



MACHAKOS UNIVERSITY

University Examination 2019/2020

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 203: STRENGTH OF MATERIALS I

DATE:18/12/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

- a) State five types of loads in structures (5 marks)
- b) A wooden beam 100mm wide and 150mm deep is simply supported over a span of 4m. If shear force at a section of the beam is 4500N, find the shear stress at a distance 25mm above the neutral axis. (5 marks)
- c) A timber beam of rectangular section is simply supported at the ends and carries a point load at the centre of the beam. The maximum bending stress is 12N/mm^2 and maximum shearing stress is 1 N/mm^2 . Find ratio of the span to the depth (7 marks)
- d) A rectangular bar of cross-sectional area $10,000\text{ mm}^2$ is subjected to an axial load of 20KN. Determine the normal and shear stresses on a section which is inclined at an angle of 30° with normal cross-section of the bar. (6 marks)
- e) The ultimate stress for a hollow steel column which carries an axial load of 1.9MN is 480N/mm^2 . If the external diameter of the column is 200mm, determine the internal diameter. Take factor of safety as 4 (5 marks)

QUESTION TWO (20 MARKS)

a) A tensile test was conducted on a mild steel bar. The following data was obtained from the test;

- i. Diameter of steel bar-3cm
- ii. Gauge length of the bar- 20cm
- iii. Load at elastic limit 250KN
- iv. Extension at a load of 150 KN- 0.21mm
- v. Maximum load -380KN
- vi. Total extension-60mm
- vii. Diameter of the rod at failure- 2.25 cm

Determine

- i. Youngs modulus
- ii. Stress at elastic limit
- iii. Percentage elongation
- iv. Percentage decrease in area (10 marks)

b) An axial pull of 35,000N is acting on a bar consisting of three lengths as shown in fig.1. if $E=2.1 \times 10^5 \text{ N/mm}^2$, determine;

- i. Total stress in each section
- ii. Total extension of the bar (10 marks)

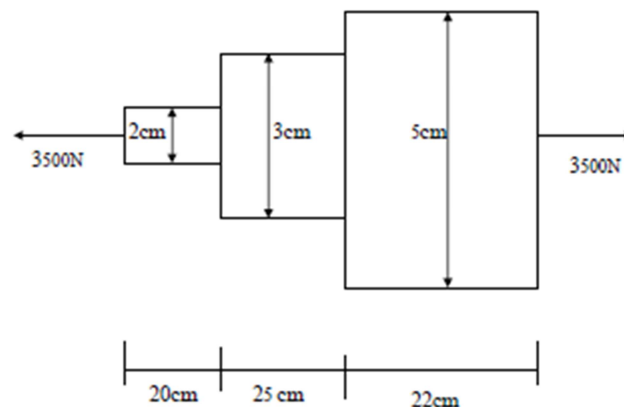


Fig 1

QUESTION THREE (20 MARKS)

Given major principal tensile stress as 200N/mm^2 , minor principal compressive stress as 100N/mm^2 and an angle made by oblique plane as 30° , determine the resultant stress and maximum shear stress by mohrs circle

QUESTION FOUR (20 MARKS)

A timber beam of rectangular section is used to support a load of 20KN uniformly distributed over a span of 3.6m when the beam is simply supported. If the depth section is to be twice the breadth, and stress in the timber is not to exceed 7N/mm^2 , find the dimensions of the cross-section when the uniformly distributed load is spread across the entire section and when point load is at the centre

QUESTION FIVE (20 MARKS)

- a) A simply supported wooden beam of span 1.3m having a cross-section 150mm wide by 250mm deep carries a point load W at the centre. The permissible stresses are 7N/mm^2 in bending and 1N/mm^2 in shearing. Calculate the safe load W. (10 marks)
- b) A circular beam of 100mm diameter is subjected to a shear force of 5KN. Calculate;
- Average shear stress
 - Maximum shear stress
 - Shear stress at a distance of 40mm from neutral axis (10 marks)