THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE

IN CIVIL ENGINEERING

ECE 2414: FOUNDATION ENGINEERING II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011
TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer booklet*
- *Scientific Calculator*
- *Drawing Instruments*

This paper consists of **FIVE** questions
Answer question **ONE (COMPULSORY)** from **SECTION A** and any other **TWO** questions from **SECTION B**
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1 (30 marks)

a) (i) State any **FIVE** factors considered in the selection of piles (5 marks)
    (ii) Define the term 'negative skin friction' (2 marks)

b) A R.C.C pile of 10M overall length is driven into a deep stratum of soft clay having unconfined compressive strength of $3.5t/m^2$. The diameter of the pile is 30cm. Determine the safe load that can be carried by the pile with a factor of safety of 3.0 given $\propto$ = 0.95 (8 marks)

c) With the aid of sketches, illustrate:

(i)   Semi-gravity retaining wall
(ii)   Counterfort retaining wall   (5 marks)

d) Figure 1 shows the details of a cantilever retaining wall. Determine :
   (i)   The maximum and minimum pressures under its base
   (ii)   The factor of safety against sliding

$$\phi = 40^o$$

Given c = 0   , unit weight of soil γ = 17KN/m³, unit weight of concrete δ = 23.5KN/m³,
=30° at the base of the wall   (10 marks)

Fig. 1   Cantilever retaining wall

SECTION B (Answer any TWO questions from this section)

Question 2 (20 marks)

a) Briefly describe the following methods of providing support in the construction of piers
   (i)   The Gow method
   (ii)   The Chicago method   (4 marks)

b) (i) State any **FIVE** advantages and **THREE** disadvantages of Drilled piers   (5 marks)
   (ii) Determine the outside diameter of an open caisson to be sunk through 40m of sand and water
   to bed rock if the allowable bearing capacity is 200t/m² .

   The caisson receivers a load of 5000t from the super structure. The mantle friction is 3.0t/m2.
   Test the feasibility of sinking and also calculate the thickness of the seal.

   Assume γ_c=2.4t/m² and δ_c = 350t/m²   (11 marks)

Question 3 (20 marks)

a) With the aid of diagrams, illustrate the following types of footings
    (i)   Strap footing
    (ii)   Isolated footing
    (iii)   Combined footing   (6 marks)

b) (i) State any **SIX** factors that govern the depth of a footing   (6 marks)

   (ii) Design a reinforced cement concrete footing for a 1M wide concrete wall carrying a load of 80t/m. The allowable soil pressure is $20t/m^2$.   (8 marks)

Question 4 (20 marks)

a) Briefly describe the following types of cofferdams:
    (i)   Rockfill cofferdams
    (ii)   Braced cofferdams   (5 marks)

b) Briefly describe the following types of sheeting and Bracing systems
    (i)   Vertical Timber sheeting
    (ii)   Steel sheet piles
    (iii)   Soldier Beams   (6 marks)

c) Determine the forces in the struts for the bracing system shown in figure 2. Assume hinges at levels B, C and D. Take γ= 18kN/m³, c = 30kN/m² and s= 2.0m   (9 marks)

        Fig. 2

Question 5 (20 marks)

a) State **TWO** classification of piles based on load transfer modes   (4 marks)

b) A raft foundation has to be supported by a group of concrete piles. The gross load to be carried by the pile group is 250t, inclusive of the weight of the pile cap. The sub-soil consists of a 25M thick stratum of normally consolidated clay having unconfined compressive strength of $4.8t/m^2$ and effective unit weight of $0.9t/m^3$. Design the pile group with a factor of safety of 3 against shear failure. Given $\propto$ = 0.9 (16 marks)