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 Choose instruction.

Do not write on the question paper.

Question ONE

a)Two solid cylindrical rods AB and BC are welded together at B as shown in FigQ1 below. Knowing that $d_{1=}$ 30 mm and $d_{2=}$ 50 mm , find the average normal stress in the mid-section of

i) rod AB and ii) rod BC.

b) A rigidly fixed circular bar 1.75 m long uniformly tapers from 125 mm diameter at one end to 100 mm diameter diameter at the other. If the maximum stress in the bar is not to exceed 108 MPa, find the temperature through which it can be heated. Take E and α for the bar material as 100GPa and 18 X 10^{-6}/K respectively.

Question TWO

A simply supported beam is loaded as shown below in FigureQ 2. Analyse and draw both the bending moment diagram and shear force diagrams. Locate the points of contraflexure if any.

Question THREE

A shaft ABC of 500 mm length and 40 mm external diameter is bored, for a part of its length AB to a 20 mmm diameter and for the remaining length BC to a 30 mm diameter bore as shown in figQ3. If the shear stress is not to exceed 80 MPa, find the maximum power, the shaft can transmit at a speed of 200 RPM.

If the angle of twist in the length of 20 mmm diameter bore is equal to that in the 30 mm diameter bore, find the length of the shaft that has been bored to 20 mmm and 30 mm diameter.

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 and 3m long is initially full of water. Determine the volume of water required to raise the pressure inside by 10 x 10^6 N/m^2 , if the ratio of thickness to diameter is 1/20.

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) A round tapered alloy bar 4 m long is subjected to load as shown in FigureQ5 below.

Find the change in length of the bar. Take E for the bar material as 120 GPa.

FIGURES

Fig Q 1

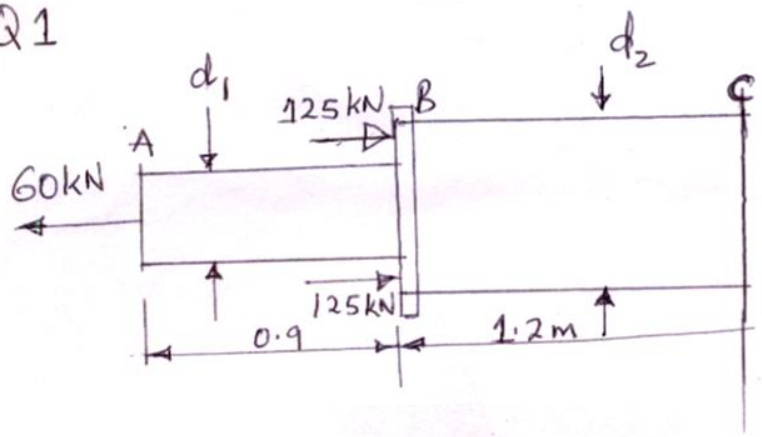

Fig Q2

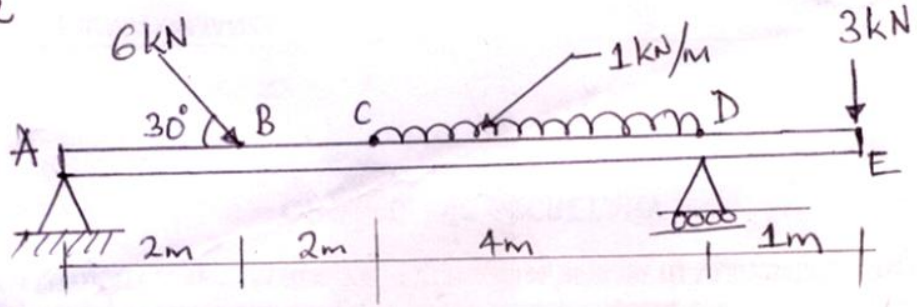

Fig Q3

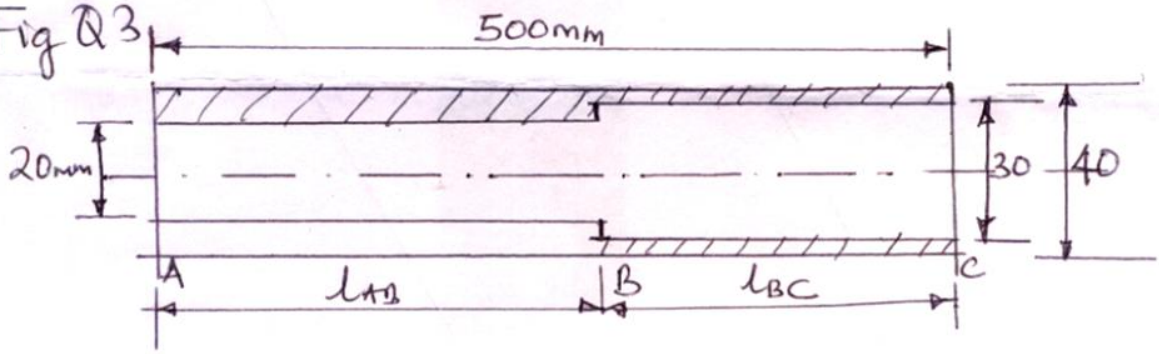

Fig Q5