MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

SECOND YEAR **SECOND** SEMESTER EXAMINATION FOR BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

EMT 209 – SOLID AND STRUCTURAL MECHANICS II

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. A composite ban is built by attaching 5mm thick steel plates to the vertical sides of a 150mm wide by 250 mm deep timber beam. The beam is to be simply supported over a span, L while supporting 20KN point load applied at mid-span. If the modular ratio is 20, and the maximum stress allowed in the steel is 180 mPa, calculate the allowed value of L. (9marks)

b. A thick walled cylinder with closed ends has an internal diameter of 130 mm. It is required to carry an internal pressure of 90mPa. The maximum direct stress allowed in two materials is 250mPa. Determine the required external diameter. (6marks)

c. A simply supported beam has a constant flexural stiffness E1 = 1.2 x 10^7 Nm^2. It is loaded with a uniformly distributed load of intensity 5 KN/m over a span of 8m. Calculate the maximum deflection showing clearly how you arrive at your answer. (10marks)

d. A tube made of aluminium (E = 70Gpa) has an external diameter of 80mm. a 5m length of the tube supports a centric compressive load of 70KN.If the tube is fixed at both ends, calculate the required internal diameter. (5marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

Draw the shear force and bending moment diagrams for a beam supported and loaded as shown in figure Q2. (20marks)

QUESTION THREE (20 MARKS)

A T-section beam with the dimensions shown in figure Q3 is loaded by a series of loads. The highest negative binding moment is -62KNm and occurs at point B along the beam. The highest positive bending moment is 50KNm and occurs at point D along the beam. Determine the highest tensile and compressive stresses induced in the beam. Specify where each maximum occurs by stating the point along the beam, as well as the position on the beam cross section.

QUESTION FOUR (20 MARKS)

a. Derive an expression for the critical load in a street fixed at one end and pinned at the other end. (10marks)

b. In the arrangement shown in figure Q4, AB is a square. Steel (E = 200 GPa) tube in which the internal dimension, Determine the minimum value of a ……. prevent buckling. (10marks)