MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

TVET EXAMINATION

2023/2024 ACADEMIC YEAR

FIRST YEAR **FIRST** SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL ENGINEERING LEVEL 6

ENG/OS/CET/CC/3/06/A – PERFORM STRUCTURAL DESIGN AND ANALYSIS

DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer ALL questions in section A and any three in section B
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A (40 MARKS): ATTEMPT ALL QUESTIONS IN THIS SECTION

QUESTION ONE

Q1. Define the following terms (Use formulas where necessary) (5 marks)

a) Stress
b) Strain
c) Modulus of Elasticity (E)
d) Modulus of Rigidity (G)
e) Factor of safety

Q2. a) Explain four different types of stresses and indicate their symbols (use diagrams). (4 marks)

b) State Hook's Law (2 marks)

Q3. A wire of 6mm in diameter and 5 metres in length suspends a load of 100kg, if the extension of the wire is 2.5mm in length, calculate (7 marks)

a) The stress in the wire
b) The strain in the wire
c) The modulus of elasticity of the material of the wire

Q4. In tensile test of aluminium wire of diameter 10mm the ultimate stress at 20% proof stress was found to be$350N/mm^2$. Find (8 marks)

a) The area of the time
b) The ultimate force applied
c) The permissible working stress given the factor of safety as 25

Q5. Define the following terms (5 marks)

a) Centre of gravity
b) Centre of mass
c) Moment of area
d) Moment of inertia (also called second moment of area)

Q6. Define and explain the following terms (5 marks|)

a) Shear force
b) Bonding moments
c) Point load
d) Uniformly distributed load
e) Point of contraflecture

Q7. Explain the importance of the following point in design (4 marks)

a) The point of zero shear force on the shear force diagram
b) The point of contaflecture on the bonding moment diagram

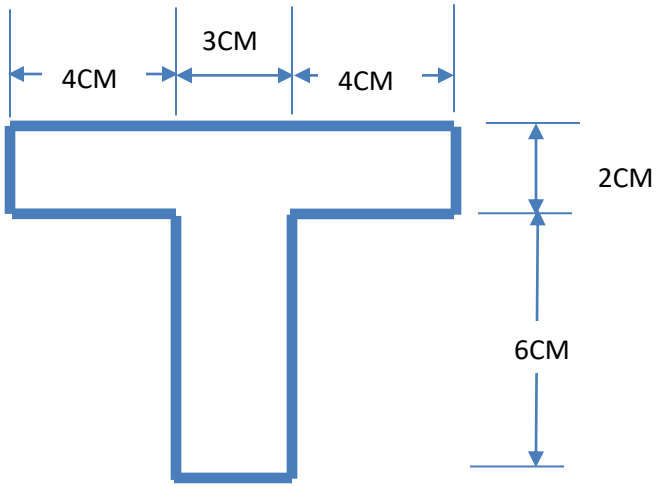
SECTION B (60 MARKS) ATTEMPT ANY THREE QUESTIONS FROM THIS SECTION

Q8.

a) A rectangular beam 300mm deep and 200mm wide is simply supported over a span of 8m. Calculate the maximum uniformly distributed load the beam can carry of the bonding stress is not to exceed $120N/mm^2$ in both tension and compression. (10 marks)

b) A beam is simply supported and earns a uniformly distributed load of 40KN/m run over the whole span the section of the beam is rectangular having a depth of 500mm, if the maximum stress in the material of the beam is $120N/mm^2$ and the moment of inertia of the section is $7X10^8 mm^4$, find the span of the beam. (10 marks)

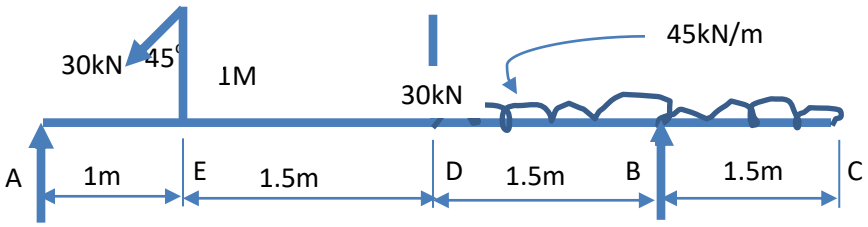
Q9. For the figure 1 shown below, calculate



a) Centre of gravity (5 marks)
b) The moment of inertia about the x-x axis passing through the base (5 marks)
c) The moment of inertia about the y-y axis passing through the left of the figure (5 marks)
d) The moment of inertia about the centre of gravity passing on the x-x axis (5 marks)

Q10. The figure 2 below shows a beam supported at A and B and with a point loads of 30KN a point D and a uniformly distributed load of 45KN/m between points D and C. At E a rigid bar 1m in length holds a force 30KN at an angle of 45^0 to the vertical. Calculate

a) Reaction at A and B (5 marks)
b) Draw a shear force diagram (7 marks)
c) Draw s bending moment diagram (8 marks)



Q11. A flitched beam as shown in figure 3 below consists of a wooden joist 100mm wide and 200mm deep strengthened by two steel flitches 10mm thick and 200mm deep on the side as shown below. If the maximum stress in the wooden joints is $7N/mm^2$. Find:

a) The corresponding maximum stress attained in steel (10 marks)

b) Moment of resistance of the composite section Take modulus of elasticity of steel as $E_s = 2x10^5$ kN/mm^{2}Take modulus elasticity of timber $E_w = 1x10^4$ kN/mm^2 . (10 marks)

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