

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.**

## 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. (4½ 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". (5½ 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