

2705/103 2709/103

2707/103 2710/103

STRUCTURES I AND CONSTRUCTION

MATERIALS

Oct./Nov. 2021

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING TECHNOLOGY

DIPLOMA IN CIVIL ENGINEERING

DIPLOMA IN ARCHITECTURE

MODULE I

STRUCTURES I AND CONSTRUCTION MATERIALS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Drawing instruments;

Scientific calculator.

This paper consists of EIGHT questions in TWO sections; A and B.

Answer FIVE questions choosing 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 a question are indicated.

Candidates should answer the questions in English.

This paper consists of 6 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A: STRUCTURES I

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

1. (a) Define the following terms:

- (i) modulus of rigidity;
- (ii) working stress;
- (iii) elasticity;
- (iv) bulk modulus.

(4 marks)

(b) A simply supported beam is loaded as shown in **figure 1**.

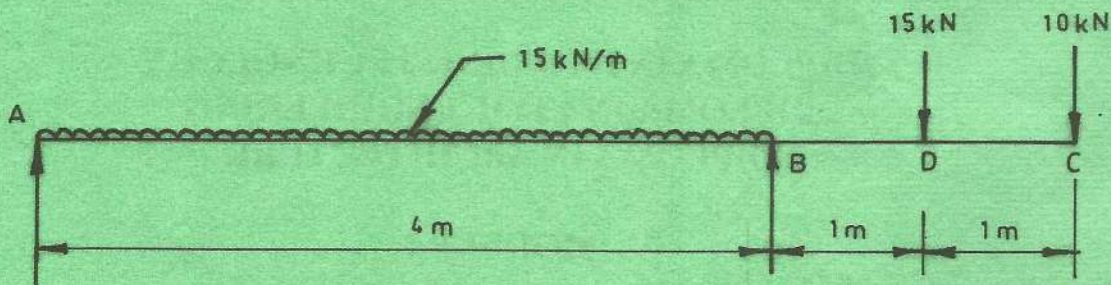


Fig.1

- (i) determine reactions at supports A and B.
- (ii) sketch the shear force and bending moment diagram indicating critical values.
- (iii) Determine the position at the point of contraflexure.

(16 marks)

2. **Figure 2** shows the plan of a space frame which consists of six pin jointed members. The members D E is horizontal and 4 m above the horizontal plane containing A, B and C, while the loads applied at D and E act in a horizontal plane. Using the method of tension co-efficient, determine the magnitude and nature of all the members. (20 marks)

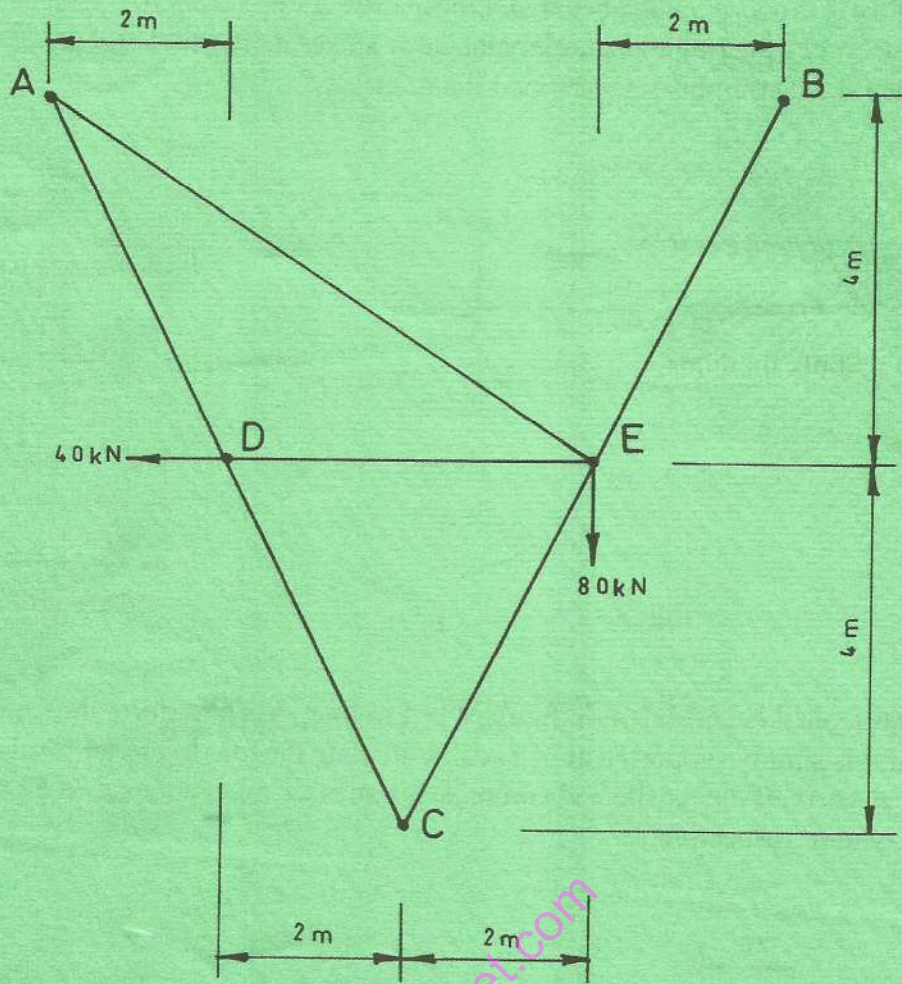


Fig.2

3. (a) Determine the Euler's critical buckling length for an alloy, circular section 50 mm external diameter and wall thickness of 8 mm carrying an axial load of 50 kN, if both ends are pinned.

Take $E = 180 \text{ kN/mm}^2$

(6 marks)

- (b) **Figure 3** shows a loaded beam and its cross section. Using the point of maximum shear force, determine the horizontal shear stress at all critical points of the section and hence sketch the shear distribution diagram. (14 marks)

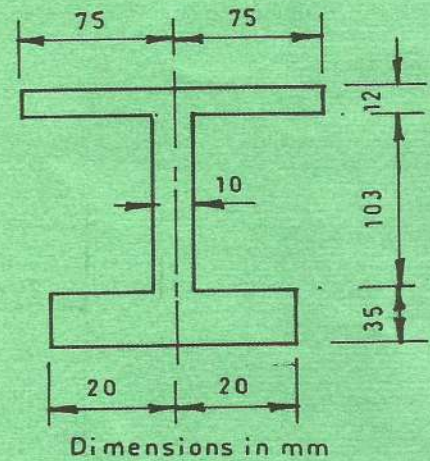
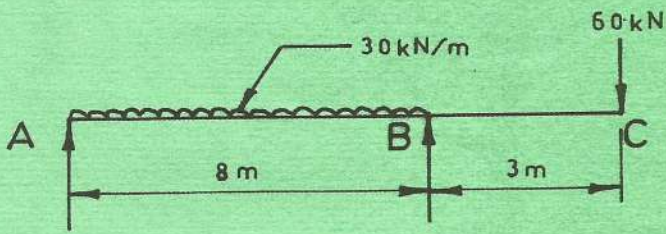


Fig. 3

4. (a) A horizontal beam shown in **figure 4** is 4 m long, has a uniform thickness of 20 mm, and it is simply supported at its ends. Calculate the maximum uniform distributed load it can carry, if the tensile and compressive stresses must not exceed 32 kN/mm^2 and 56 N/mm^2 respectively. (14 marks)

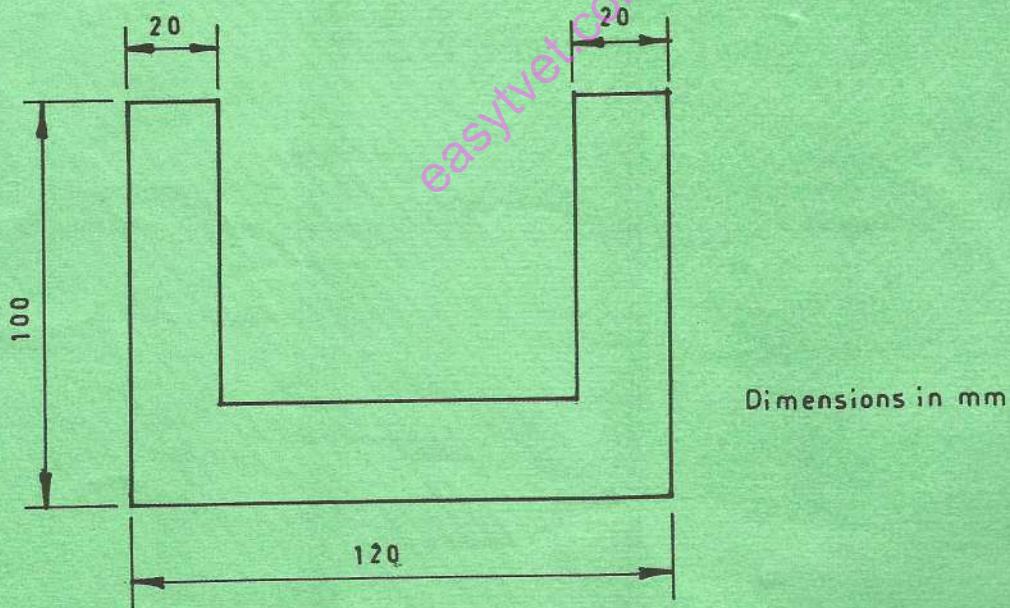


Fig. 4

- (b) Calculate the second moments of area of the section shown in figure 5 about the centroided axis; x - x and y - y. (6 marks)

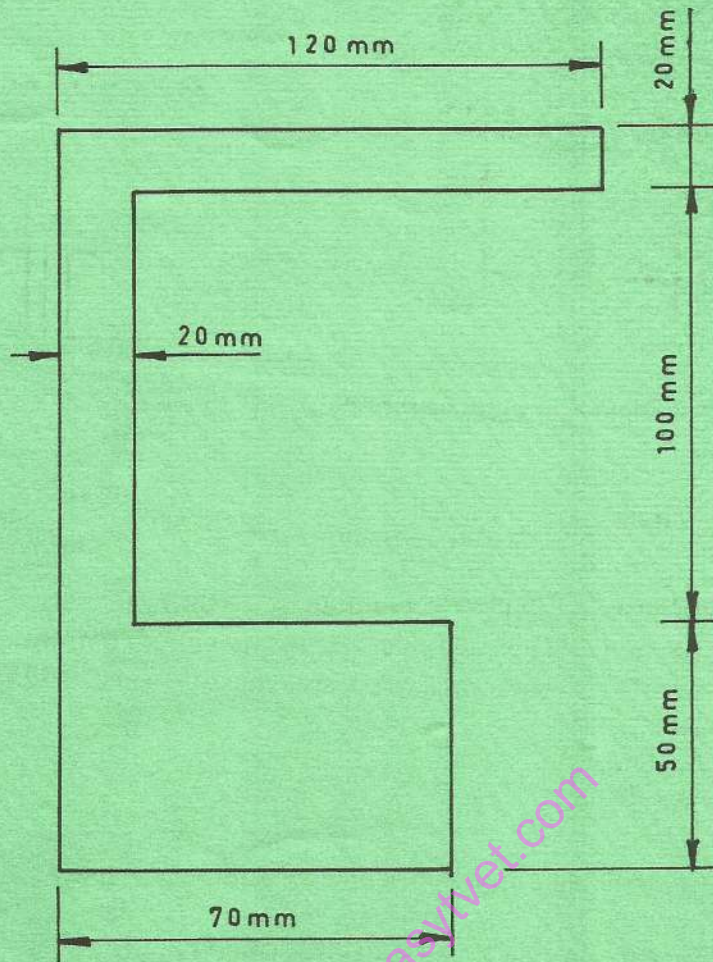


Fig. 5

SECTION B: CONSTRUCTION MATERIALS

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

5. (a) (i) State **four** reasons for painting.
(ii) State **four** characteristics of a good paint. (8 marks)
- (b) Outline the causes of the following paint film defects:
(i) chalking;
(ii) blistering;
(iii) efflorescence;
(iv) cracking. (8 marks)
- (c) Outline the steps in achieving a first class paint on an old woodwork background. (4 marks)
6. (a) Distinguish between bitumen and tar. (4 marks)
- (b) Define the following terms as applied to bituminous products:
(i) cut back bitumen;
(ii) asphalt;
(iii) straight run bitumen;
(iv) bituminous emulsion. (8 marks)
- (c) With the aid of a labelled diagram, describe the softening point test for bitumen. (8 marks)
7. (a) Sketch and label the cross-section of the following timber products:
(i) block board;
(ii) 5 plywood. (4 marks)
- (b) (i) State **four** advantages of seasoning timber.
(ii) State **four** advantages of timber as a construction material. (8 marks)
- (c) With the aid of a sketch, explain the manufacture of cement by dry process. (8 marks)
8. (a) State **three** methods of moulding plastics products. (3 marks)
- (b) Outline the characteristics of a good brick making clay. (5 marks)
- (c) Describe the composition of glass. (12 marks)

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