MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

BUILDING AND CIVIL ENGINEERING DEPARTMENT

FIRST YEAR FIRST TERM EXAMINATION FOR

DIPLOMA IN BUILDING TECHNOLOGY AND CIVIL ENGINEERING

STRUCTURES 1

DATE: **TIME:**

INSTRUCTIONS: ANSWER ALL THE FIVE QUESTIONS

QUESTION ONE (20 MARKS)

a) Define the following terms as used in construction of materials
   (i) Elasticity
   (ii) Young's modulus of elasticity
   (iii) Modulus of rigidity
   (iv) Poison's ratio
   (v) Elastic limit (10 marks)

b) Sketch the stress -strain curve of mild steel indicating all the points of the curve (10 marks)

QUESTION TWO (20 MARKS)

a) Describe a composite bar giving two examples (4 marks)

b) State hooke's law (2 marks)

c) With the aid of a diagram, explain the four types of loads on structural elements (14 marks)

QUESTION THREE (20 MARKS)

a) **Figure 1** shows a composite material .If a tensile force F is applied at the two ends, derive the

(i) Compatibility equation
(ii) Equilibrium equation (12 marks)

b) With the aid of a diagram, describe the four types of supports to beams (8 marks)

QUESTION FOUR (20 MARKS)

a) **Figure 2** shows a longitudinal section through a steel bar of varying sections. If a compressive force of 300KN is applied to the bar, calculate:

(i) Stress in each section
(ii) Total change in length of the section (12 marks)

b) A steel rod of 3cm diameter and 5cm long is connected to two grips and the rod is maintained at a temperature of 95^{o}c.Determine the stress and pull exerted when the temperature falls to 30^{o}c,if

(i) The ends do not yield
(ii) The ends yields by 0.12cm (8 marks)

QUESTION FIVE (20 MARKS)

a) Distinguish between the following, giving due explanation

(i) Stress and strain
(ii) Force and stress
(iii) Tensile stress and compressive stress (12 marks)

b) The ultimate stress, for a hollow steel column which carries an axial load of 1.9 MN is 480 N/mm^2.If the external diameter of the column is 200mm, determine the internal diameter. Take factor of safety as 4. (8 marks)