

2705/103    2709/103  
2707/103    2710/103  
**STRUCTURES I AND  
CONSTRUCTION MATERIALS**  
Oct./Nov. 2022  
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 at least **TWO** questions from each section in the answer booklet provided.*

*All questions carry equal marks.*

*Maximum marks for each part of a question are as indicated.*

*Candidates should answer the questions in **English**.*

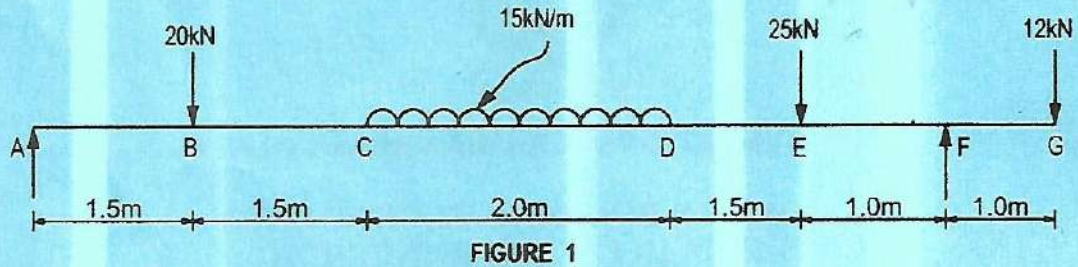
**This paper consists of 5 printed pages.**

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

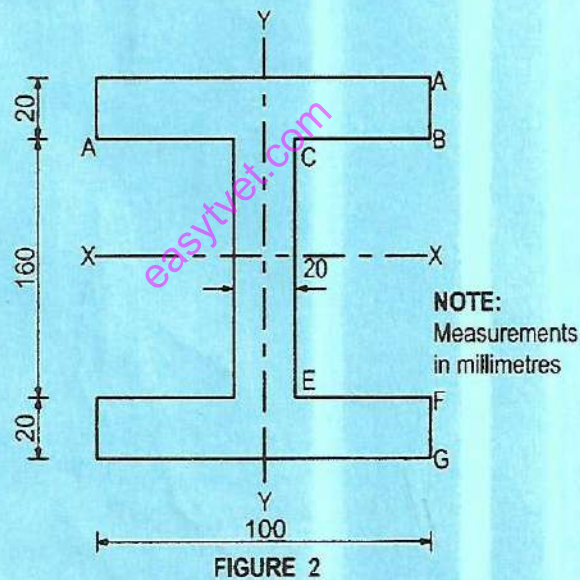
## SECTION A: STRUCTURES

*Answer at least TWO questions from this section.*

1. (a) Draw the shear force and bending moment diagrams for the beam loaded as shown in figure 1 indicating values at critical points. (17 marks)
- (b) Determine the point of contra flexure if any for the beam in 1(a). (3 marks)



2. (a) Figure 2 shows a section of a beam subjected to a shear force of 60 kN. Sketch the shear stress variation diagram across the depth of the beam. (14 marks)



- (b) If the beam in (a) above is used as a cantilever beam of span 3 m;
- (i) determine the maximum moment that can be safely applied to the beam.
- (ii) calculate the uniformly distributed load the beam can safely carry.

Take permissible stress = 150 N/mm<sup>2</sup>.

(6 marks)

3. (a) Using the method of sections, determine the magnitude and nature of forces in members BC, CE and DE in the frame shown in figure 3. (12 marks)

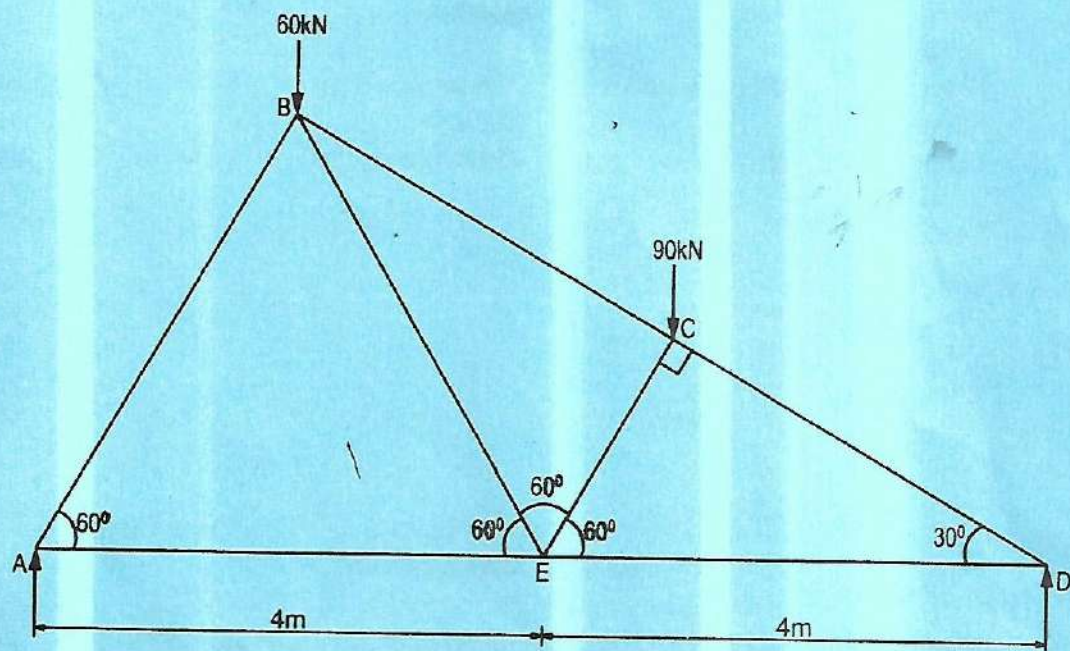


FIGURE 3

- (b) A solid alloy bar of diameter 60 mm with an overall length of 3 m is used as a column. If one end is fixed in position and direction while the other end is fixed in position but not in direction, determine Euler's crippling load. Take  $E = 125 \text{ kN/mm}^2$  (8 marks)
4. (a) Figure 4 shows a steel bar of varying cross-sections subjected to a tensile load of 40 kN. Determine the change in length of the bar due to applied load. Take:  $E = 200 \text{ kN/mm}^2$  (12 marks)

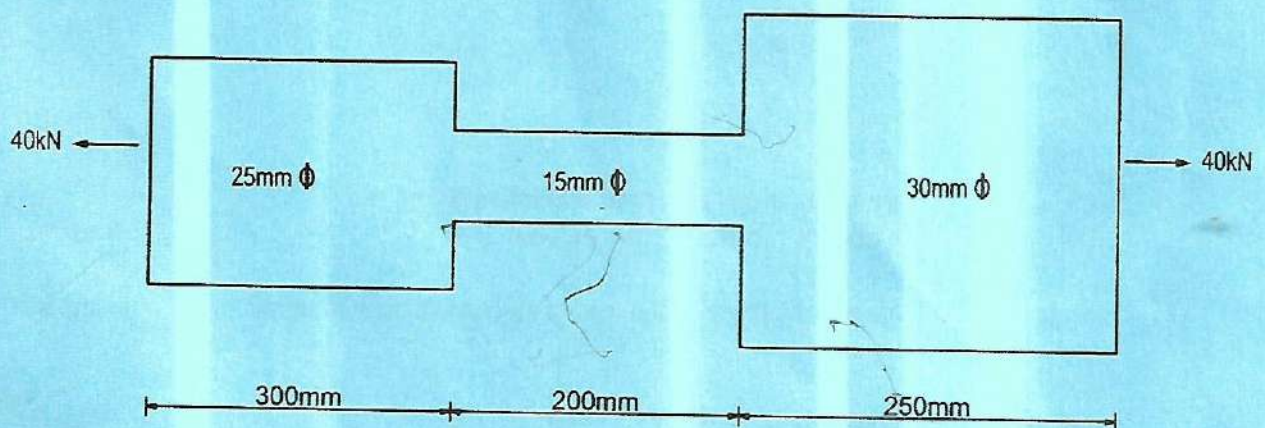


FIGURE 4

(b) A tensile test was conducted on a mild steel rod and the following results obtained.

Diameter of rod	=	50 mm
Gauge length of rod	=	400 mm
Load at yield point	=	170 kN
Extension at a load of 50 kN	=	0.05 mm
Maximum load	=	250 kN
Length at fracture	=	450 mm

(b) Determine:

- (i) Young's modulus;
- (ii) yield stress;
- (iii) maximum stress;
- (iv) percentage elongation.

(8 marks)

### SECTION B: MATERIALS

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

5. (a) State **four** forms of iron ore available. (4 marks)

(b) Explain the effects of the following impurities on iron:

- (i) silicon;
- (ii) phosphorus;
- (iii) sulphur;
- (iv) manganese.

(8 marks)

(c) Explain the following processes of painting a new wooden surface:

- (i) surface preparation;
- (ii) knotting;
- (iii) priming;
- (iv) stopping.

(8 marks)

6. (a) (i) State **three** precautions observed when handling lime. (8 marks)  
(ii) State **five** uses of mortar in construction.

(b) State **four** advantages of timber when used as a construction material. (4 marks)

- (c) With the aid of sketches, differentiate the following timber products:
- (i) lamin board and block board;
  - (ii) plywood and batten board. (8 marks)
7. (a) State **three** properties of asphalt. (3 marks)
- (b) Explain the following forms of bitumen:
- (i) cut back bitumen;
  - (ii) blown bitumen;
  - (iii) straight-rut bitumen;
  - (iv) plastic bitumen. (8 marks)
- (c) Explain the formation of stones in each of the three geological classes of stones giving two examples in each case. (9 marks)
8. (a) Explain **four** constituents of plastics. (8 marks)
- (b) (i) Differentiate between the term blowing and rolling in glass fabrication.  
(ii) State **five** advantages of glass as a construction material. (9 marks)
- (c) State **three** uses of rubber in the construction industry. (3 marks)

**THIS IS THE LAST PRINTED PAGE.**