

2705/103 2709/103
2707/103 2710/103
**STRUCTURES I AND
CONSTRUCTION MATERIALS**
Oct./Nov. 2018
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 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.**

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)

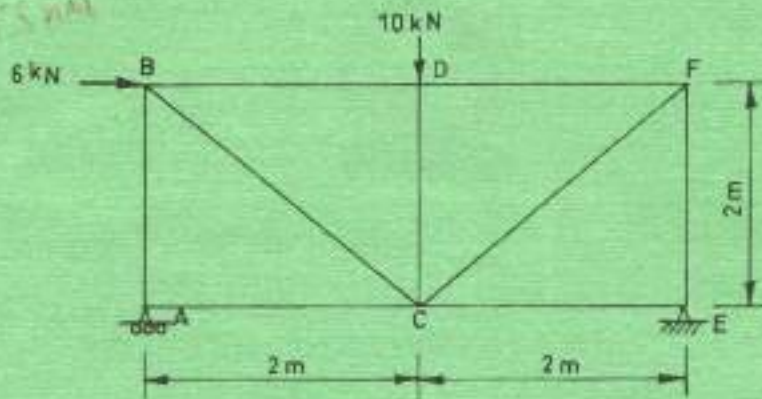


Fig.1

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

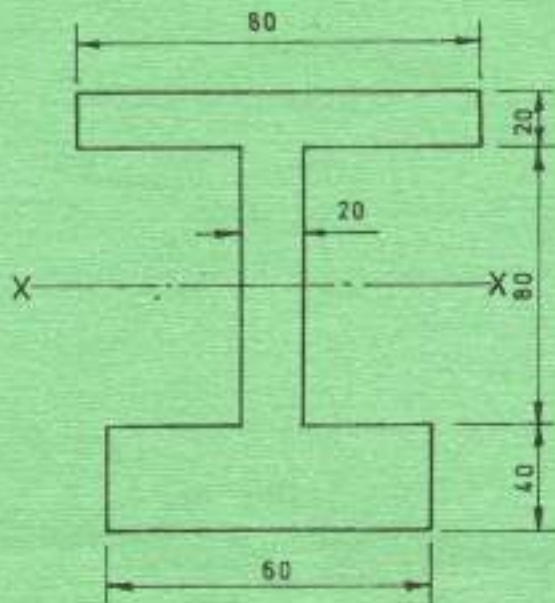
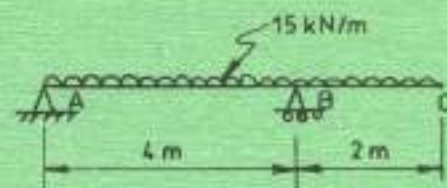


Fig.2



2. (a) Define the following terms:

- (i) point of contraflexure;
- (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 contraflexure from point B.

(18 marks)

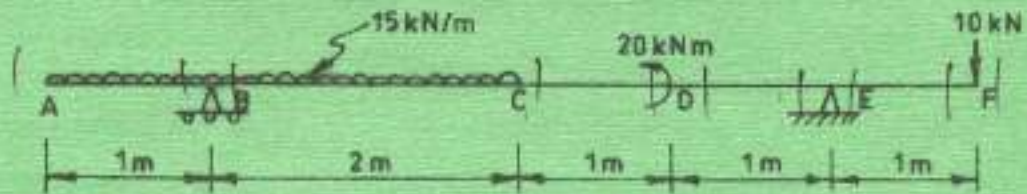


Fig. 3

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)

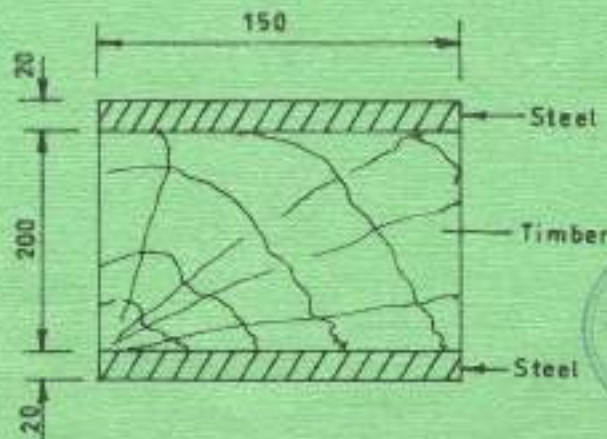


Fig. 4



(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)

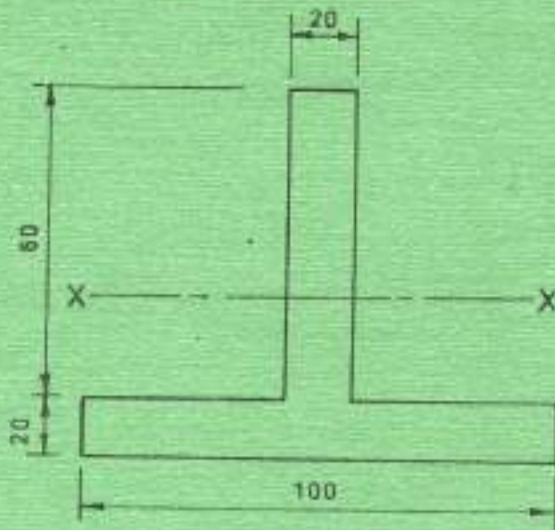
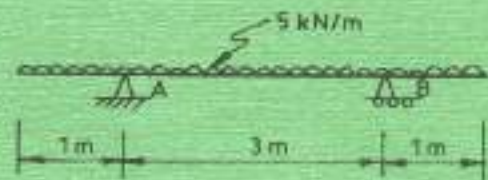


Fig. 5



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

(9 marks)

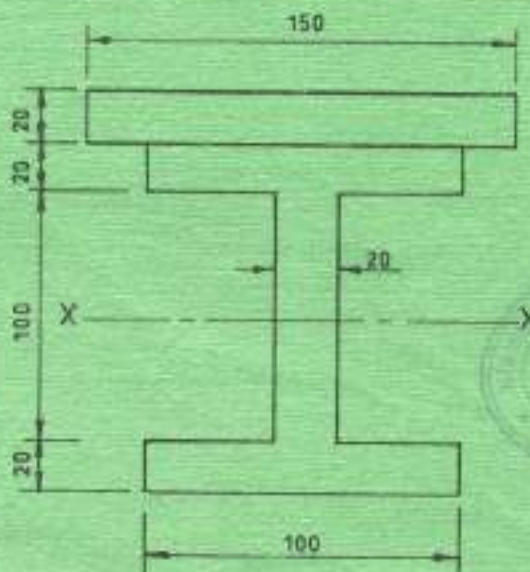


Fig. 6



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; ✓ ~~metamorphic~~
- (II) basalt; ✓ ~~sedimentary~~
- (III) slate. ✓ ~~metamorphic~~

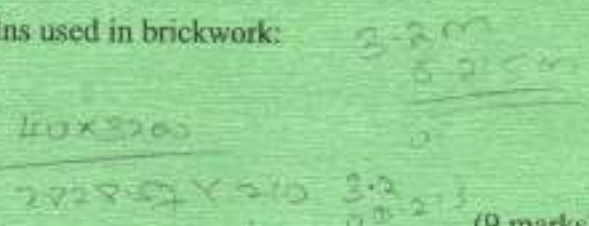
(ii) List **four** advantages of artificial stones over natural stones.

(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)

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

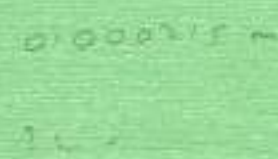
- (I) consistency test;
- (II) fineness test;
- (III) soundness test.



(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)



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.
- (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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