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;
    scientific calculator.
This paper consists of EIGHT questions in THREE sections; A, B and C.
Answer at least TWO questions from sections A and B and ONE question from section C.
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.

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SECTION A: STRUCTURES II

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

1. (a) **Figure 1** shows a loaded beam. Using MaCauley's method, determine the deflection and slope under points C and D. (12 marks)
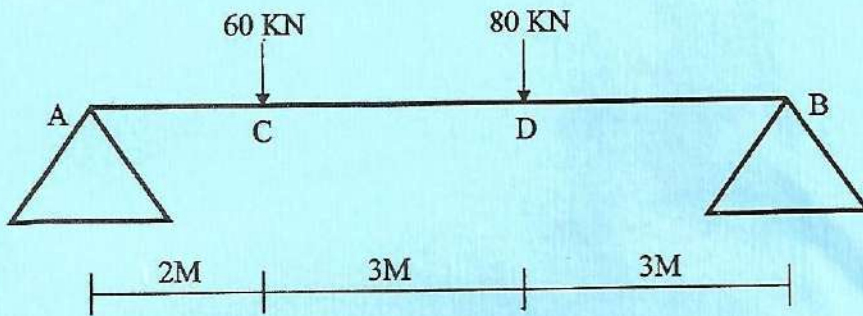
Take E = 210 KN / MM²

I = 160 x 10⁶ MM⁴

Fig. 1

(b) Using Mohr's theorem, derive the expression for the maximum slope and deflection for a simply supported beam of the span L carrying a uniformly distributed load of WkN/m over the entire span. (8 marks)

2. (a) Illustrate using sketches, three failure criteria of retaining walls. (6 marks)

(b) **Figure 2** shows a cross section of a concrete gravity retaining wall which retains a cohesionless soil of two different densities whose angle of repose is 29°. Determine the position of the resultant lateral thrust.

Take density of soil 1 = 2 000 kg/m³
soil 2 = 2 400 kg/m3 (14 marks)

Soil 1 = 2000 kg/m³ (Ø)

Soil 2 = 2400 kg/m³ (Ø)
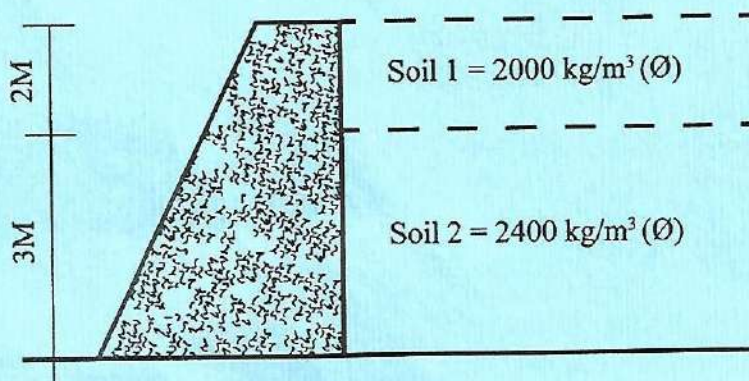
Fig. 2

3. (a) **Figure 3** shows an loaded column eccentrically section. Determine the stress in face AB and CD. (6 marks)
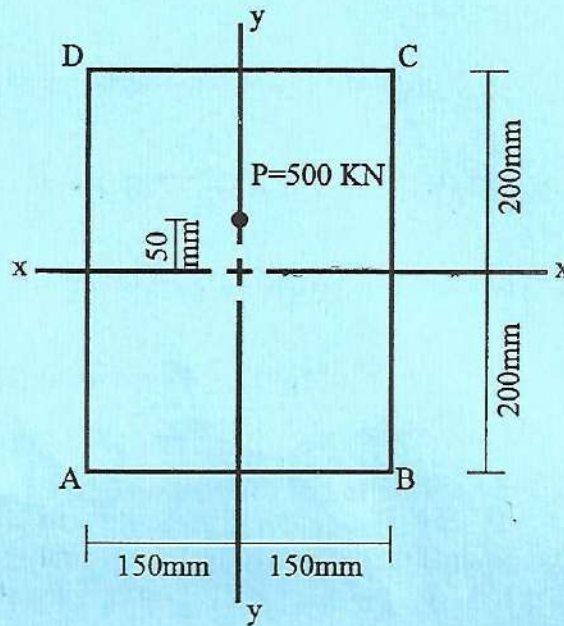
Fig. 3

(b) Design a simply supported rectangular beam for bending and shear. Use the following information.

Overall depth of beam = 600 mm
Breadth of the beam = 300 mm
Clear span of beam = 4850 mm
Breadth of supporting column = 150 mm

fcu = 35 N/mm2
fy = 460 N/mm2
fyv = 250 N/mm2

Dead load = 25 KN/m (exclusive of self weight)
Imposed load = 20 KN/m.
Provide T25 for main reinforcement
R10 for shear reinforcement
Exposure condition is mild. (14 marks)

2705/202
2707/202
2709/202
2710/202
June/July 2023

3

Turn over

SECTION B: GEOTECHNOLOGY II

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

4. (a) State **four** functions of tunnels. (4 marks)

    (b) Describe **four** geological problems encountered during tunneling process.

    (8 marks)

    (c) Describe **four** process of physical weathering. (8 marks)

5. (a) List **four** physiographical evidence used in recognizing faults in the field.

    (4 marks)

    (b) Describe **four** geological factors that are considered when selecting a site for dam construction. (8 marks)

    (c) Describe **four** types of sub-surface geological maps. (8 marks)

6. (a) List **four** types of quarries. (4 marks)

    (b) Describe **four** methods that are used in selecting a suitable quarry site.

    (8 marks)

    (c) Outline **four** limitations of using blasting as a method of quarrying stones.

    (4 marks)

    (d) Outline **four** precautions taken while using blasting as a quarrying method.

    (4 marks)

SECTION C: CONCRETE TECHNOLOGY

Answer at least ONE question from this section.

7. (a) State:

    (i)   **three** advantages of using plant in transporting concrete;
    (ii) **three** disadvantages of using the plant in transporting concrete.   (6 marks)

    (b) State **four** measures to be taken into account when concreting in hot weather.

                                                                                      (4 marks)

    (c) Distinguish between pre-tensioning and post tensioning of concrete units.   (10 marks)

8. (a) State **six** reasons for use of precast concrete units.   (3 marks)

    (b) Outline four factors that determine the location of construction joint.   (4 marks)

    (c) Sketch and label the following joints in construction:

    (i)   contraction joint;   (7 marks)

    (ii) expansion joint.   (6 marks)

Table 1: Values of design concrete shear stress, v_c (N/mm^2)

$\dfrac{100As}{bd}$	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 (mm^2)

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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