

Name _____ Index No. _____

2705/103

2707/103

2709/103

2710/103

STRUCTURES I AND
CONSTRUCTION MATERIALS

June/July 2015

Time: 3 hours

Candidate's Signature _____

Date _____



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

Write your name and index number in the spaces provided above.

Sign and write the date of examination in the spaces provided above.

You should have scientific calculator and drawing instruments for this examination.

This paper consists of TWO sections; A and B.

Answer FIVE questions, choosing at least TWO questions from each section in the spaces provided in this question paper.

All questions carry equal marks.

Maximum marks for each part of a question are as shown.

Candidates should answer the questions in English.

For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1	20	
	2	20	
	3	20	
	4	20	
B	5	20	
	6	20	
	7	20	
	8	20	
Total Score			

This paper consists of 20 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) A steel bar of diameter 25 mm is loaded as shown in figure 1. Determine the change in length that occurs in the bar. Take $E = 200 \text{ kN/mm}^2$ (6 marks)

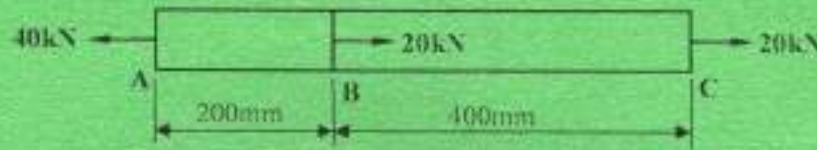


Fig. 1

- (b) Figure 2 shows a framed truss of 4 m span carrying central load of 20 kN. Using the method of resolution at joints, determine the magnitude and nature of the forces in all members of the frame. (14 marks)

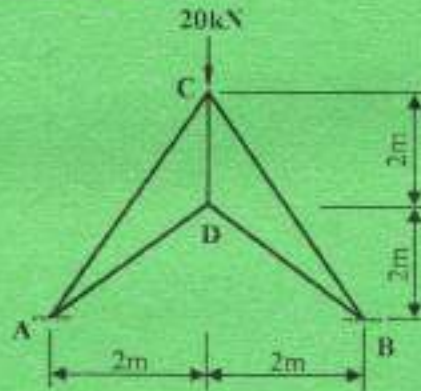


Fig. 2



2. (a) A mild steel rod of 10 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 20 mm and internal diameter 15 mm. The ends of the rod and tube are fastened together and the composite bar is subjected to an axial pull of 20 kN. Determine the stresses developed in the steel rod and copper tube. Take $E_{\text{steel}} = 200 \text{ kN/mm}^2$; $E_{\text{copper}} = 100 \text{ kN/mm}^2$ (8 marks)

- (b) A uniform lamina is shaped as shown in figure 3. Determine the centroid of the lamina (shaded portion). (12 marks)

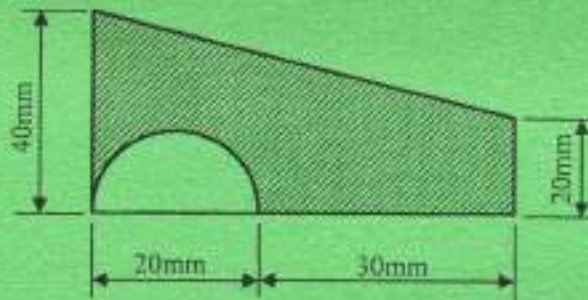


Fig. 3

3. Figure 4 shows the shear force diagram for a simply supported beam.

- (i) Sketch the loaded beam, indicating the supports.
- (ii) Calculate the bending moment at every 2 m interval.
- (iii) Sketch the bending moment diagram, indicating the critical values. (20 marks)

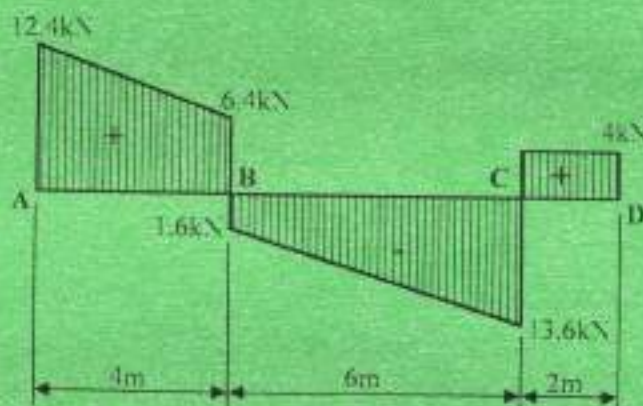


Fig. 4

- 4. (a) State four assumptions made in the analysis of plane structural frameworks. (4 marks)
- (b) Derive the general expression for shear stress across a rectangular beam section and hence sketch the shear stress distribution diagram. (8 marks)
- (c) Figure 5 shows a T-section used as a strut. The strut is 4 m long and is hinged at both ends. Calculate Euler's crippling load. Take $E = 200 \text{ kN/mm}^2$. (8 marks)

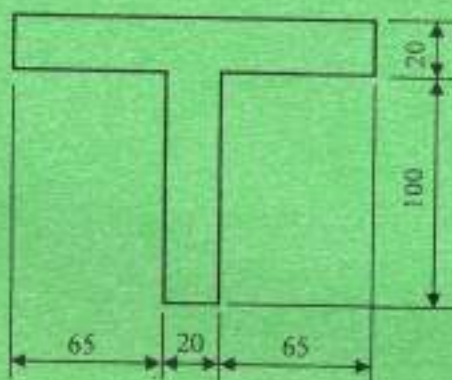


Fig.5



Note: Dimensions in mm

SECTION B: CONSTRUCTION MATERIALS

Answer at least TWO questions from this section.

5. (a) State **three** scales of strength used in compressive tests on building stones, giving the strength range in each case. (3 marks)
- (b) With the aid of labelled sketches describe the following methods of timber conversion, stating **one** advantage of each:
- (i) Plain sawing;
- (ii) Quarter sawing. (8 marks)
- (c) With the aid of sketches, explain the formation of the following timber defects:
- (i) Heart shakes;
- (ii) Star shakes;
- (iii) Cup shakes. (9 marks)
6. (a) List **six** uses of rubber in the construction industry. (3 marks)
- (b) With the aid of a flow chart, describe the process of manufacturing bricks. (9 marks)
- (c) Describe the following types of paints:
- (i) Oil paints;
- (ii) Varnish;
- (iii) Enamel;
- (iv) Latex paints. (8 marks)
7. (a) Define the following properties of metals:
- (i) Strength;
- (ii) Hardness;
- (iii) Toughness. (3 marks)
- (b) Describe the following forms of iron, stating **one** use of each:
- (i) Pig iron;
- (ii) Wrought iron;
- (iii) Cast iron. (9 marks)
- (c) Describe the following process of sheet glass production, stating **one** use of each product:
- (i) Flat drawn process;
- (ii) Float process. (8 marks)



- 8. (a) (i) List **five** properties of bitumen. (5 marks)
- (ii) List **five** uses of bituminous materials in construction. (5 marks)
- (b) Explain **two** forms in which cementitious plaster can be used. (6 marks)
- (c) Explain the following methods of processing plastics: (9 marks)
 - (i) Injection moulding;
 - (ii) Rotational moulding;
 - (iii) Extrusion.



Series of horizontal lines provided for writing answers to the questions.