TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

TCV 4215: SOLID &STRUCTURAL MECHANICS I

EMG 2303: SOLID &STRUCTURAL ENGINEERING I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: Pick Date Sep 2018

Instructions to Candidates
You should have the following for this examination
  -*Answer Booklet, examination pass and student ID*
This paper consists of **FIVE** questions. Attempt Choose instruction.
Do not write on the question paper.

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Question ONE

A rod consists of two parts that are made of steel and copper as shown in figure below. The elastic modulus and coefficient of thermal expansion for steel are 200 GPa and 11.7×10^{-6} per °C respectively and for copper 70 GPa and 21.6×10^{-6} per °C respectively. If the temperature of the rod is raised by 50°C, determine the forces and stresses acting on the rod.
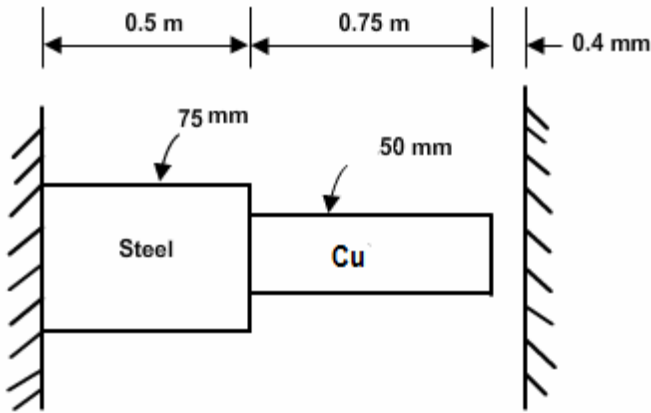
Question TWO

a) **W**ith the aid of diagrams represent the following stress – strain responses.

  i)Linear elastic

  ii) Linear Elastic- perfectly plastic

  iii)Linear elastic- hardening plastic

b) A 10 mm diameter tensile specimen has a 50 mm gauge length. The load corresponding to the 0.2% offset is 55 kN and the maximum load is 70 kN. Fracture occurs at 60 kN. The diameter after fracture is 8 mm and the gauge length at fracture is 65 mm. Calculate the following properties of the material from the tension test.
 (i) % Elongation
  (ii) Reduction of Area (RA) %
  (iii) Tensile strength or ultimate tensile strength (UTS)
  (iv) Yield strength
  (v) Fracture strength
  (vi) If E = 200 GPa, the elastic recoverable strain at maximum load

Question Three

  a) A bar having a cross-sectional area of 700mm^2 is subjected to axial loads at the positions indicated. Determine the value of stress in the Three segments.
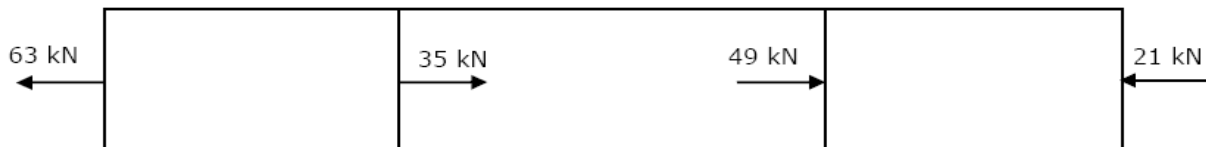
b) A solid circular rod AB of diameter D and length L is fixed at both ends. A torque T is applied at a section X such that AX = L/4 and BX = 3L/4. What is the maximum shear stress developed in the rod?
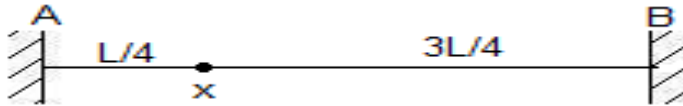
Question Four

a) If a load of 60 kN is applied to a rigid bar suspended by 3 wires as shown in the figure below what force will be resisted by each wire? The outside wires are of Al, cross sectional area 300 mm^2 and length 4 m. The central wire
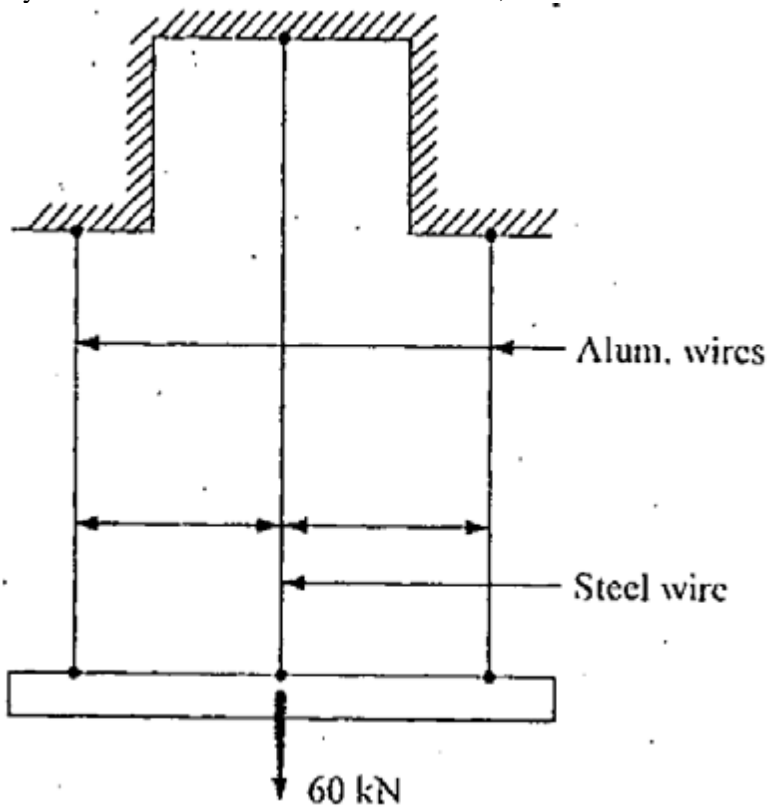
b) Consider the following statements.

1. There are only two independent elastic constants.
2. Elastic constants are different in orthogonal directions.
3. Material properties are same everywhere.
4. Elastic constants are same in all loading directions.

5. The material has ability to withstand shock loading.
Which of the above statements are true for a linearly elastic, homogeneous and isotropic material?

Question Five

Figure Q4 shows the shear force diagram of a loaded beam. Find the loading on the beam and draw the bending moment diagram.