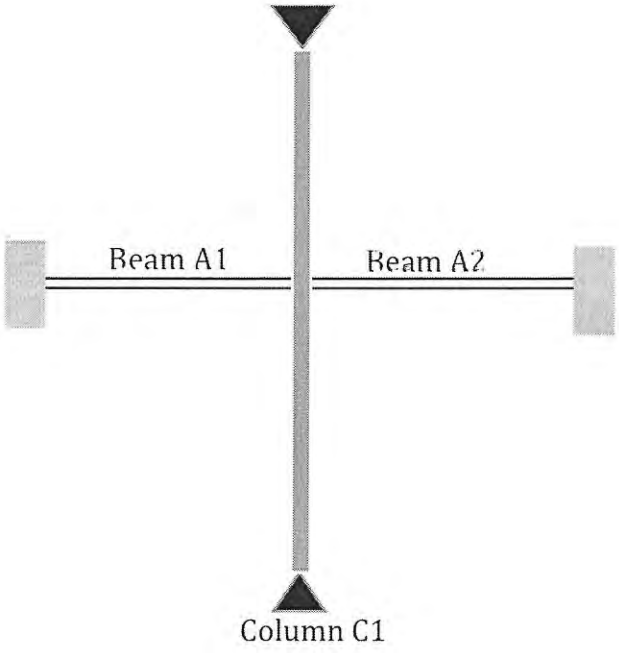
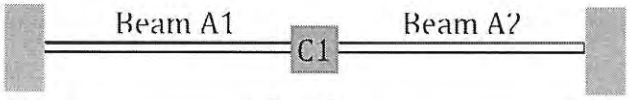


Front Elevation



Plan View

FIGURE Q1

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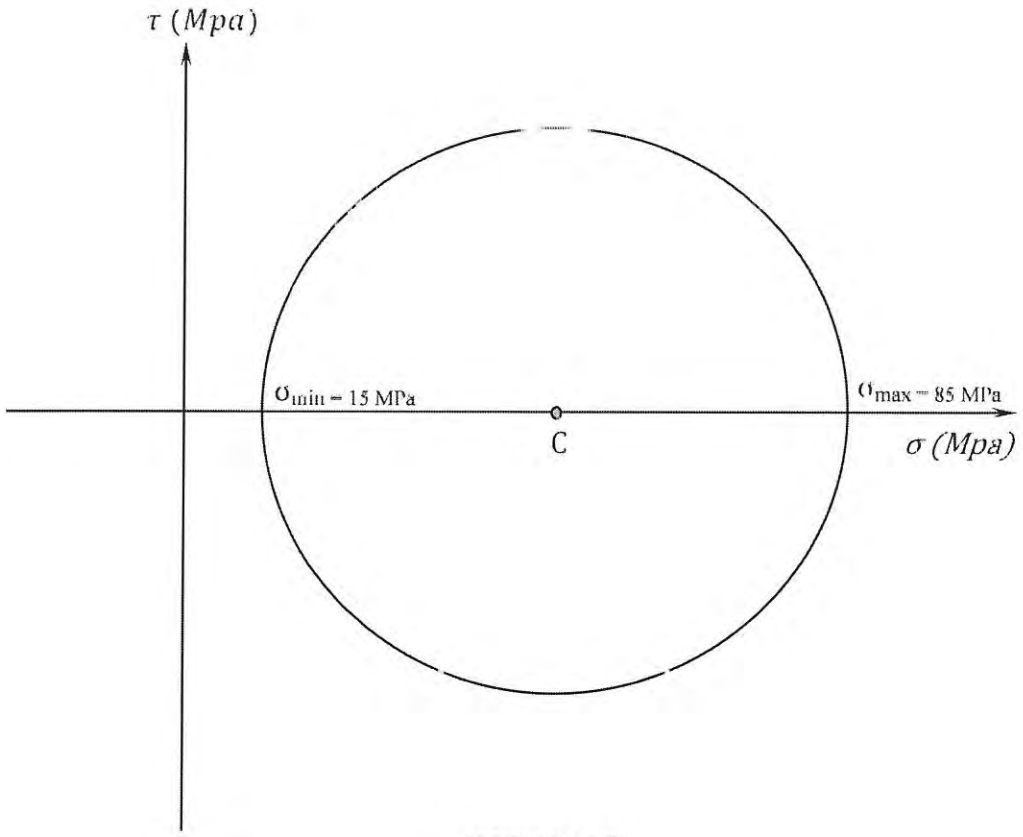

FIGURE Q2

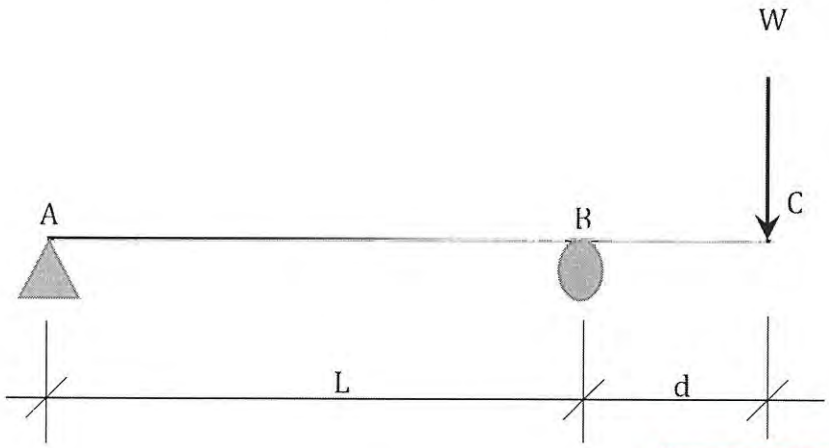

FIGURE Q3

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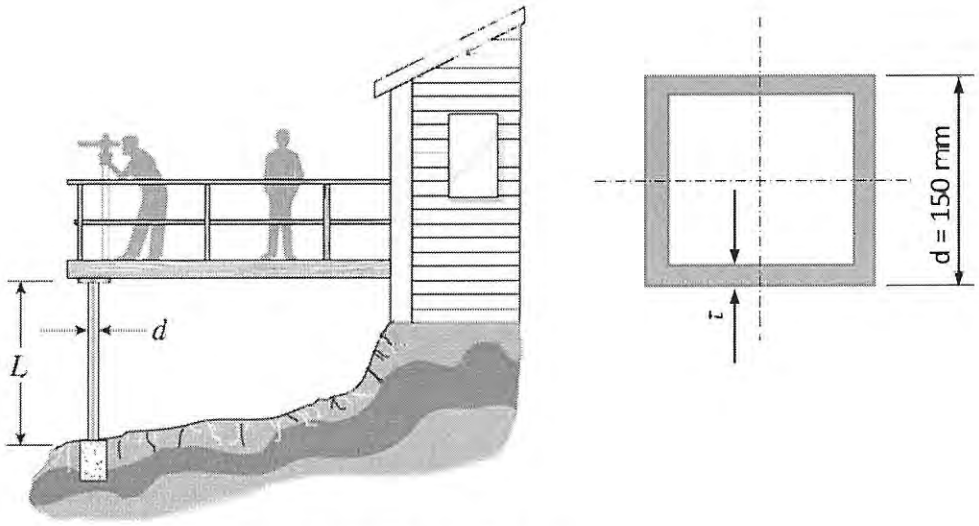

FIGURE Q4 (a)

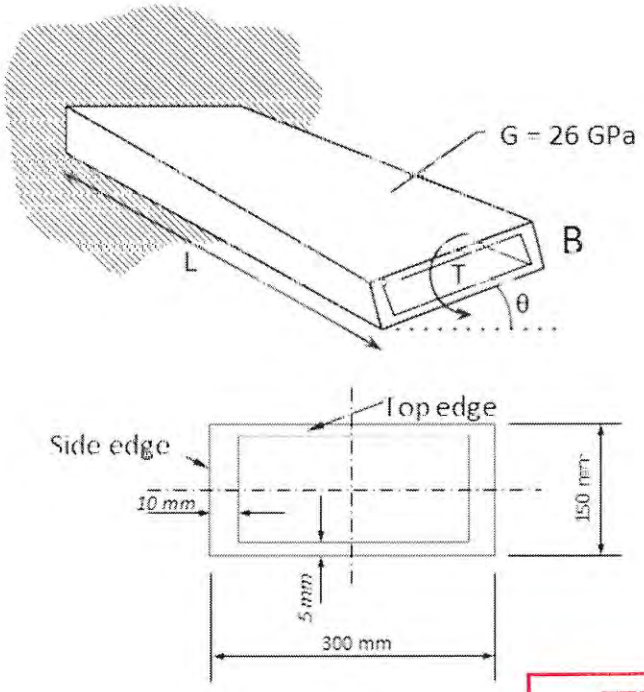

FIGURE Q4 (b)

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