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STRUCTURES I AND
CONSTRUCTION MATERIALS
Oct./Nov. 2018
Time: 3 hours

Nairobi Institute of Science & Technology
19 JAN 2019
P.O. Box 414 - 00900, Kiambu

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 examinations:
Mathematical tables/scientific calculator,
Answer booklet.
*This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.*
*Answer **FIVE** questions choosing at least **TWO** questions from each section.*
All questions carry equal marks.
Maximum marks for each part of a question are as 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.

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SECTION A: STRUCTURES I

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

1. (a) Determine the magnitude and nature of the forces in each member of the framework shown in **figure 1** using the method of tension coefficients. (12 marks)

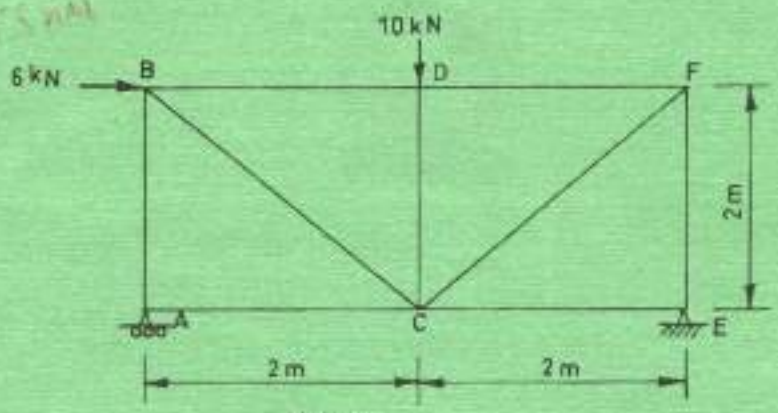
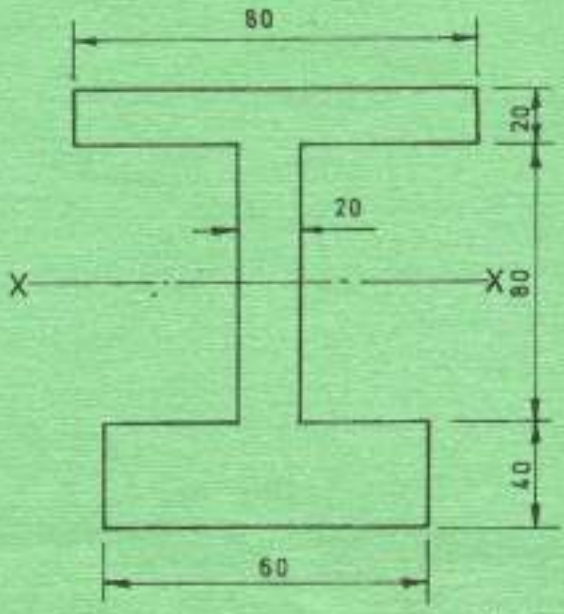


Fig. 1

(b) **Figure 2** shows a loaded beam and its cross section. Plot the horizontal shear stress distribution diagram. (8 marks)



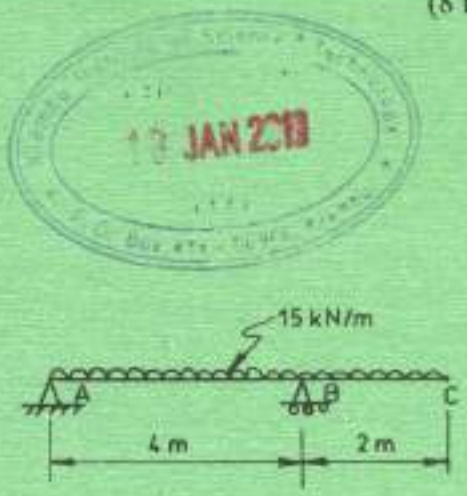


Fig. 2

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2. (a) Define the following terms:

(i) point of contraflecture;
(ii) maximum bending moment.

(2 marks)

(b) (i) Sketch the shear force and bending moment diagram for the beam in **figure 3** indicating values at critical points.

(ii) Determine the position of the point of contraflecture from point B.

(18 marks)

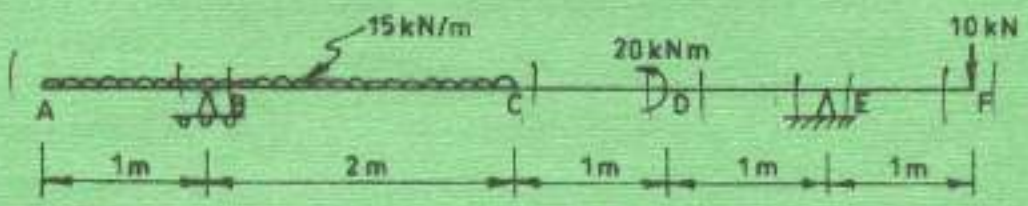

Fig. 3

3. (a) A composite timber and steel section is as shown in **figure 4**. Calculate the maximum safe uniformly distributed load that the section can carry when simply supported over a span of 3.5 m, given the following information:

Permissible stress in steel = 150 N/mm²
Permissible stress in timber = 7 N/mm²
m = 20

(9 marks)

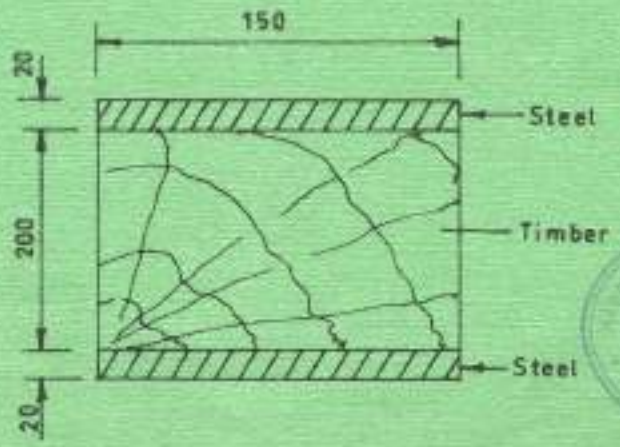

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Fig. 4

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(b) A hollow steel tube 100 mm external diameter, 80 mm internal diameter and length 3.2 m is subjected to a tensile load of 40 kN. Calculate:

(i) the stress in the material;
(ii) extension of the tube, if the Young's modulus of elasticity is 210 kN/mm^2

(7 marks)

(c) State **four** assumptions made in Euler's theory. (4 marks)

4. (a) State **two** assumptions in the theory of simple bending. (2 marks)

(b) **Figure 5** shows a loaded beam and its cross section. Calculate the maximum tensile and compressive stresses. (9 marks)

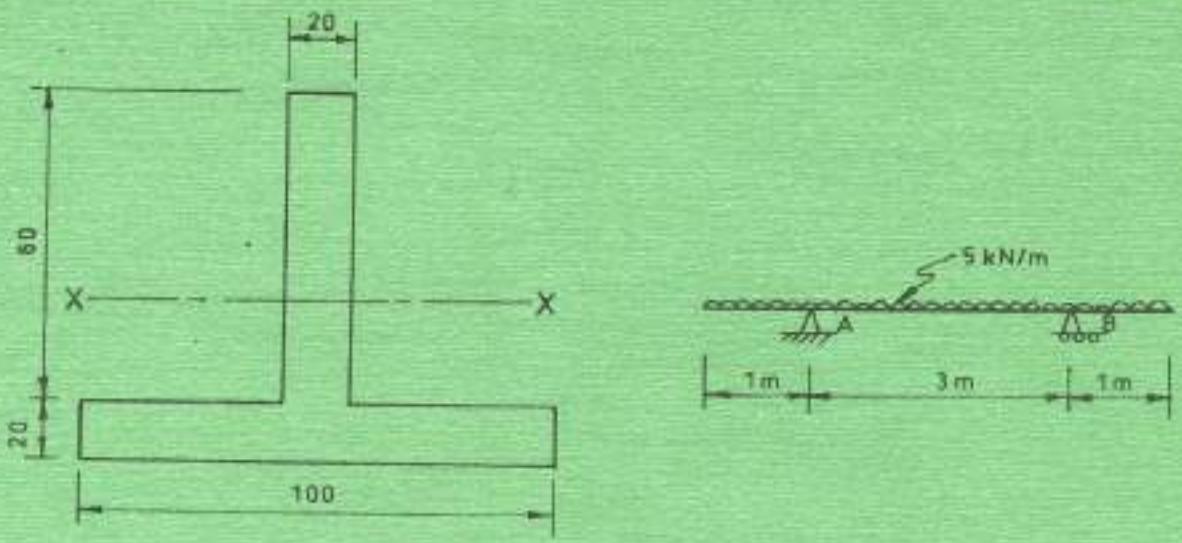

Fig. 5

(c) Calculate the section modulus about the X-X axis for the beam section shown in **figure 6**. (9 marks)

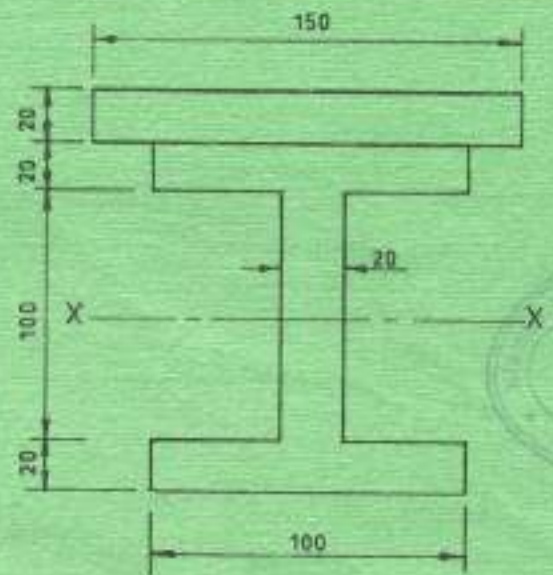

Fig. 6

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SECTION B: CONSTRUCTION MATERIALS

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

5. (a) (i) Describe the following building stones in terms of composition, characteristic and use:

(I) granite;
(II) basalt;
(III) slate.

(ii) List **four** advantages of artificial stones over natural stones.

(11 marks)

(b) (i) State **six** requirements of clay bricks.

(ii) Describe the following types of kilns used in brickwork:

(I) open kilns;
(II) intermittent kilns;
(III) continuous kilns.

(9 marks)

6. (a) (i) Describe the following tests in cements:

(I) consistency test;
(II) fineness test;
(III) soundness test.

(ii) State **four** properties of cements. (11 marks)

(b) (i) Explain the effect of the following impurities in iron:

(I) silicon;
(II) phosphorous.

(ii) Explain the purpose of heat treatment in steel.

(9 marks)

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7. (a) (i) Explain the function of each of the following constituents of paint:

(I) base;
(II) vehicle;
(III) pigment.

(ii) State **four** characteristics of paint.

(iii) State **two** functions of varnishes. (10 marks)

(b) (i) Describe the following forms of asphalt:

(I) cut-back;
(II) mastic;
(III) asphaltic emulsion;
(IV) asphaltic cement.

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(ii) State **four** uses of bitumen.

(10 marks)

8. (a) Describe the following moulding processes in the manufacture of plastics:

(i) injection moulding;
(ii) compression moulding.

(6 marks)

(b) Explain the function of the following constituents in glass:

(i) sodium;
(ii) cullet;
(iii) lime.

(6 marks)

(c) (i) Define the following terms as used in timber:

(I) log;
(II) batten;
(III) plank.

(ii) Calculate the moisture content of a timber specimen after being oven dried for 24 hours given that the wet weight and dry weight was 150 g and 135 g respectively.

(iii) Explain the uses of the following manufactured boards:

(I) lamin boards;
(II) batten boards.

(8 marks)

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