



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY REGULAR EXAMINATIONS
2023/2024 ACADEMIC YEAR**

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL
ENGINEERING/BACHELOR OF TECHNOLOGY IN BUILDING
CONSTRUCTION/BACHELOR OF TECHNOLOGY
EDUCATION (BUILDING**

COURSE CODE: CSE 213

COURSE TITLE: STRENGTH OF MATERIALS

DATE: 6TH DECEMBER 2023

TIME: 8 A.M – 10 A.M

INSTRUCTIONS:

1. This paper contains FOUR questions
2. Answer question ONE and any other two questions
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.

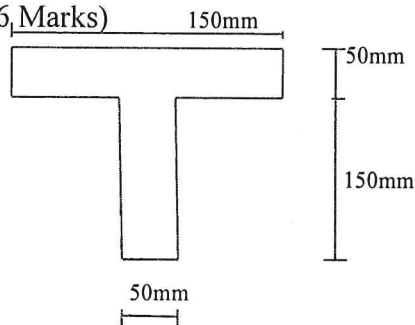
QUESTION ONE (Compulsory) (30 Marks)

- (a) Find an expression relating Bulk modulus, Young's modulus and Poisson's ratio for an element subjected to uniform pressure in all directions. Explain all steps. (10Marks)
- (b) Describe the terms 'slip' and 'creep' as used in explaining engineering material behavior. (5 Marks)
- (c) A tensile specimen has a diameter of 12.5mm. The increase in length recorded by the longitudinal gauge for a load of 50kN is 0.25mm for an original length of 50mm. The decrease in width as measured by the lateral gauge is 0.015. What is the: -
 - i) Modulus of elasticity (3 Marks)
 - iii) Poisson's ratio (2 Marks)
- (d)) Derive, explaining all steps, an expression relating length, L , radius, R , shear stress, τ , angle of twist, θ for a shaft subjected to a Torque, T . (10 Marks)

QUESTION TWO: 20 MARKS

A beam with T-section (50mm x150mm web and 150mm x 50mm flange) as shown is subjected to a maximum shear force of 50kN.

- a) Determine the maximum shearing stress at this section. (8 Marks)
- b) Sketch the distribution of shear stresses, indicating the peak values, from top to bottom of the cross-section. (6 Marks)
- c) What will be the bending stresses at the extreme fibres if a bending moment of 8kNm is applied at the section. (6 Marks)



QUESTION THREE: 20 MARKS

A short vertical column consists of a rectangular section 150mm x 100mm. A bracket attached to the 150mm face of the column carries a vertical load whose line of action is at an offset 75mm from the face and on the centerline of the section.

- a) Determine the maximum value of the load if the tensile stress induced in the section is not to exceed 30N/mm² (15 marks)
- b) Calculate the corresponding compressive stress. (5 Marks)

QUESTION FOUR: 20 MARKS

A steel tube of 35mm outer diameter and 30mm inner diameter encloses a metal rod of 25mm diameter and they are rigidly joined at each end.

- a) If the temperature of the assembly is raised by 60°C and there is no initial stress, determine the stress developed in the rod and tube. (15 marks)
- b) Determine the increase in length if the original length of the assembly is 1m. (5 marks)

Modulus of elasticity for steel = 205KN/mm²
Modulus of elasticity for rod = 90KN/mm²
Coefficient of expansion for steel = $11 \times 10^{-6}/^{\circ}\text{C}$
Coefficient of expansion for the rod = $18 \times 10^{-6}/^{\circ}\text{C}$

