

2705/202 2709/202

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STRUCTURES II, GEOTECHNOLOGY II AND  
CONCRETE TECHNOLOGY II

June/July 2021

Time: 3 hours

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RAMOGI INSTITUTE OF  
ADVANCED TECHNOLOGY  
P. O. Box 1738, KISUMU



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING CONSTRUCTION  
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 section A and B and ONE question from section C.*

*All questions carry equal marks.*

*Maximum marks for each part of a question are as indicated.*

*Candidates should answer the questions in English.*

**This paper consists of 5 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**



**SECTION A: STRUCTURES II**

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

1.

(a) State two Mohr's theorems for slope and deflections of beams. (4 marks)

(b) A timber beam of rectangular section 100 mm wide and 240 mm deep is simply supported over a span of 4 m. Determine the uniformly distributed load that the beam should carry in order to produce a deflection of 6 mm at the mid span.

Take  $E = 11 \text{ kN/mm}^2$  (10 marks)

(c) Simply supported beam of span 1.5 m is subjected to a point load of 10 kN at mid span. Find the maximum deflection of the beam if  $E = 200 \text{ kN/mm}^2$ .

Take  $I$  for the beam as  $12.1 \times 10^6 \text{ mm}^4$ . (6 marks)

2.

A mass concrete dam shown in figure 1 has a trapezoidal cross-section. The height above the foundation is 62 m and its water face is vertical. The width at the top is 4.5 m and base width is 36.35 m. Determine the maximum stress and minimum stress at the base.

(20 marks)

Take:

Unit weight of concrete =  $23 \text{ kN/m}^3$

Unit weight of water =  $9.81 \text{ kN/m}^3$

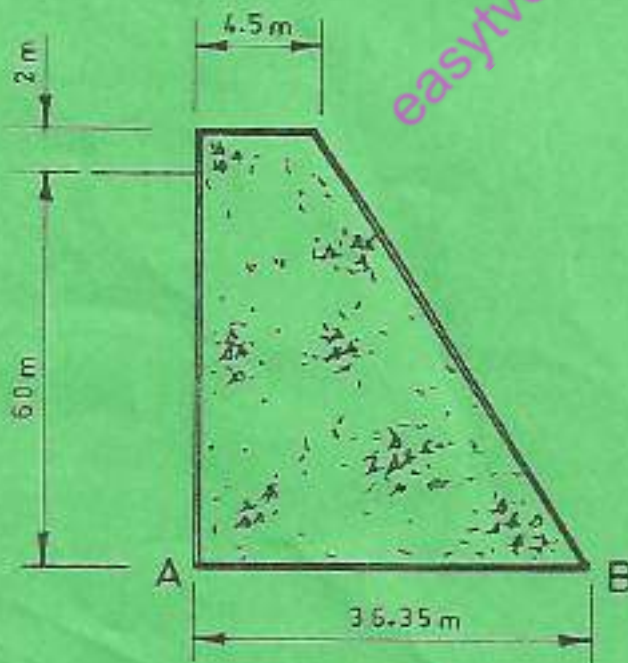
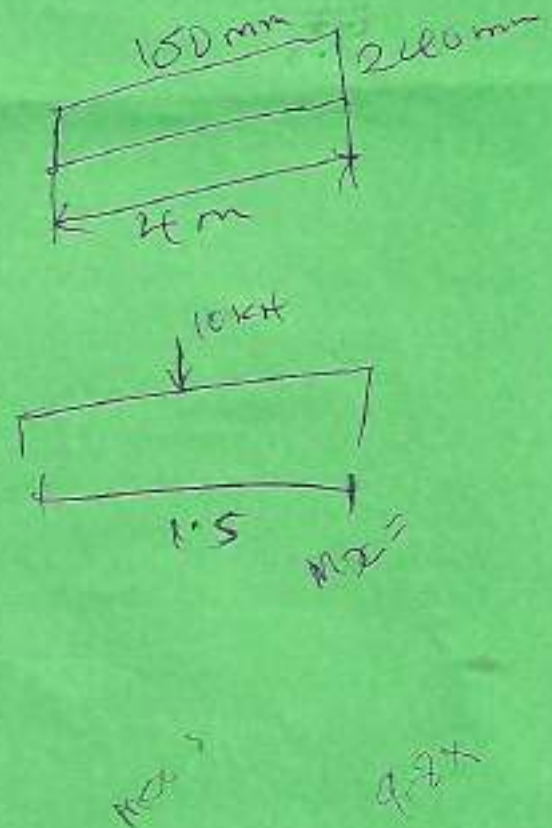


Fig. 1





3. A reinforced concrete column is to carry an axial load of 950 kN. Design and detail the column given the following data:

$$f_y = 460 \text{ N/mm}^2$$

$$f_{ck} = 35 \text{ N/mm}^2$$

Area of main bars = 1% of gross cross-sectional area of column.

Assume a square column.

effective height = 3.5 m.

(20 marks)

### SECTION B: GEOTECHNOLOGY II

Answer TWO questions from this section.

- 4
- (a) Outline four purposes of dams. *Domestic use & industrial, flood control, for HEP, Recreation.* (6 marks)
- (b) Name four types of dams. *gravity* (4 marks)
- (c) Explain four factors affecting selection of a dam site. *Height of the dam, topography, geotechnical condition of site, site accessibility.* (6 marks)
- (d) Explain the following structures: (4 marks)
- (i) cofferdams; -
  - (ii) an overflow spillway.
- 5
- (a) (i) Define the term fault. *a line on rocks mass caused by tectonic force.* (2 marks)
- (ii) Explain four features that may be used to recognize faults in the field. (4 marks)
- (b) Describe four types of faults. *Normal, reverse.* (4 marks)
- (c) Explain four effects of ground movement due to faulting on constructed structures. (6 marks)
- (d) Describe the following tunnel support systems: (4 marks)
- (i) passive support system;
  - (ii) active support system.



- 6.
- (a) (i) Explain the term 'quarrying' as used in construction. (2 marks)
  - (ii) Describe **three** methods of rock excavation. (6 marks)
  - (b) Explain **four** effects of quarrying on the environment. (8 marks)
  - (c) (i) State **four** features of topographical maps. (2 marks)
  - (ii) State **four** uses of geological maps. (2 marks)

### SECTION C: CONCRETE TECHNOLOGY II

*Answer at least ONE question from this section.*

- 7.
- (a) State **four** advantages of precast concrete in slab construction. (4 marks)
  - (b) State **four** requirements for each of the following:
    - (i) expansion joints;
    - (ii) contraction joints. (8 marks)
  - (c) Define the following terminologies associated with prestressed concrete:
    - (i) tendon;
    - (ii) anchorage;
    - (iii) pre-tensioning;
    - (iv) post tensioning. (8 marks)
- 8.
- (a) Explain the method of concrete in hot weather. (4 marks)
  - (b) Explain the uses of the following concreting plants:
    - (i) vibrators;
    - (ii) central mixing plant;
    - (iii) dumpers;
    - (iv) conveyors;
    - (v) truck mixers. (10 marks)
  - (c) Outline **four** methods of conveying concrete when concreting under water. (6 marks)



Reinforcement-bar areas ( $\text{mm}^2$ ) 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 ( $\text{mm}^2$ )

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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Hand  
- Mid  
- Plate

BC - skip method  
- Pumping technique  
- Pneumatic  
- Tremie

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