



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN CIVIL ENGINEERING MODULE I

2707 / 103: STRUCTURES I AND CONSTRUCTION MATERIALS

DATE: 25/4/2019

TIME: 8:30 – 11:30 AM

Instructions:

- This paper consists of **Eight** questions in **Two** sections, **A** and **B**.
- Answer any **Two** questions from Section A, **Two** questions from Section B and **One** question from either section.
- All questions carry equal marks.
- Maximum marks for each part of the question are as shown.

SECTION A: STRUCTURES I

Answer at least **Two** questions from this section.

1. A beam is loaded as shown in figure 1.

- Draw the shear force and bending moment diagrams
- Determine the position of the maximum sagging bending moment
- Calculate the maximum sagging bending moment (20 marks)

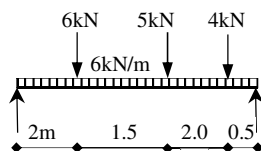


Fig. 1

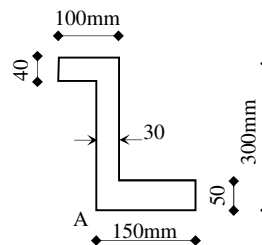


Fig. 2

2. Figure 2 shows the cross section of a structural member.
- 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)

3.

- 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.

$$E_s = 205\text{kN/mm}^2; E_t = 8.2\text{kN/mm}^2 \quad (15 \text{ marks})$$

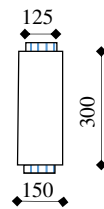


Fig. 3

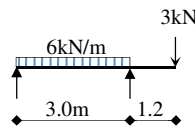


Fig. 4

4. 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)

SECTION B: CONSTRUCTION MATERIALS

*Answer at least **Two** questions from this section.*

- 5.
- a) Mention four types of clay products used in the construction industry. (4 marks)
 - b) Outline the procedure of manufacturing clay bricks. (16 marks)
- 6.
- a) Briefly explain the classification of rocks on the basis of their geological formation, physical characteristics and chemical composition. (16 marks)
 - b) Mention four methods of quarrying stones. (4 marks)
- 7.
- a) Draw and label a cross-section of a mature tree. (5 marks)
 - b) State the principal causes of decay in timber. (3 marks)
 - c) Explain the following defects in timber:
 - i) shakes
 - ii) knots
 - iii) checks
 - iv) end splits (6 marks)
 - d) Mention two methods of seasoning timber and briefly explain how each of them is done. (6 marks)
- 8.
- a) Differentiate between ferrous and non-ferrous metals (2 marks)
 - b) State three methods of casting iron. (3 marks)
 - c) Define the following heat treatment for steel:
 - i) Hardening
 - ii) Tempering
 - iii) Annealing
 - iv) Normalizing (8 marks)
 - d) Mention any four non-ferrous metals (2 marks)
 - e) List down three types of steel and mention two uses of each. (5 marks)