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STRUCTURES II, GEOTECHNOLOGY II
AND CONCRETE TECHNOLOGY II
June/July 2016
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING TECHNOLOGY
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE

MODULE II

STRUCTURES 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 **TWO** questions in section **A**, **TWO** questions in section **B** and **ONE** question from section **C**.*
Relevant tables are included in this paper.
All questions carry equal marks.
Maximum marks for each part of a question are as shown.
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.

Turn over

SECTION A: STRUCTURES II

Answer any TWO questions in this section.

1. (a) State any **three** assumptions made in slope and deflection. (3 marks)

(b) Figure 1 shows a simply supported beam carrying two point loads as shown:

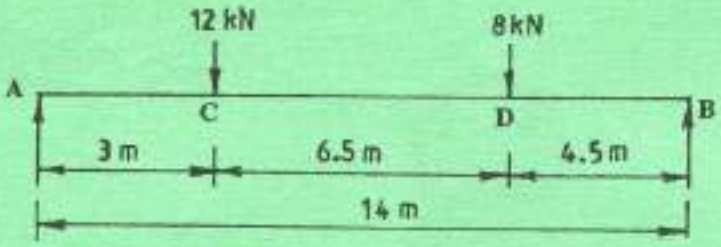

Fig. 01

Calculate the deflection of the beam at C and D, using Macauley's method. Take $E = 200 \times 10^3$ N/mm² and $I = 160 \times 60^6$ mm⁴. (17 marks)

2. (a) With the aid of diagrams, describe the following mode of failure of a retaining wall:

(i) overturning;
(ii) sliding. (6 marks)

(b) Figure 2 is a concrete dam of a trapezoidal section, retaining water on one side as shown.

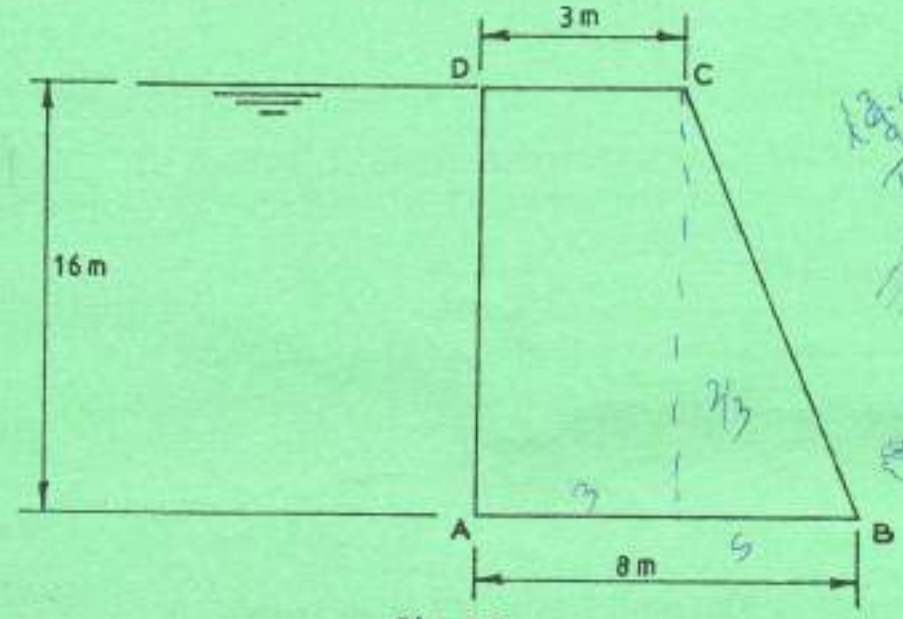

Fig. 02

Determine:

(i) the resultant upthrust on the base per metre length;
(ii) the point, where the resultant thrust cuts the base;
(iii) the intensities of stresses at A and B.

Take weight of the concrete as 25 KN/m³, the density of water as 1000 kg/m³ and g = 9.81. (14 marks)

3. (a) Distinguish between one way spanning slab and two way spanning slab as used in the design of concrete slabs. (4 marks)

(b) A one way spanning slab is subjected to an imposed load of 4 KN/m² spans between brick walls as shown in figure 3. Design the slab, using the following information:

f_{cu}	= 35 N/mm²
f_y	= 460 N/mm²
concrete cover	= 20 mm
density of concrete	= 24 KN/m³

(16 marks)

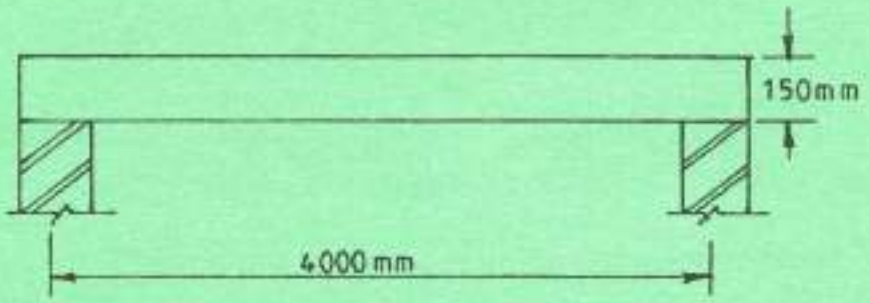

Fig. 03

$P = \frac{1}{2} e g h^2$

$= \frac{1}{2} \times 1000 \times 9.81 \times 1.6^2$

$= 12556.8$ acting at $\frac{1.6}{2} = 0.8$ m

ii) $w_1 = \frac{1}{2} \times 5 \times 1.6 \times 1 \times 9.81 \times 25$

$= 98.1$ KN/m run

$w_2 = 3 \times 5 \times 1 \times 9.81 \times 25$ KN

$= 3675.75 \times 10^3$

$\bar{x}_1 = 3 + \frac{2}{3}(5) = 6.33$

$\bar{x}_2 = 2.5$

$\bar{x} = w_1 \bar{x}_1 + w_2 \bar{x}_2$

$= 98.1 \times 6.33 + 3675.75 \times 2.5$

$= 15409.5$

SECTION B: GEOTECHNOLOGY II

Answer any TWO questions from this section.

4. (a) Define the following terms as applied to geological structures:

(i) faults;
(ii) folds. (4 marks)

(b) Explain the following physical weathering processes on rocks:

(i) temperature;
(ii) frost action;
(iii) decay biogenic product. (9 marks)

(c) Outline any **two** geological effects caused by faults. (7 marks)

5. (a) Define the term quarrying. (2 marks)

(b) State any **five** factors to consider when locating a quarry site. (5 marks)

(c) Differentiate between hard and soft rocks. (4 marks)

(d) Describe the following:

(i) weak zone; (3 marks)
(ii) seismic velocity. (6 marks)

6. (a) State any **three** purposes of constructing the following:

(i) tunnels;
(ii) dams. (6 marks)

(b) Explain any **three** geological problems that can be encountered when tunnelling. (6 marks)

(c) Outline any **four** factors to consider when selecting a site for a dam. (8 marks)

SECTION C: CONCRETE TECHNOLOGY II

Answer ONE question from this section.

7. (a) State any **two** uses of concreting plants. (2 marks)

(b) Describe the following types of concreting plants:

(i) dumpers;
(ii) trucker mixers. (8 marks)

(c) A mixer at a central batching plant has an average output of 90 m³ and is to be used exclusively to fill a mass foundation of 3000 m³ total volume. The round trip including filling and unloading of each dumper with 0.5 m³ concrete is an average of 8 minutes.

Given the following data:

- average capacity of a dumper per trip is 0.5 m³ concrete at 200/= per hour;
- plant operator costs = 50/= per hour;
- working week = 5 days @ 9 hours per day;
- labour for mixing, laying and concreting is encountered elsewhere.

Determine approximate:

(i) number of dumpers;
(ii) number of days;
(iii) cost of using dumper per hour. (10 marks)

8. (a) State any **three** requirements to consider when providing for joints in a concrete structure. (3 marks)

(b) With the aid of sketches, describe the following:

(i) expansion joints;
(ii) contraction joints. (12 marks)

(c) Outline the procedure of fixing a pre-cast concrete column to a pre-cast pad foundation. (5 marks)

: 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

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