



TECHNICAL UNIVERSITY OF MOMBASA
**Faculty of Engineering &
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)

ECE 2406: FOUNDATION ENGINEERING I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- Answer Booklet
- Pocket Calculator

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

Use neat, large and well labeled diagrams where required

This paper consists of **TWO** printed pages

Question One (Compulsory)

- a) State **THREE** differences between Rankin's theory and Coulomb's theory in lateral earth pressure **(6 marks)**
- b) A strip footing 2.25m wide is located at a depth of 1.5m in cohesionless sand. The angle of internal friction of the sand is 38° . The unit weight of the sand above the water table is 18KN/m^3 and the saturated unit weight is 20KN/m^3 . Determine the ultimate bearing capacity. **(4 marks)**
Explain the working of a standard penetration test **(4 marks)**
- (i) If the water table is at the ground surface
 - (ii) If the water table is at foundation level
 - (iii)** If the water table is well below the foundation level **(8 marks)**

- c) Illustrate the THREE shear failure modes of soils for a strip footing **(6 marks)**

Question Two

- a) In lateral earth pressure draw the active and passive pressure distribution diagrams and indicate the locations of the active and passive pressures on the distribution diagrams **(8 marks)**
- b) The backfill behind a retaining wall above the water table consists of a sand of unit weight 17KN/m^3 having shear strength parameters $C'=0$ and $\phi = 37^\circ$. The height of the wall is 6m and the surface of the backfill is horizontal. Derive the equation for the total passive resistance from passive pressure expression according to Rankine's theory. Determine the depth it acts from the top of the wall **(8 marks)**
- c) Define a raft foundation, where applicable and the structural damage it minimizes **(4 marks)**

Question Three

- a) Explain the following types of settlements:
- (i) Elastic settlement **(2 marks)**
 - (ii) Consolidation settlement **(2 marks)**
 - (iii) Secondary settlement **(2 marks)**
- b) A series of plate load tests were conducted on THREE plates 300mm, 450mm and 600mm square plates. The loads and corresponding settlements in the linear portions of load-deflection curves are shown in the table below. Find the immediate settlement of a 2m square footing subjected to a load of 1000KN **(14 marks)**

| Plate Size (mm) | Load (KN) | Settlement (mm) |
|-----------------|-----------|-----------------|
| 300 x 300 | 4.50 | 1.00 |
| 450 x 450 | 8.71 | 1.50 |
| 600 x 600 | 14.40 | 2.00 |

Question Four

- a) Using illustrations, explain how a braced excavation works as an earth retaining structure **(6 marks)**
- b) State the purpose of sub-surface exploration and TWO types of sub-surface exploration **(6 marks)**
- c) In the general Terzaghi equation for ultimate bearing capacity, define the THREE terms contributing to the ultimate bearing capacity of a strip footing **(6 marks)**
- d) Differentiate between shoring and underpinning **(2 marks)**

Question Five

- a) Define the term dewatering and FIVE objectives of dewatering **(6 marks)**
- b) Explain with illustrations how a multistage well-point system works in dewatering the ground to enable excavation **(14 marks)**

