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STRUCTURES I AND
CONSTRUCTION MATERIALS
June / July 2023
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;
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 A and B.*
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 5 printed pages.

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

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SECTION A: STRUCTURES I

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

1. **Figure 1** shows a loaded overhanging beam Determine:

    (a)   the reactions at B and D;   (4 marks)

    (b)   shear force at critical points along the beam;   (6 marks)

    (c)   bending moment along the beam and   (6 marks)

    (d)   points of contraflexture from supports B and D.   (4 marks)

20 KN/M   60 KN   10 KN/M

B

A   C   D   E

1.5M   1.0M   4.0M   1.5M
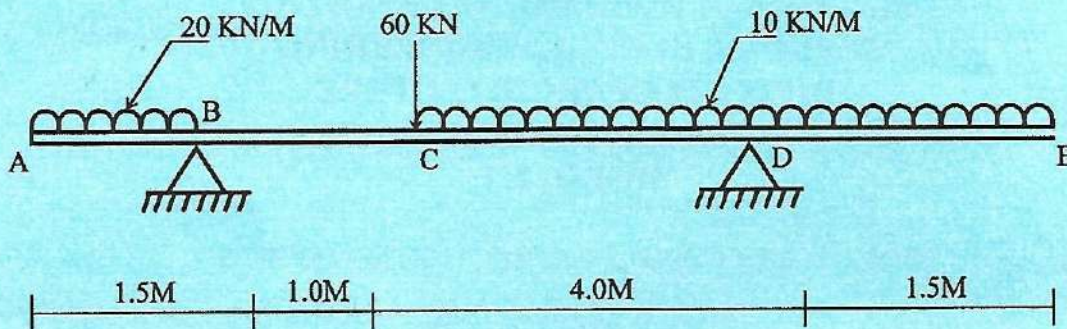
Fig. 1

2. **Figure 2** shows a loaded pin-jointed plane frame. Determine the forces in all the members using the method of joint resolution.   (20 marks)
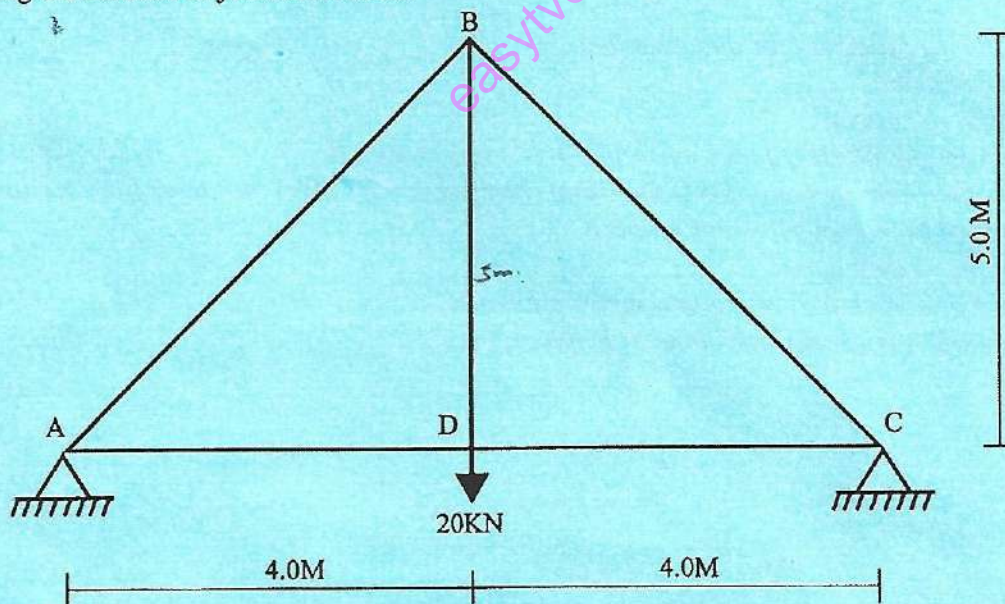

B

5.0 M

A   D   C

20KN

4.0M   4.0M

Fig. 2

3. (a) Define the following terms as used in structural of materials:

(i) elasticity;
(ii) young's modulus;
(iii) strain.

(6 marks)

(b) A steel tube of 50 mm external diameter and 2.5 mm thick encloses centrally a solid copper rod of 40 mm diameter. The rod and the tube are rigidly connected together at the ends at a temperature of 30°C. Find the following when the temperature is increased to 180°C:

(i) the stress induced in each metal and
(ii) the force in each metal.

(14 marks)

Take :
$$\alpha_{copper} = 17 \times 10^{-5}/°C$$
$$\alpha_{steel} = 12 \times 10^{-5}/°C$$
$$E_{copper} = 100 \, kN/mm^2$$
$$E_{steel} = 210 \, kN/mm^2$$

4. (a) **Figure 3** shows section of a simply supported beam which spans 5.5 M.ends. Determine the maximum shear stress when a U.D.L of 10 kN/m is supported by the beam and hence plot the shear stress distribution across the section. (14 marks)
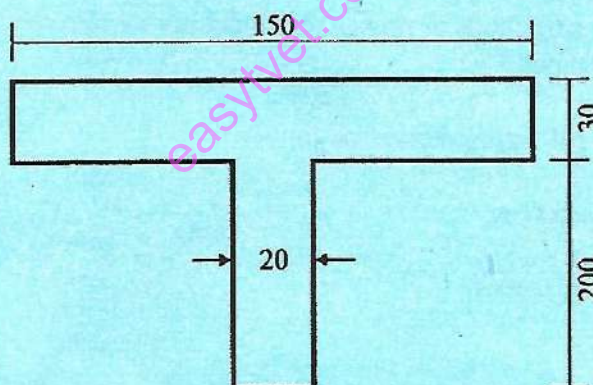
Fig. 3

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(b)   **Figure 4** shows a cantilever beam of length 2.5 m. The beam is rectangular in section of size 400 mm deep x 250 mm wide. Determine the maximum uniformly distributed load that can be carried by the beam if the maximum tensile and compressive stresses are 50 N/mm². (6 marks)

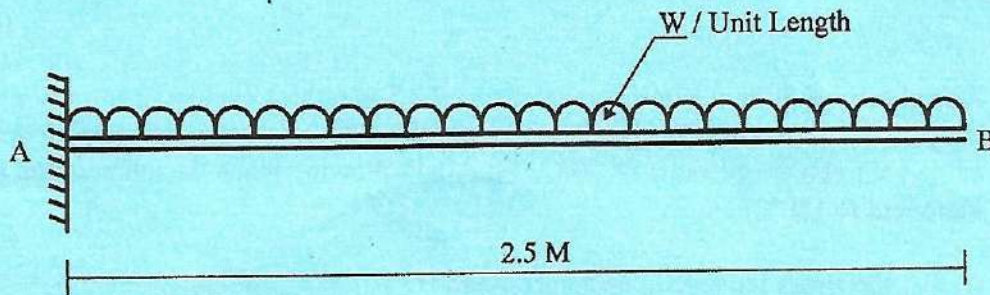W / Unit Length

A

B

2.5 M

Fig. 4

SECTION B: CONSTRUCTION MATERIALS

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

5.   (a)   Using a well labeled diagram show the parts of the cross-section of a tree trunk. (8 marks)

(b)   Define the term 'seasoning of timber'. (2 marks)

(c)   Explain **two** methods of timber seasoning giving two merits and two demerits of each method. (6 marks)

(d)   Define the following defects on timber:

(i)   cup shakes;

(ii)   heart shakes. (4 marks)

6.   (a)   State **four** properties of glass which make it to be used in construction work. (8 marks)

(b)   State **two** materials used in fixing glass. (4 marks)

(c)   List **four** ideal properties of a good paint. (4 marks)

(d) State **two** uses of each of the following paints:

    (i)   aluminium paints;
    (ii)   oil paints.

                                                (4 marks)

7.   (a)   State the **three** principal types of building stones used in construction.   **(3 marks)**

       (b)   Explain **two** methods of extracting building stones.   **(6 marks)**

       (c)   Define the term 'concrete'.   **(3 marks)**

       (d)   Outline with the aid of line diagram the 'wet process' of manufacture of ordinary Portland cement.   **(8 marks)**

8.   (a)   State the **three** types of bricks used in construction.   **(3 marks)**

       (b)   Give **two** methods used in manufacture of bricks stating **one** advantage of each method.

                                                  (4 marks)

       (c)   Explain the following processes in extraction of metals:

           (i)   reduction;
           (ii)   electrolysis.

                                                  (7 marks)

       (d)   Describe the following bituminous materials giving **one** use of each in construction industry:

           (i)   bitumen;
           (ii)   asphalt;
           (iii) tar.

                                                  (6 marks)

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