



2705/202

2707/202

2709/202

2710/202

**STRUCTURES II, GEOTECHNOLOGY II  
AND CONCRETE TECHNOLOGY II****Oct./Nov. 2017****Time: 3 hours****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;**Drawing instruments;**Scientific calculator**This paper consists of EIGHT questions in THREE sections; A, B and C.**Answer FIVE questions choosing THREE questions from section A, ONE question from section B and ONE question from section C in the answer booklet provided.**Maximum marks for each part of a question are as indicated.**Candidates should answer the questions in English.***This paper consists of 4 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

Answer **THREE** questions from this section.

1. (a) Describe each of the following in the design of engineering structures:

- (i) ultimate limit state;
- (ii) serviceability limit state.

(4 marks)

- (b) Using BS 8110 design the longitudinal steel and links for a square column of dimension 250 x 250 mm thick. The column is short and braced and is to carry an axial load of 1350 kN with the following material properties:

$$f_{cu} = 30 \text{ N/mm}^2$$

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

(16 marks)

2. (a) State the Mohr's first and second theorems. (2 marks)

- (b) Using Mohr's method, derive the expression for the maximum slope and deflection for a simply supported beam of span  $L$ , carrying a uniformly distributed load of  $w$ /unit length over the entire span. (8 marks)

- (c) A simply supported beam of span 6 m carries a point load of 450 kN at the midspan. Using Mohr's theorem calculate:

- (i) the maximum slope;
- (ii) the maximum deflection;
- (iii) the deflection of the beam at 1.4 m from either end.

Take:  $E = 205 \text{ kN/mm}^2$

$$I = 2.1 \times 10^9 \text{ mm}^4$$

(10 marks)

3. (a) A reinforced concrete floor is subjected to an imposed load of 4 kN/m and spans between break walls as shown in figure 1. Design the floor with a concrete cover of 25 mm.  $f_{cu} = 35 \text{ N/mm}^2$  and  $f_y = 460 \text{ N/mm}^2$ .

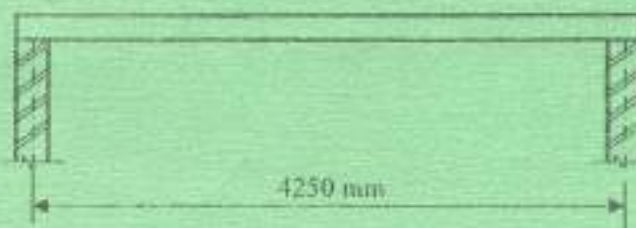


Fig. 1

(16 marks)

- (b) Detail the slab design in question 3(a) above. (4 marks)

4. (a) Determine the resultant if tension occurs at the base when a lateral thrust of uniform wind pressure acts on the wall shown in figure 2.  
Take density of wall as  $2000 \text{ kg/m}^3$ .

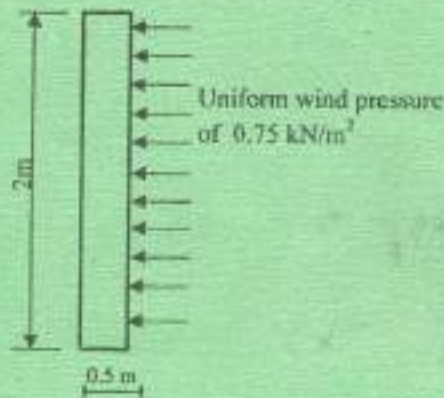


Fig. 2



(14 marks)

- (b) With aid of sketch clearly elaborate **three** critical modes of failure of a retaining wall. (6 marks)

### SECTION B: GEOTECHNOLOGY

Answer **ONE** question from this section.

5. (a) (i) Define the term weathering. (1 mark)
- (ii) Describe **three** processes of physical weathering. ( $4 \frac{1}{2}$  marks)
- (b) (i) State **three** purposes of tunneling. (3 marks)
- (ii) Briefly describe **three** geological defects that may be encountered during tunnel construction. ( $4 \frac{1}{2}$  marks)
- (c) (i) With aid of sketches describe **two** types of faults. (5 marks)
- (ii) Outline **two** physiographical evidences used in recognizing faults in the fields. (2 marks)
6. (a) State **six** geological factors considered for selection of a dam site. (6 marks)
- (b) (i) Briefly explain **three** methods used in prospecting for suitable quarries. ( $4 \frac{1}{2}$  marks)
- (ii) Outline the excavation method used in hardrock quarries. ( $1 \frac{1}{2}$  marks)

- (c) With reference to **figure 3** draw a geological cross-section of A-B. (8 marks)

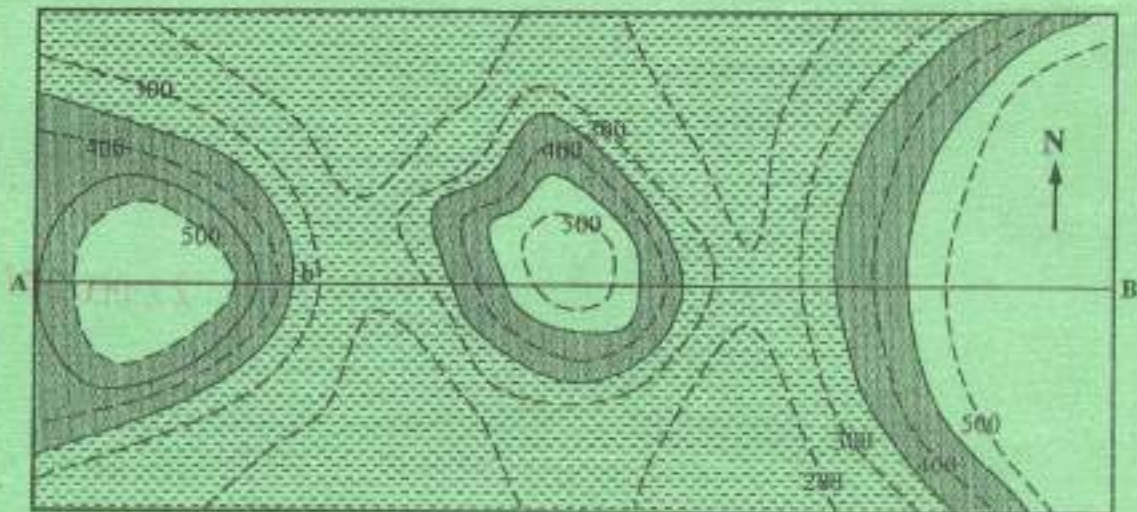


Fig. 3

### SECTION C: CONCRETE TECHNOLOGY II

*Answer ONE question from this section.*

7. (a) Briefly describe the tremie pipe method of concreting underwater. (8 marks)
- (b) (i) State six routine maintenance measures of a concrete batching and mixing plant. (6 marks)
- (ii) State three advantages of tilting drum mixes. (3 marks)
- (c) Briefly explain three safety gears that should be worn on a concreting site. (3 marks)
8. (a) Briefly describe two methods of pre-stressing concrete. (4 marks)
- (b) Outline four factors that may lead to failure of prestressed concrete. (8 marks)
- (c) (i) State two factors that determine the need of joints in concrete pavement. (2 marks)
- (ii) Briefly describe three types of concrete pavements. (6 marks)

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