(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITRY REGULAR EXAMINATIONS 2022/2023 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 213

COURSE TITLE: STRENGTH OF MATERIALS

DATE: 5TH DECEMBER **TIME:** 3 – 5 P.M

INSTRUCTIONS:

1. This paper contains Four questions
2. Answer question **One** and any **other two**
3. Marks for each question are indicated in the parenthesis.
4. Examination duration is 2 **Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE – Compulsory (30 Marks)

a) Define the parallel axis theorem as used in strength of engineering materials. (2 Marks)
b) Derive an expression for stresses in bars of different materials arranged in parallel to support a load. (4 Marks)
c) Describe any three theories on engineering material failure (6 Marks)
d) At a point in a material, an element is subjected to two dimensional normal stresses at right angle to each other and shear stresses. From first principles find an expression for normal and shear stress on a plane inclined at an angle to one of the axis. (6 Marks)
e) Define Poisson's ratio and Bulk Modulus as used in strength of engineering materials (4 Marks)
f) Explain with aid of sketches, circumferential and longitudinal stresses in thin walled pressure vessels. Show that the longitudinal stress is half the circumferential stress. (4 Marks)
g) Two shafts having same length and material are joined in series to support a torque. If the ratio of their diameters is 2, what is the ratio of their shear stresses (4 Marks)

QUESTION TWO (20 Marks)

A beam is made of a timber section strengthened by securely bolting it to steel section as shown in Figure Q2. If a moment of 50kNm is applied about the horizontal centroidal axis, determine a) the maximum bending stress in the timber and steel. The modula ratio E_{steel}/E_{timber} is 20. (20 Marks)

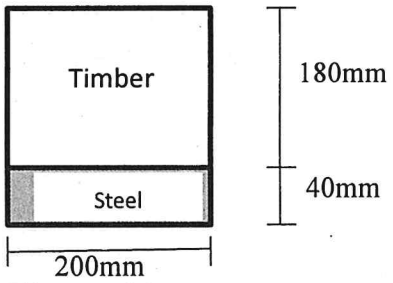

Figure: Q2

QUESTION THREE (20 Marks)

A steel bar 500mm long and 70mm in diameter is placed inside an aluminium tube having 75mm inside diameter and 100mm outside diameter. The aluminium is 0.15mm longer than the steel bar. An axial load of 600kN is applied to the bar through a rigid cover plate as shown in Figure Q3. Determine the stresses developed in the steel and aluminium tube. Modulus of Elasticity for steel is 200kN/mm2 and that of aluminium is 70kN/mm2.

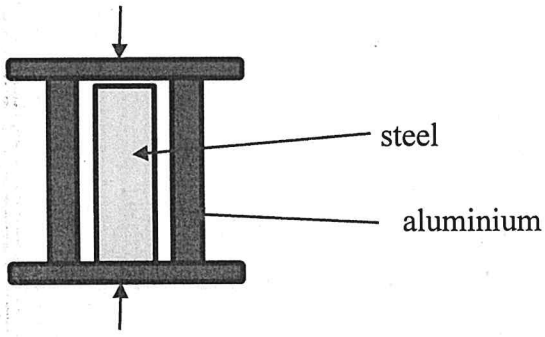

Figure Q3

QUESTION FOUR

A beam of cross section shown in Figure Q4 is subjected to a transverse shearing force of 500kN. Sketch the shear stress distribution across the section, showing the peak values. (20 Marks)

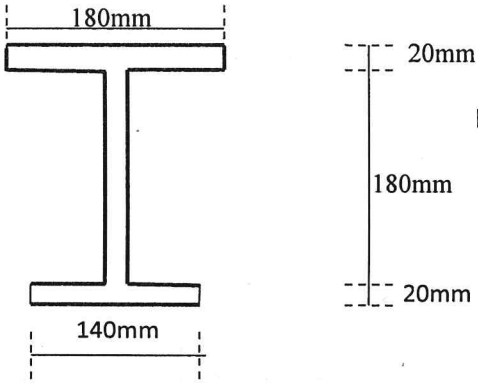

Figure Q4