



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

BACHELOR OF ENGINEERING IN BUILDING & CIVIL ENGINEERING
(BEBC)

[Institutional Based Programmes]

EBC 4404: FOUNDATION ENGINEERING II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions

Maximum marks for each part of a question are as shown

This paper consists of **TWO** printed pages

Question One (30 marks)

a) With the aid of neat sketches, illustrate the following types of cast-in-situ piles:

- (i) Straight bored pile
- (ii) Single bulb pile
- (iii) Multi-bulb pile

(9 marks)

b) A concrete pile of 40cm diameter is required to be driven into homogenous mass of cohesionless soil. The pile carries a safe load of 650kN. A static cone penetration test conducted at the site indicates an

$$q_c = 40 \text{ kg/cm}^2$$

average value of q_c along the pile and 120kg/cm² below the pile tip. Compute the length of the pile with $F_s = 2.5$

(11 marks)

c) (i) State any **THREE** advantages of standard Penetration Tests (SPT).

(ii) An R.C.C column footing of 5.8m x 1.8m size is founded at 1.5m below G.L. The subsoil consists of a loose deposit of silty sand having the following properties: $\gamma = 1.75t/m^3$, $\phi = 20^\circ$, $C = 1.1t/m^2$. Determine the ultimate bearing capacity of the footing when the ground water table is located 0.6m below ground level. **(10 marks)**

Question Two (20 marks)

a) (i) Briefly describe **FIVE** features contained in a borehole log. **(10 marks)**

(ii) The observed standard penetration test value in a deposit of a fully submerged sand was 45 at a depth of 6.5m. The average effective unit weight of the soil is $9.69kN/m^3$; hammer efficiency = 0.8; drill rod length correction factor = 0.9 and borehole correction factor = 1.05. Determine the corrected SPT value for standard energy

$R_{es} = 60\%$ and $R_{cs} = 70\%$ **(10 marks)**

Question Three (20 marks)

a) (i) Outline any **SIX** factors considered in the selection of piles.
(ii) Define the term "Negative skin friction" **(8 marks)**

b) A group of 9 piles with 3 piles in a row was driven into a soft clay extending from ground level to a great depth. The diameter and the length of the piles were 30cm and 10m respectively. The unconfined compressive strength of the clay is 70kPa. If the piles were placed 90cm c/c, compute the allowable load on the pile group on the basis of a shear failure criterion for a factor of safety of 2.5 **(12 marks)**

Question Four (20 marks)

The consolidation settlement of a new structure founded on a 5m thick layer is estimated as 6.5cm. The structure was found to have settled by 1.6cm in 6 months after the completion of the construction. If the clay layer is underlain by rock and overlain by a layer of coarse sand, determine:

- a) The time required for 50% consolidation to occur
- b) The amount of settlement which will take place in the next six months. **(20 marks)**

Question Five (20 marks)

- a) Briefly describe **THREE** disadvantages of field tests in determining soil bearing capacity. **(9 marks)**
- b) A strip footing 2m wide carries a load intensity of 400kPa at a depth of 1.2m in sand. The saturated unit weight of sand is $19.5kN/m^3$ and unit weight above water table is $16.8kN/m^3$.

$$\phi = 35^\circ$$

If $c = 0$ and $\gamma = 18 \text{ kN/m}^3$, determine the factor of safety when:

- (i) Water table is at Ground level
- (ii) Water table is 4m below ground level

Take $N_q = 41.4$ and $N_\gamma = 42.4$

(11 marks)