



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIRST YEAR SECOND TERM EXAMINATION FOR

DIPLOMA IN CIVIL ENGINEERING MODULE I

2707 / 103 ST: STRUCTURES I

DATE: 26/04/2019

TIME: 8:30 – 11:30am

INSTRUCTIONS:

- This paper consists of **Five** questions.
- Answer **All** questions.
- All questions carry equal marks.
- Maximum marks for each part of the question are as shown.

QUESTION ONE (20 MARKS)

A beam is loaded as shown in figure 1.

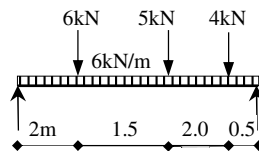


Fig. 1

- Draw the shear force and bending moment diagrams
- Determine the position of the maximum sagging bending moment
- Calculate the maximum sagging bending moment

QUESTION TWO (20 MARKS)

Figure 2 shows the cross section of a structural member.

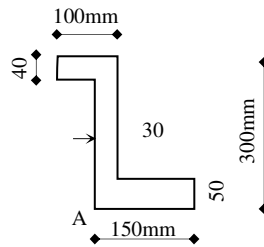


Fig. 2

- Determine the position of the centroid.
- Calculate the values of I_{xx} and I_{yy}
- Calculate the values of r_{xx} and r_{yy}
- Calculate the section moduli Z_{xx} and Z_{yy} about the bottom left corner A. (20 marks)

QUESTION THREE (20 MARKS)

- State **Five** assumptions made in the theory of simple bending. (5 marks)
- A timber beam 150 X 300mm deep is reinforced with two 125 X12mm thick steel plates bolted firmly along each edge as shown in figure 3. The safe stress in the steel is 140N/mm^2 and that in timber is 7N/mm^2 . Calculate the moment of resistance of the beam.
 $E_s = 205\text{kN/mm}^2$; $E_t = 8.2\text{kN/mm}^2$ (15 marks)

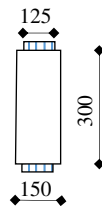


Fig. 3

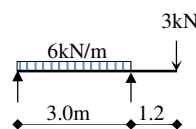


Fig. 4

QUESTION FOUR (20 MARKS)

A timber beam having a rectangular cross section 240 X 85mm wide is loaded as shown in figure 4. Determine the following:

- The maximum bending stress in the beam
- The bending stress in the beam at a point 0.2m to the left of point B and 30mm below the upper edge of the section. (20 marks)

QUESTION FIVE (20 MARKS)

Figure 5 shows the cross section of a beam carrying a uniformly distributed load over a span of 3.6m.

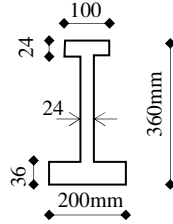


Fig. 5

- Calculate the position of the neutral axis
- Determine I_{xx}
- Determine the values of Z_{xx}
- Calculate the safe uniformly distributed load that the beam can carry if the tensile stress is not to exceed 20N/mm^2 and the compressive stress 100N/mm^2 . (20 marks)