2307/306
CIVIL ENGINEERING
CONSTRUCTION AND DRAWING
Oct./Nov. 2011
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN CIVIL ENGINEERING

CIVIL ENGINEERING CONSTRUCTION AND DRAWING

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;
Drawing instruments;
Drawing paper size A2;
Scientific calculator.

*This paper consists of **EIGHT** questions in **TWO** sections **A** and **B**.*
*Answer **FIVE** questions choosing **FOUR** questions from section **A** and **ONE** question from section **B**.*
*Questions in section **A** carry 15 marks each while those in section **B** carry 40 marks each.*
Maximum marks for each part of a question are as shown.

This paper consists of 5 printed pages.

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

Turn over

SECTION A: CIVIL ENGINEERING CONSTRUCTION

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

1. (a) (i) State **four** factors that affect the design period of a water supply scheme.

(ii) Describe **two** methods used in forecasting the population in the design of a water supply scheme.

(6 marks)

(b) (i) State **four** objectives of water treatment.

(ii) Describe each of the following water treatment processes:

- screening;
- disinfection.

(6 marks)

(c) State **three** advantages and **three** disadvantages of pressure filters. (3 marks)

2. (a) Define the following terms used in sewerage:

(i) dry weather flow;

(ii) biochemical oxygen demand.

(3 marks)

(b) Outline **four** performance criteria considered in management of waste water systems. (6 marks)

(c) State **four** factors considered in the selection of a site for sewage treatment works. (2 marks)

(d) (i) State **three** objectives of sedimentation in sewage treatment.

(ii) Sketch and label a section through a sedimentation tank for sewage treatment. (4 marks)

3. (a) (i) Distinguish between "cofferdam" and "caisson".

(ii) State **four** factors considered in the selection of a suitable cofferdam.

(iii) Sketch and label the following:

- crib cofferdam;
- box caisson

(10 marks)

(b) (i) State **three** factors considered before tunnelling.

(ii) With the aid of a labelled sketch, describe the "pilot tunnel method". (5 marks)

4. (a) (i) State **four** factors considered in selecting a site for a dam.

(ii) Sketch and label a rockfill dam with an R.C. impermeable face. ($4\frac{1}{2}$ marks)

(b) (i) Define the term "spillway".

(ii) Sketch and label the following:

- ogee spillway;
- siphon spillway.

(5 marks)

(c) With the aid of a sketch, describe an "artesian well". ($5\frac{1}{2}$ marks)

5. (a) (i) State **three** comparisons between flexible and rigid pavements.

(ii) Sketch and label a section through a rigid pavement. (6 marks)

(b) Sketch and label the following railway components:

(i) rail chairs;
(ii) bearing plates.

(3 marks)

(c) With the aid of a sketch, describe sea walls. (6 marks)

6. (a) With the aid of sketches describe the following types of bridges:

(i) swing bridges
(ii) non-submersible bridge

(6 marks)

(b) Describe situations where the following types of foundations are applied:

(i) raft foundations;
(ii) wide strip foundation;
(iii) pile foundation.

(6 marks)

(c) Explain water control by freezing technique. (3 marks)

SECTION B: CIVIL ENGINEERING DRAWING

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

7. (a) To a scale of 1:20, draw the sectional elevation and plan for a square cesspool given the following data: (20 marks)

Data

Internal size of cesspool	–	2.5 m x 2.5 m
Thickness of external wall	–	200 mm engineering brick
Thickness of concrete cover slab	–	100 mm
Depth of liquid below inlet	–	1750 mm
Free board	–	300 mm
Thickness of concrete base slab	–	150 mm
Hardcore filling at the bottom	–	200 mm

Assume any other relevant information

(b) To a scale of 1:25 draw a vertical section through a reinforced concrete cantilever retaining wall given the following data: (20 marks)

Data

Overall width of footing	–	2750 mm
Thickness of footing base	–	425 mm
Key size	–	775 mm x 250 mm
Distance of key from face to edge of vertical stem	–	1075 mm
Height of vertical stem above top of footing	–	5000 mm
Width of vertical stem	–	150 mm at top and varying to 425 mm at the base / stem intersection

Reinforcement

Base

Main bars Y 20 @ 200 c/c Top

Stem

First one meter above base: Main - Y 20@ 100 c/c Distribution Y 10 @ 125 c/c

Over 1 m above base: main - Y 20 @ 200 c/c

Toe

main Y 20 @ 275 c/c

Distribution Y 10 @ 125 c/c

Assume any other relevant data.

8. (a) A framed building measuring 10.5 m x 8.0 m c/c of external columns is to be built on a site requiring beam and slab raft foundation. The building is divided into panels 3.5 m x 4 m with 300 mm x 300 mm columns at intersections. Using the data given, draw to a scale of 1:50:

(i) plan;

(ii) longitudinal cross section.

(20 marks)

Data:

Projection of slab from centre of external columns	–	650 mm
Thickness of slab	–	200 mm
Upstand beams	–	300 mm x 600 mm deep

(b) To scale of 1:20 and using the following data, draw a part section through a basement wall and slab to show external tanking details. (20 marks)

Data

Thickness of suspended ground floor slab in 1:3:6 mix.	–	150 mm
Depth from ground floor slab to ground level.	–	230 mm
Solid concrete blockwall external leaf	–	100 mm thick
Reinforced concrete wall	–	200 mm thick
Waterproof plaster on RC wall	–	30 mm
Reinforced concrete floor slab, on 30 mm thick horizontal asphalt.	–	200 mm thick
Concrete plain concrete bed	–	150 mm thick
Width of foundation	–	1200 mm
Thickness of foundation	–	450 mm
Projection from edge of foundation to face of solid concrete blockwall.	–	340 mm
Height of vertical wall from top of foundation to ground level.	–	2200 mm
Vertical mastic asphalt	–	20 mm thick