2705/202   2709/202
2707/202   2710/202
STRUCTURES II, GEOTECHNOLOGY II
AND CONCRETE TECHNOLOGY II
June/July 2020
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING TECHNOLOGY
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE

MODULE II

STRUCTURE II, GEOTECHNOLOGY II AND CONCRETE TECHNOLOGY II

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
 Answer booklet;
 Drawing instruments;
 Scientific calculator.
*This paper consists of **EIGHT** questions in **THREE** sections; A, B and C.*
*Answer **FIVE** questions, choosing **TWO** questions from section A, **TWO** questions from section B and **ONE** question from section C.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
Necessary design tables are provided.
Candidates should answer the questions in English.

This paper consists of 7 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

SECTION A: STRUCTURES II

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

1. (a) **Figure 1** shows a plan and section of a simply supported slab on four sides, of effective span 6000 mm by 4000 mm. Design and detail the slab using the following information:

   Live load – 3 kN/m^2,

   Finishes – 1 kN/m^2,

   Strength of concrete – 35 N/mm^2,

   Strength of steel – 460 N/mm^2,

   Concrete density – 24 kN/m^3,

   Exposure condition – mild,

   Thickness of slab –175 mm.

   (20 marks)

4000 mm
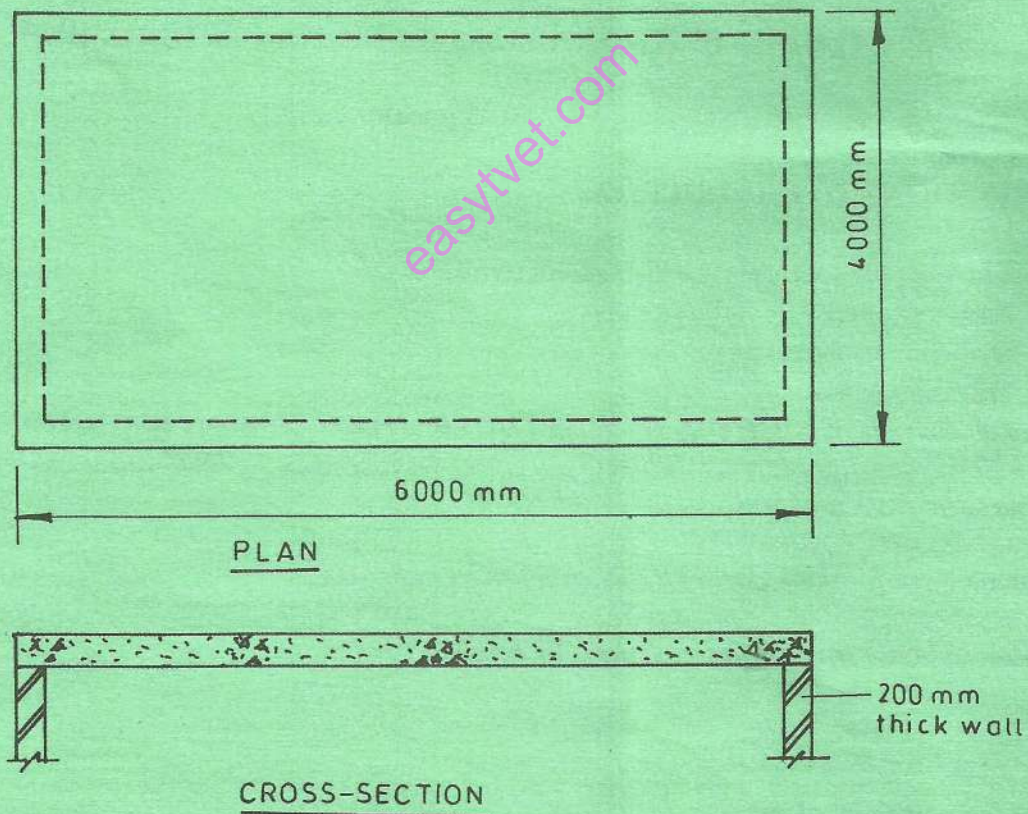
6000 mm

PLAN

200 mm thick wall

CROSS-SECTION

Fig. 1

2. (a) (i) State **four** factors that affect deflection of a beam.

    (ii) **Figure 2** shows a loaded cantilever beam. Using Mohr's theorem, determine deflection at the free end in terms of EI. (8 marks)
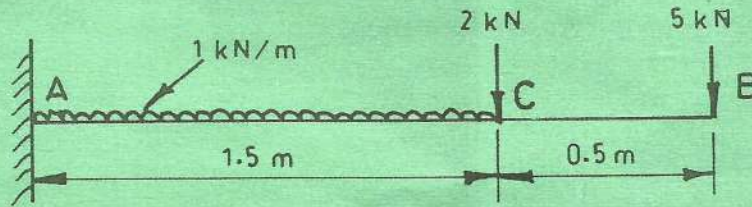

Fig. 2

(b) **Figure 3** shows a cross-section of a loaded column. Determine the extreme fibre stresses at point A, B, C and D. (12 marks)
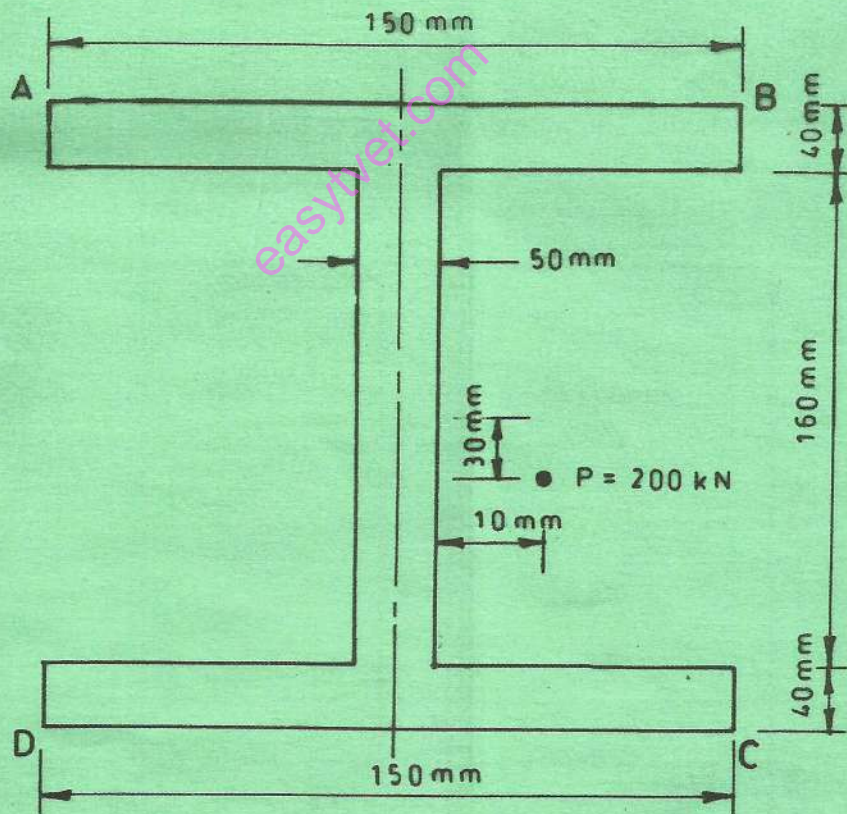

Fig. 3

3.   (a)   Describe with the aid of sketched the following modes of failures in gravity retaining walls:

   (i)   rotational slip;

   (ii)   bearing along the base.

   (6 marks)

   (b)   **Figure 4** shows a gravity retaining wall retaining grannular materials. Determine the following using the given information:

   Density of soil – 18 kN/m³,
   Density of concrete – 24 kN/m³,
   Angle of repose – angle of frictional resistance = 30°
   Factor of safety against overturning – 2,

   (i)   whether tension will occur at the joints;

   (ii)   maximum and minimum pressure exerted the wall on the base;

   (iii)   whether overturning will occur;

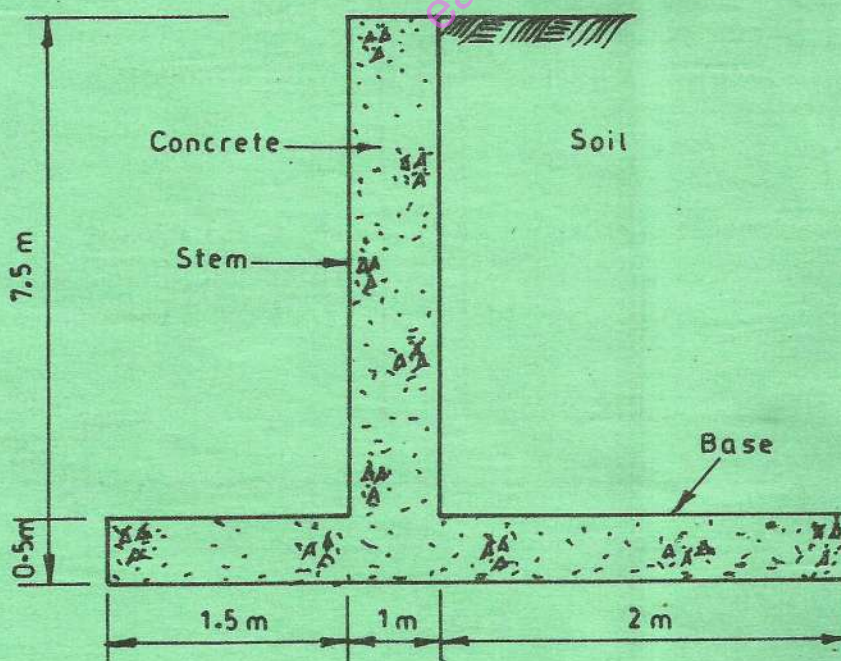   (iv)   whether sliding will occur along the base.

   (14 marks)

Fig. 4

SECTION B: GEOTECHNOLOGY II

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

4. (a) (i) Outline **five** factors considered when selecting a dam site.

   (ii) With the aid of a labelled sketch describe showing the plan view of the following:

       (I)   arch dam;

       (II)   buttress dam.

                                              (17 marks)

   (b) Describe the cut and cover method of tunneling giving **two** examples.   (3 marks)

5. (a) Describe the **two** classifications of rock weathering.

   (b) Outline **five** effects caused by rock weathering.

   (c) Describe the following rock weathering processes:

       (i)   frost action;

       (ii)   hydration;

       (iii)   hydrolysis.

                                                (20 marks)

6. (a) State **three** factors that influence selection of quarrying methods.   (3 marks)

   (b) Describe with the aid of a labelled sketch the reversed faulting.   (6 marks)

   (c) (i) State **five** uses of geological maps.

   (ii) Explain **three** classifications of engineering geological maps.   (11 marks)

2705/202   2709/202   5   **Turn over**
2707/202   2710/202
June/July 2020

SECTION C: CONCRETE TECHNOLOGY II

Answer ONE question from this section.

7. (a) (i) A mixer has a capacity of 0.45 m³ and 80% efficiency. Mixing cycle is 5 minutes. Determine the number of days required to place 220 m³ concrete, if working hours per day is 9 hours.

   (ii) List **four** types of compaction plant. (8 marks)

   (b) State **five** advantages of precast over insitu concrete. (5 marks)

   (c) Outline the procedure of fixing a precast concrete column to foundation using mortar. (7 marks)

8. (a) (i) State **six** factors that affect cold weather concreting.

   (ii) Outline **four** factors to be considered during the placing of fresh concrete at hot weather conditions. (10 marks)

   (b) (i) Sketch ad label the concrete slab construction joint.

   (ii) Describe the purpose of a construction joint. (10 marks)

Table 1: Nominal cover to all reinforcement (including links) to meet durability.

Condition of exposure	Nominal cover				
Mild	25	20	20	20	20
Moderate	-	35	30	25	20
Severe	-	-	40	30	25
Very severe	-	-	50	40	30
Extreme	-	-	-	60	50
Maximum free water/cement ratio	0.65	0.60	0.55	0.50	0.45
Minimum cement content (kg/m^3)	275	300	325	350	400
Lowest concrete grade	C30	C35	C40	C45	C50

Table 2: Reinforcement bar areas (mm^2) per metre width for various bar spacings

Bar diameter (mm)	Bar spacing (mm)									
	75	100	125	150	175	200	225	250	275	300
6	377	283	226	189	162	142	126	113	103	94
8	671	503	402	335	287	252	223	201	183	168
10	1047	785	628	523	449	393	349	314	286	262
12	1508	1131	905	754	646	566	503	452	411	377
16	2681	2011	1608	1340	1149	1005	894	804	731	670
20	4189	3142	2513	2094	1795	1571	1396	1257	1142	1047
25	6545	4909	3927	3272	2805	2454	2182	1963	1785	1636
32	-	8042	6434	5362	4596	4021	3574	3217	2925	2681
40	-	-	10050	8378	7181	6283	5585	5027	4570	4189

Table 3: Bending moment coefficients for slabs spanning in two directions at right angles simply supported on four sides.

L_y/L_x	1.0	1.1	1.2	1.3	1.4	1.5	1.75	2.0
α_{sx}	0.062	0.074	0.084	0.093	0.099	0.104	0.113	0.118
α_{sy}	0.062	0.061	0.059	0.055	0.051	0.046	0.037	0.029

THIS IS THE LAST PRINTED PAGE.

2705/202   2709/202   7
2707/202   2710/202
June/July 2020