

**UTHM**

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA**FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017**

COURSE NAME : MECHANICS OF MATERIAL
COURSE CODE : BFC20903
PROGRAMME CODE : BFF
EXAMINATION DATE : JUNE 2017
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

- Q1** (a) Describe briefly about:
- (i) Hooke's law
 - (ii) Poisson's ratio
- (4 marks)
- (b) A steel reinforcement is subjected to tensile test and the stress-displacement graph resulted from the test is shown in **Figure Q1(a)**. Explain in details about the graph.
- (6 marks)
- (c) **Figure Q(b)** shows a cantilever beam with fix support at point A. The beam is loaded with point load at point B and moment at point C.
- (i) Calculate the reaction forces of the beam.
- (3 marks)
- (ii) Draw the shear force diagram and bending moment diagram for the beam.
- (12 marks)
- Q2** (a) List the assumptions that are required to define the bending stress of beams. Provide sketches where necessary.
- (5 marks)
- (b) **Figure Q2(a)** shows a cross sectional diagram of a beam with its dimensions. The beam is subjected to a negative bending moment of 40 kNM, as given in **Figure Q2(b)**. To determine the maximum bending stresses of the beam, calculate.
- (i) Neutral axis of the beam, y'
- (7 marks)
- (ii) Moment of inertia about the z-axis, I_z
- (7 marks)
- (iii) Maximum tensile stress
- (3 marks)
- (iv) Maximum compressive stress
- (3 marks)
- Q3** (a) Explain the definition and importance of shear flow in a built-up member, with aided of relevance equations and sketches.
- (5 marks)

- (b) Based on the cross section given in **Figure Q3**.
- (i) Calculate \bar{y} and I_{x-x}
 - (ii) Identify the shear flow at B
 - (iii) Maximum spacing could be applied if the capacity of the nail is 450 N/nail.
- (20 marks)

- Q4** (a) Explain the buckling and torsion of a column. (5 marks)
- (b) **Figure Q4** shows a steel column that fixed at its bottom. The column is braced at its top by horizontal steel beam to prevent movement at top along x axis. If a pin support is considered at its top, determine the largest allowable load P that can be applied. Factor of safety for buckling = 3.0. Take $E_{stl} = 90 \text{ GPa}$, $\sigma_y = 250 \text{ MPa}$, $A = 7.5 \times 10^{-3} \text{ m}^2$, $I_x = 65 \times 10^{-6} \text{ m}^4$, $I_y = 23 \times 10^{-6} \text{ m}^4$. (10 marks)
- (c) A solid circular steel shaft of 2.0 m long transmits 400 kW at a speed of 400 rpm. If the allowable shearing stress is 80 MPa, the allowable angle of twist is 3° and the shear modulus of steel is 80 GPa. Determine:
- (i) The minimum permissible diameter of the shaft.
 - (ii) The speed at the same power that can be delivered if the shearing stress does not exceed 50 MPa in a diameter of 90 mm.
- (10 marks)

-END OF QUESTIONS-

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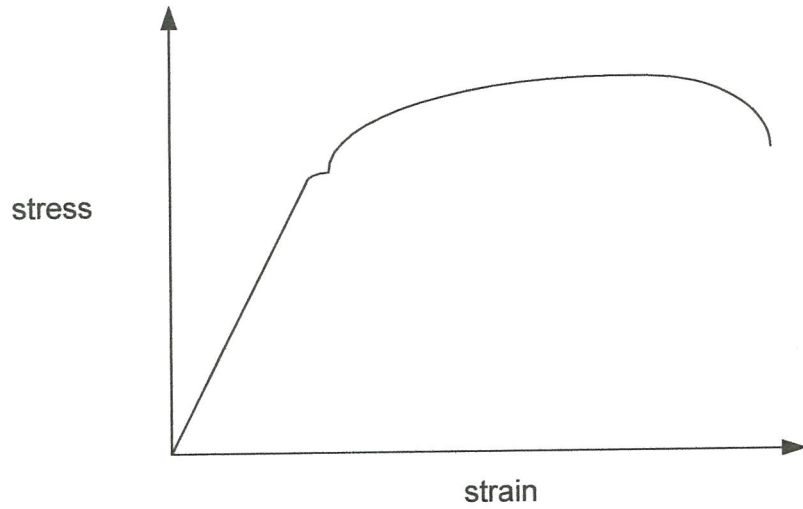


FIGURE Q1(a)

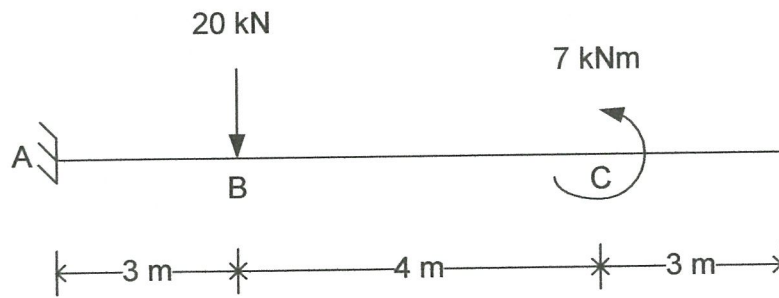


FIGURE Q1(b)

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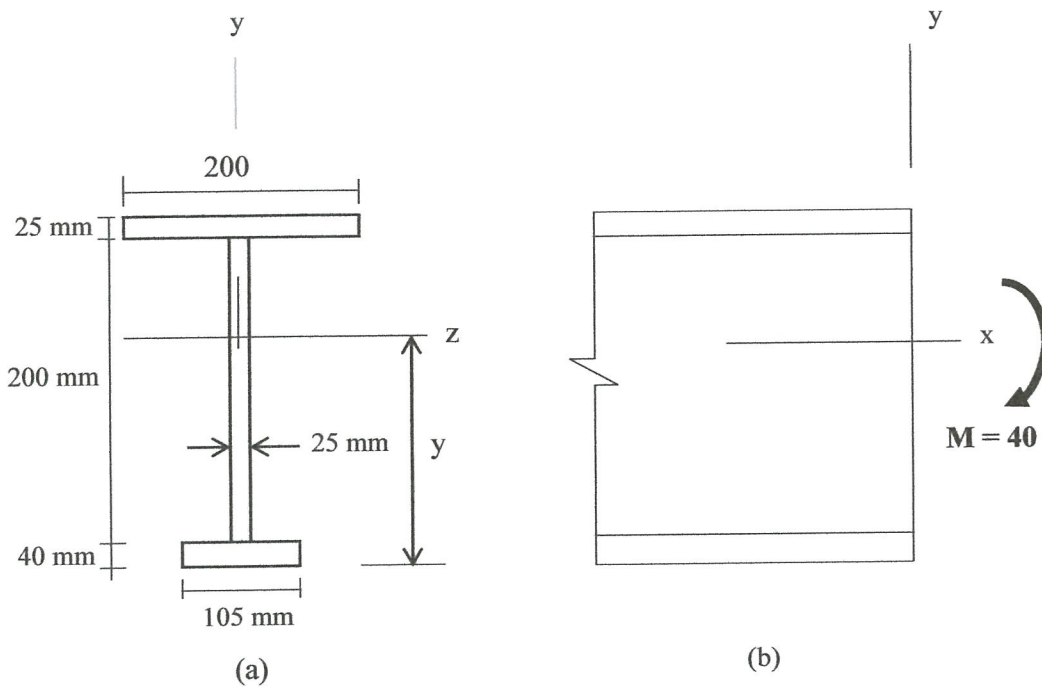


FIGURE Q2

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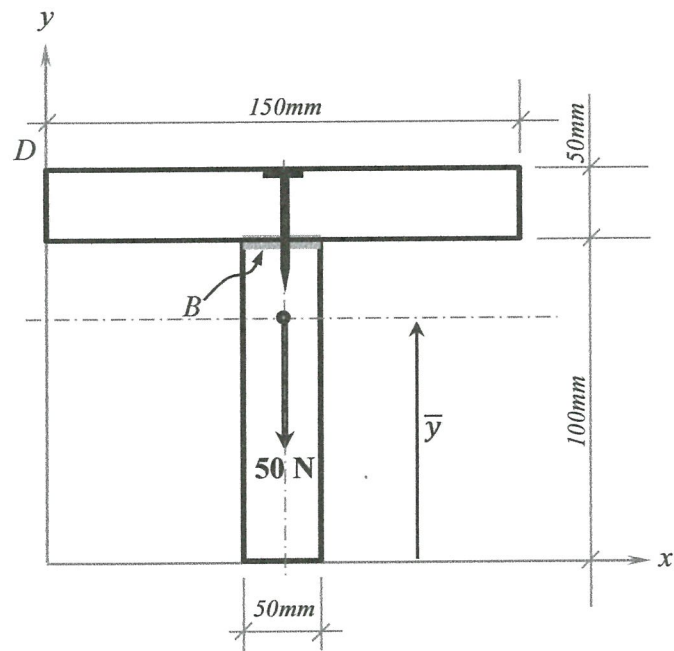


FIGURE Q3

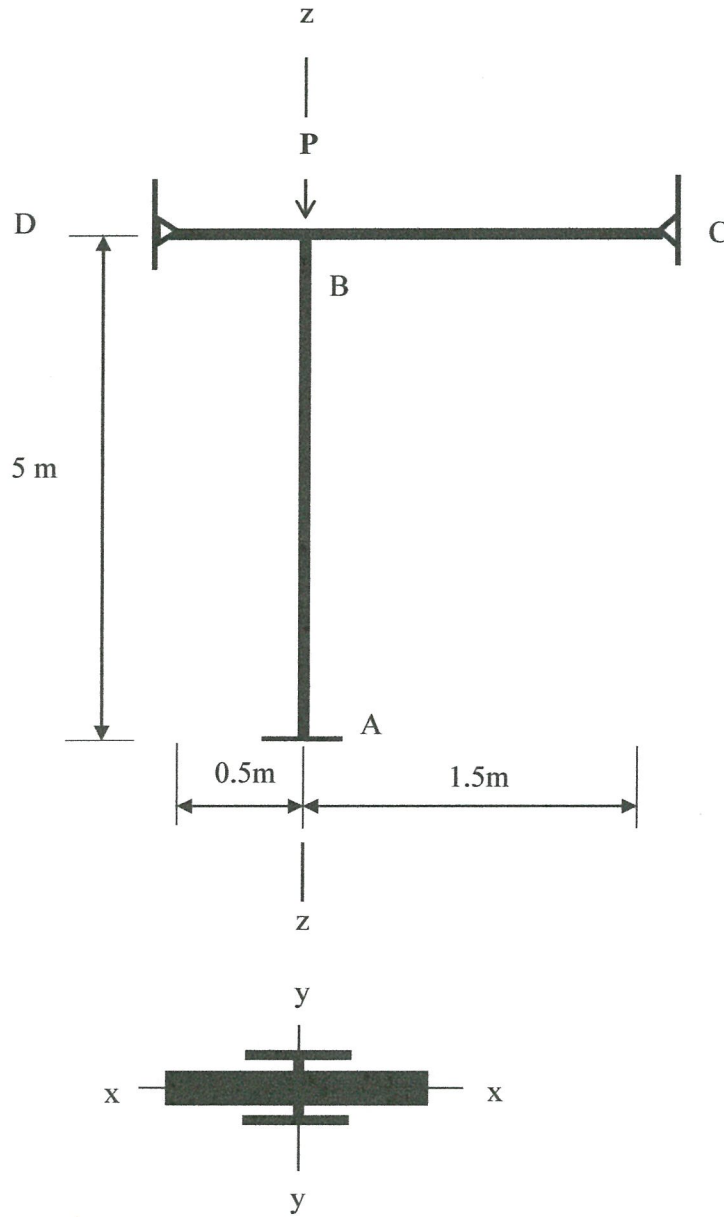
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Plan view

FIGURE Q4