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STRUCTURES I AND
CONSTRUCTION MATERIALS I

Oct./Nov. 2017

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING CONSTRUCTION
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE

MODULE I

STRUCTURES I AND CONSTRUCTION MATERIALS I

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 TWO from section A and TWO from section B and ONE other question from either section.

All questions carry equal marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

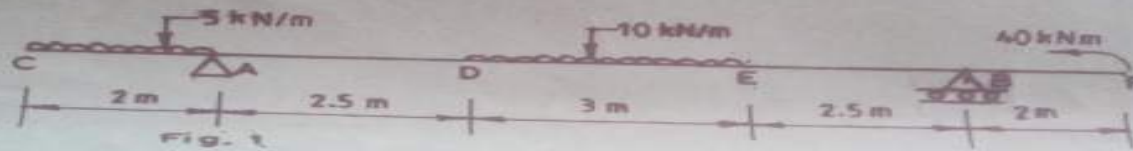
This paper consists of 6 printed pages.

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) Show that the maximum uniformly distributed load for a simply supported beam is given by $WC^2/8$. (3 marks)
- (b) Figure 1 shows a loaded beam:
- (i) plot the shear force diagram and bending moment diagram;
 - (ii) calculate the point of contraflexure from left hand end. (17 marks)



2. ✓ (a) Figure 2 shows the cross section of a beam. Plot the horizontal shear stress distribution diagram given a shear force of 35 kN. (15 marks)

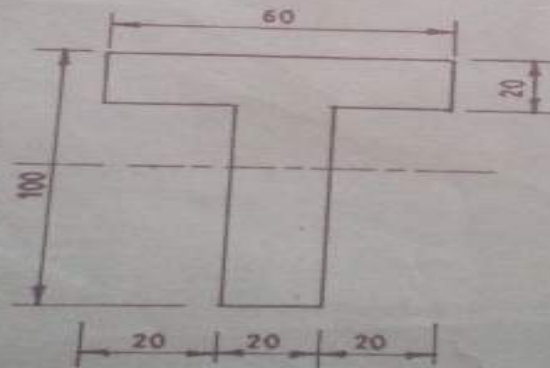


Fig. 2

τ $q h^2 +$
 $\tau = \frac{V}{I} y_1$
 $y_1 =$

- (b) Calculate the moment of resistance of the beam section if the stresses in upper and lower sections are limited to 10 N/mm^2 and 25 N/mm^2 respectively. (5 marks)

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3. (a) Using the method of joint resolution. Calculate the magnitude and nature of forces in members of the frame shown in Figure 3. (15 marks)

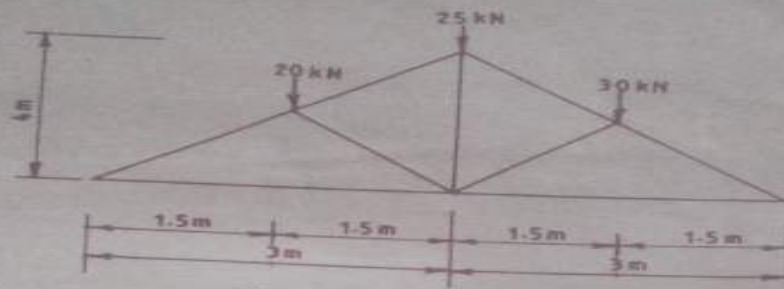


Fig. 3

- (b) Show that the maximum shearing stress in a rectangular beam is given by $\frac{3Q}{2A}$. (5 marks)

4. (a) A short circular column of 250 mm diameter is to be reinforced with steel bars. It carries an axial load of 400 kN.

- (i) calculate the diameter of the bars;
 (ii) calculate the stress in steel and concrete;

Data: $E_{\text{concrete}} = 14 \text{ kN/mm}^2$
 $E_{\text{steel}} = 210 \text{ kN/mm}^2$

(6 marks)

- (b) Define the following terms:

- (i) poisson's ratio;
 (ii) modulus of rigidity;
 (iii) bulk modulus.

(3 marks)

- (c) A steel wire of 3.0 mm diameter and length 10 m stretches 9.67 mm when subjected to a load of 1.5 kN. Calculate the Young's modulus of the material.

(3 marks)

- (d) (i) State four assumptions made in Eulers formula.
- (ii) Calculate the load on a column 50 mm diameter that is fixed on one end and free in the other using Eulers formula. The column is 3.5 m long.
- $E = 210 \text{ kN/mm}^2$
- (8 marks)

SECTION B : CONSTRUCTION MATERIALS

Answer at least TWO questions from this section.

5. (a) Describe the following methods of fabricating plastics:
- (i) transfer moulding;
- (ii) calendring. (4 marks)
- (b) Differentiate between the following types of plastics:
- (i) thermoplastics;
- (ii) thermosetting plastics. (4 marks)
- (c) Explain the uses of the following types of cement:
- (i) rapid hardening;
- (ii) high alumina cement;
- (iii) pozzolana;
- (iv) coloured. (4 marks)
- (d) With the aid of a sketch, outline the procedure of manufacture of cement using the dry process. (8 marks)

6. ✓ (a) (i) Define the term 'quarrying'.
Handwritten note: extracting stone for construction from their natural existence. Heating - use of hand tools to extract loose stones. Digging - use of hand tools to extract loose stones.
- (ii) Describe two methods of quarrying. *Blacking - used in large scale quarry where explosive are used to blast the hard rock.* (5 marks)
- (b) Describe the three geological classifications of stones giving one example of each. (9 marks)
- Handwritten notes:*
 Igneous - These stones are formed when the magma from the earth's core reaches the surface of the earth. (with coal)
 Sedimentary - Sandstone, limestone are formed mainly in sea water from the remains of animals and plants.
 Metamorphic - Marble, quartzite etc produced from sedimentary or igneous rock by the action of heat and pressure.

- (c) (i) State four properties of a good brick.
- (ii) outline the procedure for the manufacture of bricks.

State 4 properties of a good brick
 1. Durable
 2. Strong
 3. Uniform
 4. Smooth
 (6 marks)

7. (a) Define the listed terms as used in timber:

- (i) seasoning: - removing the excess of water from timber
- (ii) live knot;
- (iii) dead knot;
- (iv) dry rot: - defect in timber that is caused by fungal hence making the timber rot

(b) With the aid of sketches, describe the stated defects in timber:

- (i) star shake; 
- (ii) twisting; 
- (iii) cupping.  - cup shaped effect

(6 marks)

(c) Differentiate between the hard wood and soft wood timber giving one example of each:
 Show distinct annual ring
 (4 marks)

(d) (i) Explain two functions of paint.

(ii) Describe four main ingredients of paint. - Base - Enhance the life of the paint & prevent showing cracks
 (6 marks)

8. (a) Explain the following types of bituminous materials:

- (i) native asphalt;
- (ii) cut back asphalt;
- (iii) asphaltite.

Thinners - it added to the paint to make it's applied easily & fast
 Pigment - provide color & opacity to the paint
 (6 marks)

(b) (i) State four properties of glass;

(ii) State four uses of bitumen.

Vehicle - liquid which carries the base & it's film by evaporation
 (4 marks)



(c) Describe the following forms of glass:

(i) pressed;

(ii) laminated;

(iii) glass fibre.

(6 marks)

(d) Differentiate between natural and synthetic rubber.

(4 marks)

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