TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

INSTITUTION BASED

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

EMG 2303 : SOLID & STRUCTURAL MECHANICS I

TCV 4215 : SOLID & STRUCTURAL MECHANICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2017

TIME: 2 HOURS

DATE: Pick Date Apr 2017

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 any THREE questions.

Do not write on the question paper.

Question ONE

A rod consists of two parts, that are made of copper and steel as shown in the figure below, FigQ1.The elastic modulus and the coefficient of thermal expansion for copper is 70GPa and 21.6 $x10^{-6}$ per ^{0} C and for steel 200GPa and 11.7 x 10^{-6} per ^{0} C respectively. If the temperature of the rod is raised by 50^0 C, Determine the forces and stresses acting on the rod. (20 marks)

Question TWO

A simply supported beam is loaded as shown below in FigureQ 2. Analyze and draw both the bending moment diagram and shear force diagrams. Locate the points of contraflexure if any. Determine the position and value of the maximum bending moment. (20 marks)

Question THREE

a) In a torsion test the specimen is a hollow shaft with 50 mm external diameter and 30 mm internal diameter. An applied torque of 1.6kNm is found to produce an angular twist of 0.4 ^{0} measured on a length of 0.2 m of the shaft. The Young's modulus of elasticity obtained from the tensile test was 200GPa.Find the values of

i)Modulus of rigidity

ii)Poisson's ratio. (13 marks)

b) Steel shaft and brass shaft of same length and diameter are connected by a flange coupling. The assembly is rigidly held at its ends and is then twisted by a torque through the coupling. G_{steel} =2 x G_{brass}. If torque of the steel shaft is 500Nm, then determine the torque in the brass shaft. (7 marks)

Question FOUR

A cylindrical shell has the following dimensions:

Length = 3 m

Inside diameter = 1 m

Thickness of metal = 10mm

Internal Pressure = 1.5 MPa

Calculate the change in dimensions of the shell and the maximum intensity of the shear stress induced. Take E = 200GPa, Poisson's ratio = 0.3 also Shear stress $= \frac{\sigma_2 - \sigma_1}{2}$ (20 marks)

Question FIVE

a) An aluminium bar 3 m long and 2500 mm^2 in cross-section is rigidly fixed at A and D as shown in FigQ5. Determine the loads shared and stresses in each portion and the distances through which the points B and C will move. Take E for the aluminium as 80 GPa. (20 marks)