TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

BACHELOR OF SCIENCE IN MEDICAL ENGINEERING

EMG 2303 : SOLID &STRUCTURAL MECHANICS I

EME 4354 : SOLID &STRUCTURAL MECHANICS

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: Pick Date Dec 2016

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

An alloy bar of 1 m has a Square section throughout , which tapers from one end of 10 mm x 10 mm to the other end of 20 mm x 20mm.Find the change in its length due to an axial tensile load of 30 kN. Take E for the alloy as 120GPa.

Question TWO

FigureQ2 shows the shear force diagram of a loaded beam. Determine the loading on the beam and draw the bending moment diagram.

Question THREE

A solid shaft of 200mm diameter has the same cross-sectional area as a hollow shaft of the same material with inside diameter of 150 mm. Find the ratio of:

a) power transmitted by both the shafts at the same angular velocity.

b) angles of twist in equal lengths of these shafts, when stressed to the same intensity..

Question FOUR

a) Show that the volumetric strain, $\in_v$, of a vessel under internal pressure is given by:

$$\in_v = 2\ \in_l + \in_c$$

Where $\in_c = hoop\ strain$

$$\in_l = axial\ strain$$

b) A steel container 2m internal diameter and5m long is initially full of water. Determine the volume of water required to raise the pressure inside by 15 x 10^6 N/m^2 , if the ratio of thickness to diameter is 1/15.

Take K for water = 2.1 x 10^9 N/m^2

E for steel = 210 x 10^9 N/m^2

And $\vartheta\ for\ steel = 0.3$.

Question FIVE

A composite bar made up of an aluminium bar and a steel bar is firmly held between two unyielding supports as shown in figQ5.An axial load of 200kN is applied at B at 320 K. Find the stresses in each material when the temperature is

370 K.

Take $\propto_{alumium} = 24\ X\ 10^{-6}\ /K$. $\propto_{steel} = 12\ X\ 10^{-6}\ /K$ $E_{aluminium} = 70\ GPa$ $E_{steel} = 210\ GPa$

Fig Q2.

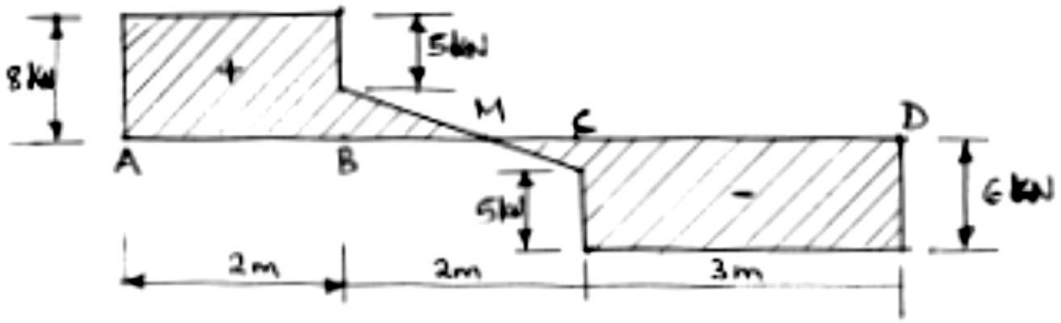
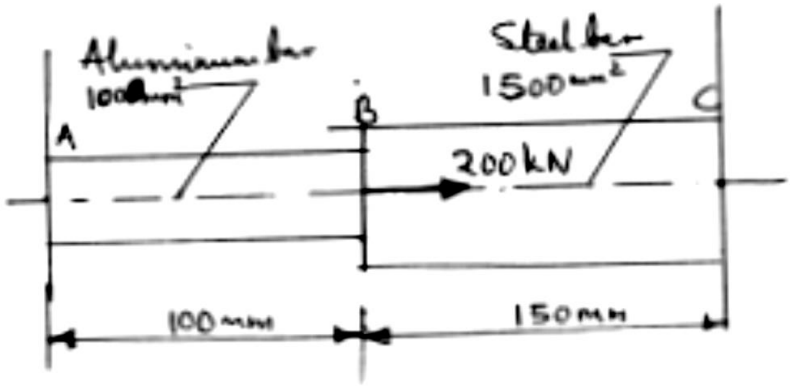

8kN
5kN
M
A
B
C
D
5kN
6kN
2m
2m
3m

Fig Q 5


Aluminium bar
Steel bar
1500 mm²
A
B
C
200 kN
100 mm
150 mm