



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS

ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2020/2021 ACADEMIC YEAR

**SECOND YEAR FIRST SEMESTER EXAMINATION FOR, BACHELOR OF
SCIENCE IN ELECTRICAL AND ELECTRIC ENGINEERING**

EES 201–SOLID AND STRUCTURAL MECHANICS

DURATION: 2 HOURS

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a) Differentiate between strain and stress induced in structure due to external loading (2 marks)
- b) Explain the following Three(3) types of stresses that are induced in mechanical structures when external loads are applied to them. (3 marks)
- Compression stress
 - Tensile stress
 - Shear stress
- c) Figure Q1(C) illustrates stress- strain curve for ductile materials .Name the points indicated on the graph and explain behaviour of material at the following portions as indicated on the curve in figure below. (6 marks)
- Portion OA
 - Portion CD
 - Portion DEF

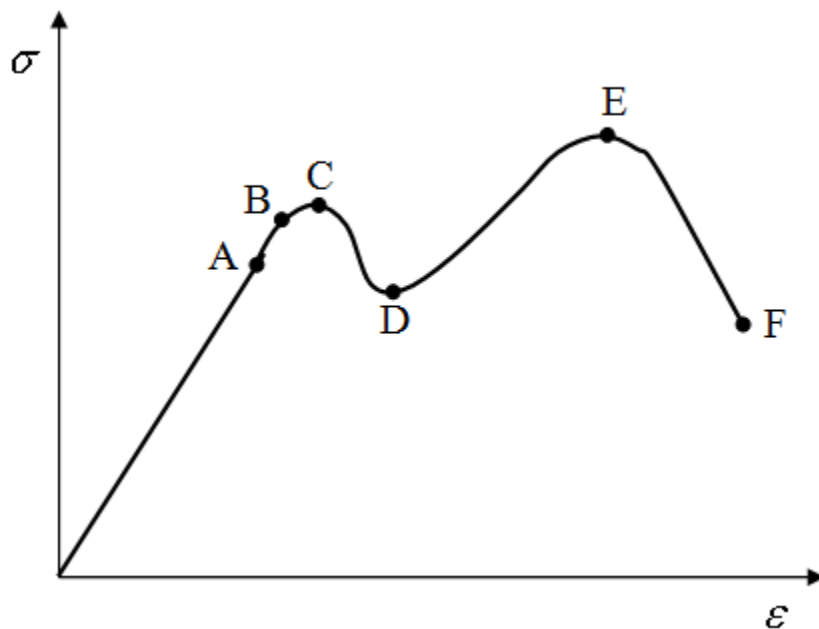


Figure Q1(C)

- d) A rod 1500mm long and diameter 20mm is subjected to an axial pull of 20 kN. Calculate the following if $E = 2 \times 10^5 \text{ N/mm}^2$ (5 marks)
- The stress
 - The strain
 - The elongation of the rod in mm
- e) A rectangular beam 10cm wide and 25cm deep is subjected to a maximum shear force of 50 kN. Determine: (7marks)
- Average shear stress
 - Maximum shear stress
 - Shear stress at a distance of 2.5 cm above the neutral axis
- f) Determine the reaction at support A and B for the overhanging beam subjected to the loading as shown in Figure Q1 (f) (7 marks)

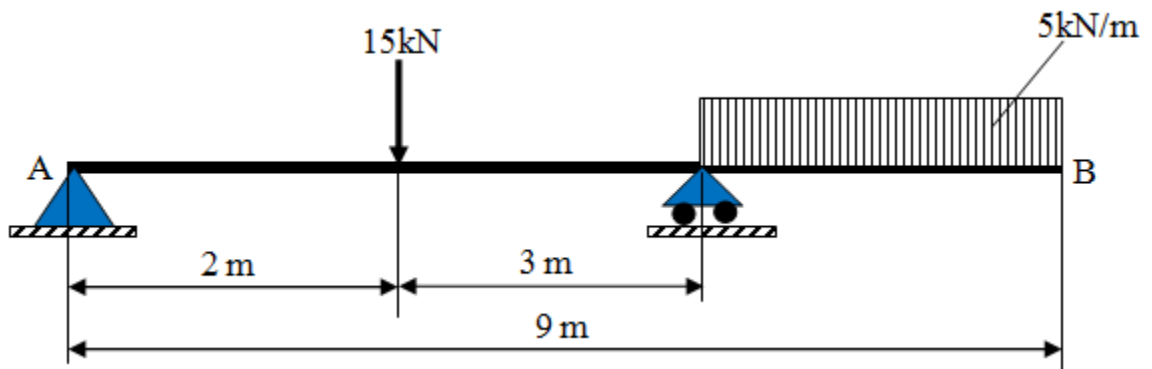


Figure Q1 (f)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

- Explain importance of shear force and bending moment diagrams (2 marks)
- With a well labelled diagram, illustrate the following types of supports and beams and also show the reaction directions at each support. (4 marks)
 - Pinned support
 - Roller support
 - Simply supported beam
 - Cantilever beam

c) Draw and determine shear force and bending moment diagrams for the beam shown in Figure Q2 (c),

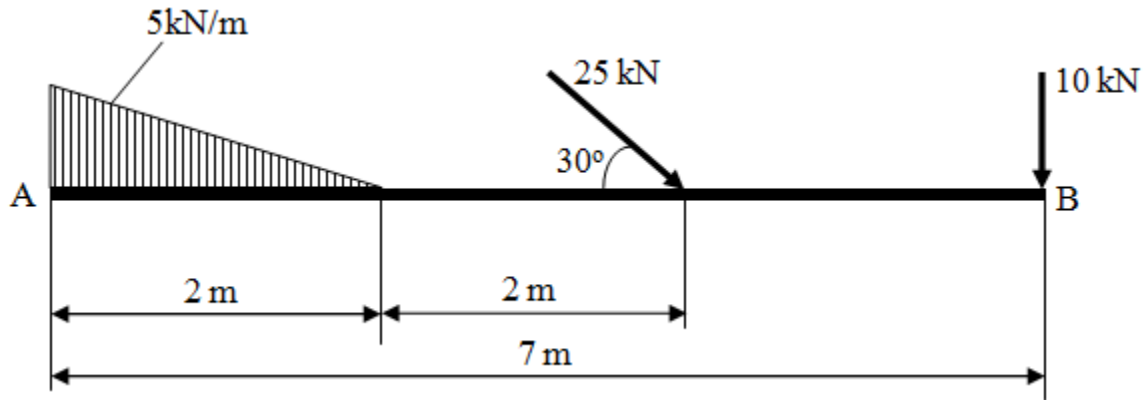


Figure Q2 (c),

QUESTION THREE (20 MARKS)

a) Explain what you understand by neutral axis on the bent beam (2 marks)

b) Using a clear diagram of an elastic beam, demonstrate the pure bending stress is given by the formula below.....

$$\sigma = \frac{E}{R} y$$

(6 marks)

c) A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress (Take $E = 2 \times 10^5 \text{ N/mm}^2$)

(6 marks)

d) An I-section steel beam has dimensions as shown in Figure Q3 (d), if the maximum allowable normal stress in the steel is 150 MPa. Determine the greatest bending moment the beam can support. (6 marks)

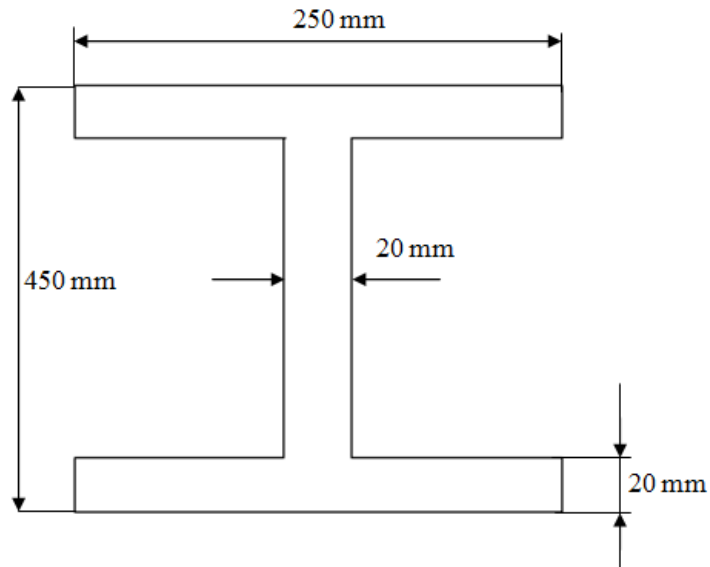


Figure Q3 (d)

QUESTION FOUR (20 MARKS)

- a) A wooden beam 140 mm wide and 240 mm deep has a span of 4 m. Determine the load that can be placed at its centre to cause the beam a deflection of 10 mm.

Take $E = 6 \text{ GPa}$

(8 marks)

- b) A thin cylinder 75 mm internal diameter 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MN/m^2
- Determine the change in internal diameter and the change in length (6 marks)
 - Determine hoop and longitudinal stress set-up in the thin cylinder (6 marks)