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 TECHNOLOGY IN MECHANICAL ENGINEERING

EMG 2309: SOLID &STRUCTURAL MECHANICS II

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2017

TIME: 2 HOURS

DATE: Pick Date Aug 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 simply supported beam carrying a uniformly distributed load has a T-section as shown in Figure Q1. If the limiting stresses for the material of the beam are 80 MN/m^2 in compression and 160 MN/m^2 in tension, find the maximum intensity of the udl that the beam can carry over a span of 5m.

(20 marks)

Question TWO

a) Show that when a beam with an initially straight longitudinal axis is loaded by lateral forces, the axis is deformed into a deflection curve given by

$$EI\frac{dy^2}{dx^2} = M$$ y= deflection, and M = bending moment

(10 marks)

b) Working from the Moment-area method, show that for a simply supported beam carrying a uniformly distributed load, w

Maximum slope, $\theta = \frac{wl^3}{24EI}$ and maximum deflection $\delta = \frac{5wl^4}{384EI}$

(10 marks)

Where **w**, **l**, **E** and **I** have the usual meaning.

Question THREE

A simply supported beam made of rolled steel joist (I-section: 450mm × 200mm) has a span of 5 m and it carries a central concentrated load W, FigureQ3. The flanges are strengthened by two 300mm × 20mm plates, one riveted to each flange over the entire length of the flanges. The second moment of area of the joist about the principal bending axis is 35060 cm^4 . Calculate

i) The greatest central load the beam will carry if the bending stress in the 300mm/20mm plates is not to exceed 125 MPa.

(ii) The minimum length of the 300 mm plates required to restrict the maximum bending stress in the flanges of the joist to 125 MPa.

(20 marks)

Question FOUR

a) Show that for a rectangular section beam, the maximum shear stress distribution ,τ is given by

$$\tau = \frac{3Q}{2bd}$$ where Q = shear force, b and d are the breadth and depth respectively

(13 marks)

b) Sketch the shear stress distribution.
(7 marks)

Question FIVE

A beam of rectangular cross-section 50 mm wide and 100 mm deep is simply supported over a span of 1500 mm. It carries a concentrated load of 50 kN, 500 mm from the left support. Calculate

a) The maximum tensile stress in the beam and indicate where it occurs

(b) The vertical deflection of the beam at a point 500 mm from the right support. E for the material of the beam = 2 × 105MPa.

(20 marks)