SCAN

Name: _____ Index No: _____/____

2705/202 2709/202
2707/202 2710/202
STRUCTURES II, GEOTECHNOLOGY II AND CONCRETE TECHNOLOGY II
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

STRUCTURES II, GEOTECHNOLOGY II AND
CONCRETE TECHNOLOGY II

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 drawing instruments and a Scientific calculator for this examination.
*This paper consists of **EIGHT** questions in **THREE** sections; **A**, **B** and **C**.*
*Answer **TWO** questions from section **A**, **TWO** questions from section **B** and **ONE** question from section **C** in the spaces provided in this question paper.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
*Do **NOT** remove any pages from this booklet.*
Candidates should answer the questions in English.

For Examiner's Use Only

Section	Question	Maximum Marks	Candidate's Score
A	1	20	
	2	20	
	3	20	
B	4	20	
	5	20	
	6	20	
C	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.

Turn over

SECTION A: STRUCTURES II

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

1. Figure 1 shows a retaining wall which supports a cohesionless soil having density 1800 kg/m^3 and shearing resistance of 28°. The density of the wall material is 2400 kg/m^3. Examine the stability conditions of the wall with regard to:

(a) tension in the joints;
(b) ground bearing pressure;
(c) factor of safety against overturning;
(d) factor of safety against sliding, assuming angle of wall friction $\delta = 0.9\phi$.

(20 marks)

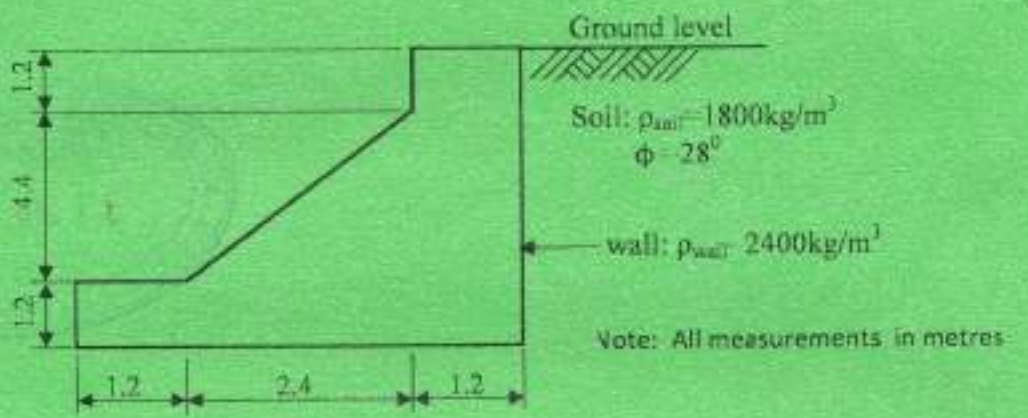

Fig. 1

2. (a) State Mohr's theorems for slope and deflection. (4 marks)

(b) A simply supported beam carries a concentrated load of magnitude 200 kN at the mid-span. Determine using Mohr's theorems:

(i) the maximum deflection;

(ii) the slope and deflection at point D.

Take $EI = 100 \times 10^3 kNm^2$

(16 marks)

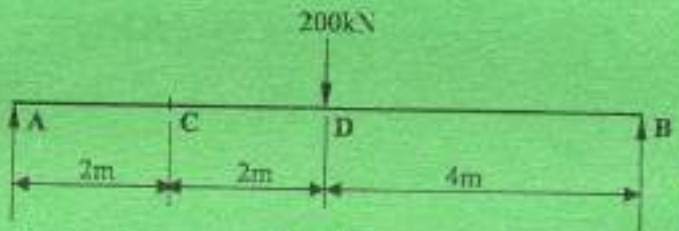

Fig. 2

3. Design a square pad footing given the following information:

-	length of side of square column	=	400 mm
-	axial loads on column:		
	dead load (G_k)	=	900 kN
	imposed load (Q_k)	=	300 kN
-	safe bearing capacity of the soil	=	150 kN/m²
-	Material strengths:		
	fc_u	=	35 N/mm²
	f_y	=	460 N/mm²
-	Information in tables 1 and 2		
-	Assume any other relevant information		

(20 marks)

Table 1: Values of design concrete shear stress, v_c (Nmm^{-2})

$\frac{100A_s}{bd}$	Effective depth (d) (mm)							
	125	150	175	200	225	250	300	≥400
≤0.15	0.45	0.43	0.41	0.40	0.39	0.38	0.36	0.34
0.25	0.53	0.51	0.49	0.47	0.46	0.45	0.43	0.40
0.50	0.67	0.64	0.62	0.60	0.58	0.56	0.54	0.50
0.75	0.77	0.73	0.71	0.68	0.66	0.65	0.62	0.57
1.00	0.84	0.81	0.78	0.75	0.73	0.71	0.68	0.63
1.50	0.97	0.92	0.89	0.86	0.83	0.81	0.78	0.72
2.00	1.06	1.02	0.98	0.95	0.92	0.89	0.86	0.80
≥3.00	1.22	1.16	1.12	1.08	1.05	1.02	0.98	0.91

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

Areas of group of reinforcement bars (mm2)

Bar Diameter (mm)	Number of bars									
	1	2	3	4	5	6	7	8	9	10
6	28	57	85	113	141	170	198	226	254	283
8	50	101	151	201	251	302	352	402	452	503
10	79	157	236	314	393	471	550	628	707	785
12	113	226	339	452	565	679	792	905	1017	1131
16	201	402	603	804	1005	1206	1407	1608	1809	2011
20	314	628	942	1257	1571	1885	2199	2513	2827	3142
25	491	982	1473	1963	2454	2945	3436	3927	4418	4909
32	804	1608	2412	3216	4021	4825	5629	6433	7237	8042
40	1256	2513	3769	5026	6283	7539	8796	10050	11310	12570

SECTION B: GEOTECHNOLOGY II

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

4. (a) Outline each of the following chemical weathering processes:

(i) solution;
(ii) hydration;
(iii) reduction;
(iv) oxidation.

(6 marks)

(b) Distinguish between a fold and a fault. (2 marks)

(c) With the aid of a sketch, define the following elements of a fault:

(i) upthrow and down-throw side;
(ii) footwall and hanging wall;
(iii) throw and heave;
(iv) hade and dip.

(12 marks)

5. (a) (i) Outline **two** types of hard rock quarries.

(ii) Explain the process of removing different types of overburden material in hard rock quarries.

(9 marks)

(b) State **five** precautions to be taken to prevent misfire when quarrying hard rocks. (5 marks)

(c) (i) State **four** factors that may dictate the choice of a tunnelling method.

(ii) State **four** tunnel construction methods.

(6 marks)

6. (a) Outline **six** purposes of constructing dams. (9 marks)

(b) (i) Describe a drift edition geological map.

(ii) Explain how a geological map is made.

(7 marks)

(c) State **two** advantages and **two** disadvantages of earth pressure balance TBM type of a tunnelling boring machine. (4 marks)

SECTION C: CONCRETE TECHNOLOGY II

*Answer **ONE** question from this section.*

7. (a) Explain each of the following:

(i) Why joints are necessary in concrete structures;

(ii) Why it is necessary to take precautions while concreting in cold weather. (12 marks)

(b) (i) Outline **four** properties of high strength concrete mixes used in prestressed concrete;

(ii) State **four** areas of application of prestressed concrete. (8 marks)

8. (a) (i) Describe a ready mixed concrete;

(ii) Outline **three** disadvantages of ready mixed concrete. ($6\frac{1}{2}$ marks)

(b) Describe the following precast concrete elements:

(i) columns;
(ii) beams;
(iii) stairs. ($7\frac{1}{2}$ marks)

(c) Explain the tremie method of concreting under water. (6 marks)