Name: _____ Index No: _____

2305/303
2307/303
2308/303
STRUCTURES
Oct./Nov. 2014
Time: 3 hours

Candidate's Signature: _____

Date: _____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN HIGHWAY ENGINEERING

STRUCTURES

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.
*Answer any **FIVE** of the **EIGHT** questions in the spaces provided in this question paper.*
All questions carry equal marks.
Maximum marks for each part of a question are as shown.
*Do **NOT** remove any pages from this booklet.*
Candidates should answer the questions in English.

For Examiner's Use Only

Question	1	2	3	4	5	6	7	8	TOTAL SCORE
Candidate's 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.

Turn over

1. (a) (i) Derive the Euler's formula for critical buckling load for pin-ended strut.

(ii) Determine the Euler's critical buckling load for a hollow strut 4 m long pinned at both ends, with a square cross-section of 250 x 250 mm and 10 mm thickness.

Take: $E = 200\ kN/mm^2$

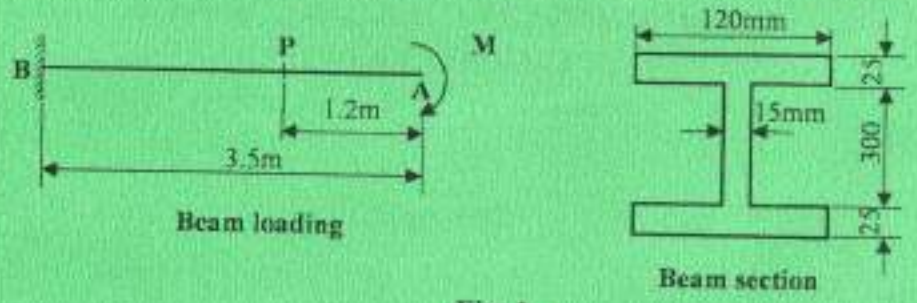
(12 marks)

(b) (i) State Mohr's theorems for slope and deflection;

(ii) Use Mohr's theorem to determine the slope and deflection for the cantilever beam shown in figure 1 at Y point (P) 1.2 m from the free end.

Take: $E = 220\ kN/mm^2$

(8 marks)



Beam loading

Beam section

Fig. 1

2. (a) Distinguish between determinate and indeterminate structures. (2 marks)

(b) Using the three moments theorem analyse the beam shown in figure 2 and sketch the shear force and bending moment diagrams showing all the critical values. (18 marks)

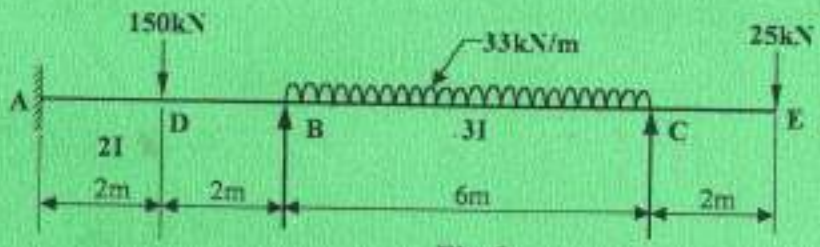


Fig. 2

3. Using the moment distribution method, analyse the beam shown in figure 3 and sketch the bending moment diagram showing all the critical values. (20 marks)

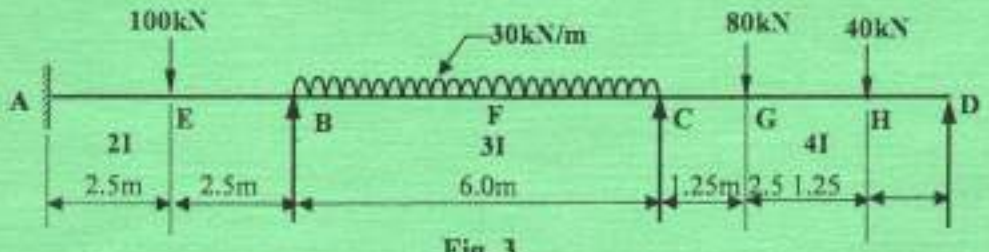
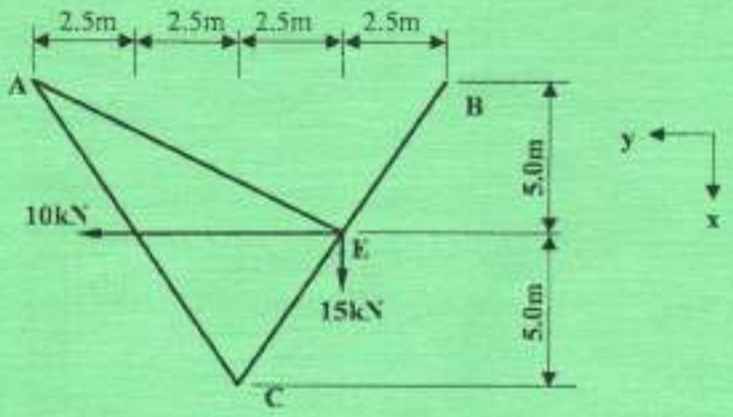
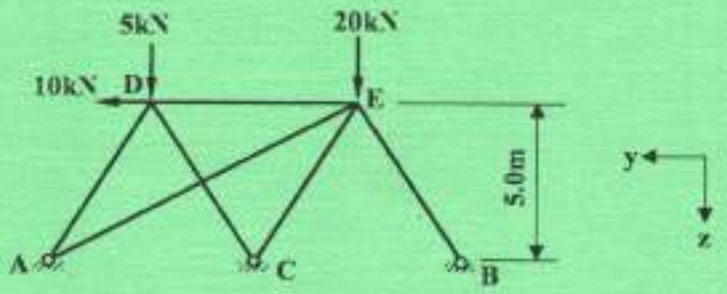


Fig. 3

4. Using the tension coefficient method, analyse the space frame shown on plan and elevation in figure 4 to determine the magnitude and nature of forces in all the members. (20 marks)



PLAN



ELEVATION

Fig. 4

5. Reinforced concrete beams of effective spans 5.0 m are spaced at 2.5 m c/c, as shown in figure 5, to support precast concrete panel floor slab and central column loads at mid spans.

Design and detail the beams to the following specifications:

Concrete mix	–	$1{:}1\frac{1}{2}{:}3$
Breadth of beam (b)	–	300 mm
Liveload	–	3.5 kN/m^2
Slab thickness	–	150 mm
Unit weight of concrete	–	24 kN/m^3
Floor finishes	–	24 kN/m^3
Central column load	–	75 kN
Pst	–	230 N/mm^2

(20 marks)

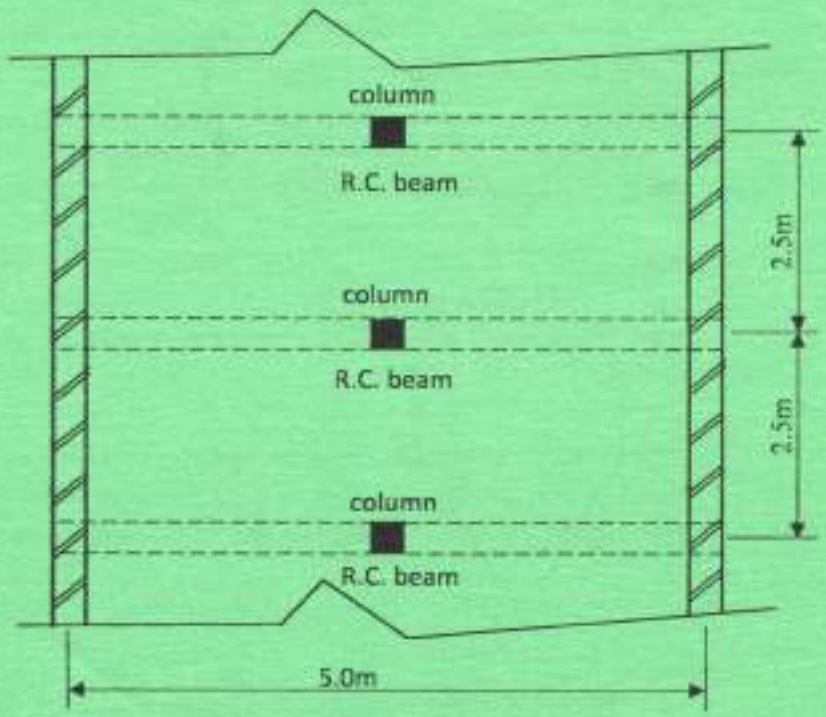


Fig. 5

6. Design for flexure and detail the section of a reinforced concrete slab shown in figure 6 using the following information:

Concrete mix	–	1:2:4
Liveload	–	3.0 kN/m^2
Floor finishes of 25 mm thick granolithic of unit weight	–	22.5 kN/m^3
Pst	–	140 N/mm^2, m = 15
Unit weight of RC	–	24 kN/m^3

(20 marks)

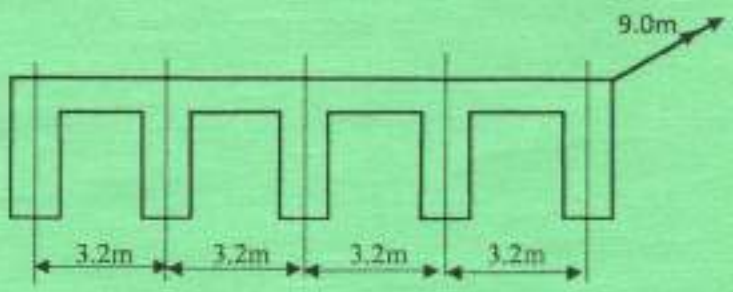


Fig. 6

7. (a) (i) State **three** advantages and **three** disadvantages of casing steel sections.

(ii) An internal stanchion in a multistorey building is of actual length of 4.2 m c/c of floor beams. If the section is 203 x 203 x 52 kg/m UC determine the safe axial load the strut can carry if it is cased in accordance with the requirements of the code. (12 marks)

(b) A simply supported beam spanning 11 m carries a udl of 60 kN/m over the entire span. If the beam is fully restrained laterally in the compression flange, select the most suitable UB section for the beam, checking for shear and deflection.

Take Pq = 90 N/mm^2;
E = 220 kN/mm^2;
liveload = 75% of the udl.

(8 marks)

8. (a) Differentiate between the following terms used in structural timber:

(i) basic stress and grade stress;
(ii) modification factor and knot ratio.

(4 marks)

(b) With the aid of sketches, explain the use of split ring timber connector. (4 marks)

(c) A cantilever timber beam of solid section overhangs with a clear span of 2. m on a bearing of 400 mm at the support. It is to carry a udl of 10 kN/m together with a point load of 8 kN at the free end.
Design the beam for bending, checking for shear and deflection using the following information:

Depth:breadth	–	3:1
Permissible shear stress	–	4 N/mm^2
Modulus of elasticity (E)	–	10.5 k/Nm^2
Permissible bending stress	–	$8N/mm^2$

(12 marks)