2705/202 2709/202
2707/202 2710/202
STRUCTURES II, GEOTECHNOLOGY II AND
CONCRETE TECHNOLOGY II
June/July 2018
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:*
*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.**



**Turn over**

## SECTION A: STRUCTURES II

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

1. (a) **Figure 1** shows a loaded beam. Using Macaulay's method, determine the deflection and slope under point C. (12 marks)

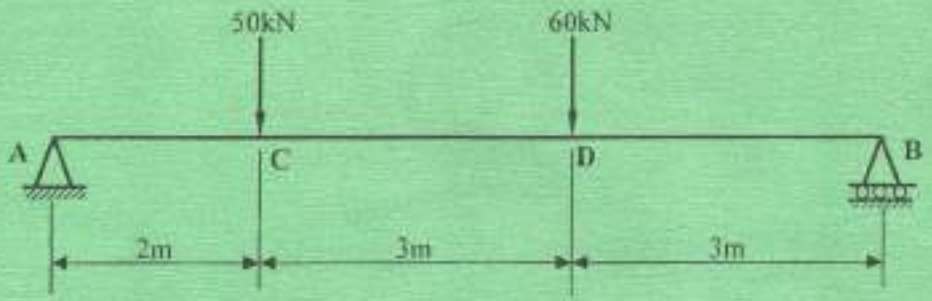


Fig. 1

(b) **Figure 2** is a retaining wall. Determine:

(i) tension in the joints;

(ii) pressure at the toe and heel.

Given:

(I) unity weight of masonry wall = 24 kN/m$^3$;

(II) unity weight of water = 10 kN/m$^3$. (8 marks)

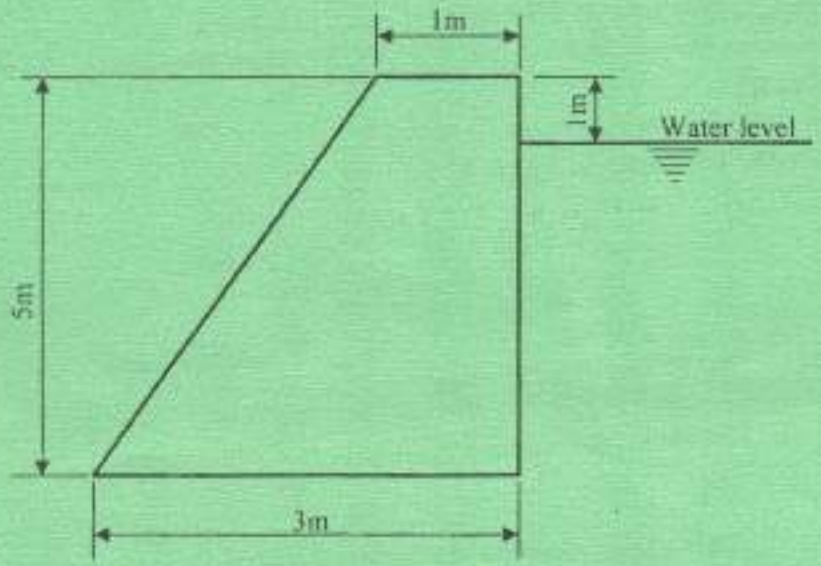


Fig. 2

2. (a) **Figure 3** shows a loaded cross-section of a column. Determine the stresses in face AB and CD. (6 marks)

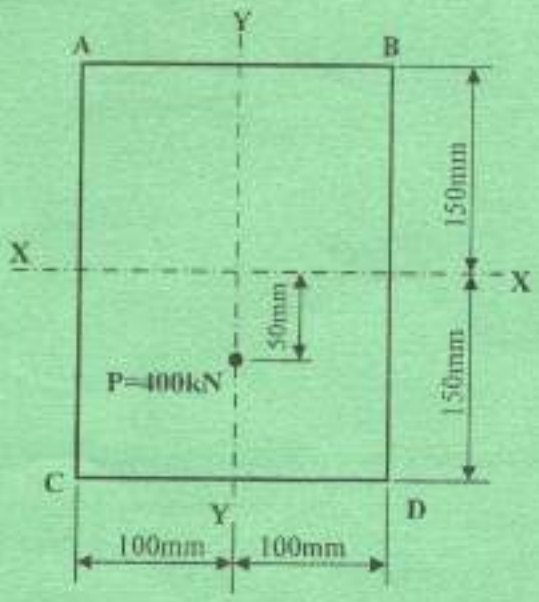


**Fig. 3**

(b) (i) A rectangular beam of section 200 mm x 500 mm is reinforced with 5 No. Y 20 bars, concrete cover being 25 mm, and effective span 8 m. Determine the allowable distributed load it can carry over the entire span, given:

Lever arm = 0.95 d.
$f_y = 460\ N/mm^2$.

(ii) A short braced column 300 mm x 300 mm and 7 m long is fixed at both ends and carries an axial load of 1500 kN. Design and detail the column given the following information:

Data:

$f_{cu} = 30\ N/mm^2$
$f_y = 460\ N/mm^2$ (for longitudinal bars)
$f_{yv} = 250\ N/mm^2$ (for transverse bars). (14 marks)

3. Design a continuous one way spanning slab shown in **figure 4** given the following details:

Data:

Imposed load = 4 kN/m²
Finishes = 0.8 kN/m²
$f_{cu}$ = 35 N/mm²
$f_y$ = 460 N/mm²
Slab thickness = 150 mm
Unity weight of concrete = 24 kN/m³ (20 marks)

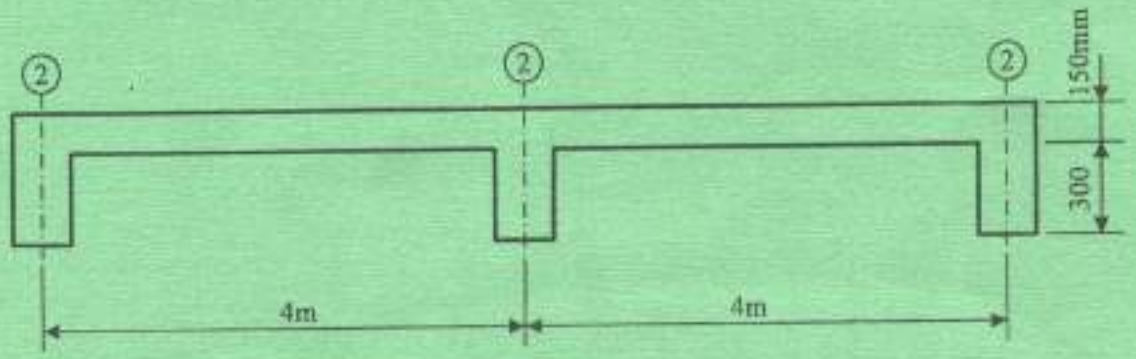


**Fig. 4**

(5b) Oxidation → The most common substance is the oxidation of iron and combination with oxygen and water to form $Fe^{2+}$ hydroxides and oxides. This gives the affected rocks a reddish brown coloration at the surface which crumbles easily and weakens the rocks.

Hydration → This involves the rigid attachment of the OH- ions to the atoms and molecules of a mineral.
- when rocks minerals take up water the increased volume creates physical stresses within the rock thus causing breaks of rocks.

Frost → When water has entered the joints freezes twice formed strains the walls of the joints and causes the joints to deepen and widen. When the ice thaws, water can flow into the rock
- Repeated freeze-thaw cycles weakens the rocks causing them to break up along the joints into angular pieces.

Granular → It is a form of weathering where the surface of a rock becomes loosened and particles tend to leave a pitted, uneven surface.

## SECTION B: GEOTECHNOLOGY II

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

4. (a) (i) Explain **three** classes of dams according to their uses.

(ii) State **five** factors considered in selecting a site for a dam. (11 marks)

(b) (i) Explain the term 'alignment' as used in tunnels.

(ii) With the aid of sketches, describe **two** methods of tunnelling in soft ground. (9 marks)

5. (a) With the aid of sketches, describe how the following geological faults are formed:

(i) normal faults;

(ii) reverse faults. (8 marks)

(b) Describe the following processes of weathering:

(i) granular disintegration;

(ii) oxidation;

(iii) frost action;

(iv) hydration. (12 marks)

6. (a) Describe **four** precautions taken before blasting is undertaken in a quarry. (8 marks)

(b) Describe the following terms as used in geological maps:

(i) dip;

(ii) strike. (6 marks)

(c) Describe **three** engineering geological map features. (6 marks)

## SECTION C: CONCRETE TECHNOLOGY II

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

7. (a) State **three** advantages and **three** disadvantages of precast concrete over the insitu concrete. (6 marks)

(b) State **four** effects caused by high temperatures in setting of concrete. (4 marks)

(c) (i) List **three** factors to be taken into consideration when selecting the type of concrete mixer.

(ii) With the aid of a sketch, describe the operation of reversing drum mixer. (10 marks)

8. (a) Differentiate between pre-tensioning and post-tensioning in prestressed concrete. (10 marks)

(b) With the aid of a sketch, describe the construction procedure of an expansion joint. (10 marks)

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