



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN CIVIL ENGINEERING

BCECD 312: FOUNDATION ENGINEERING

DATE:

TIME:

INSTRUCTIONS:

- *This paper consists of **Five** questions.*
- *Answer question **ONE** and any other **TWO** questions*
- *Maximum marks for each part of the question are as shown.*

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Define the following terms:

- Bearing Capacity
- Ultimate bearing capacity
- Safe bearing capacity (6 marks)

b) State six assumptions made in Terzaghi's bearing capacity theory.

(6 marks)

c) Explain the following types of soil compression:

- Elastic compression
- Primary compression
- Secondary compression (6 marks)

d) Outline the standard penetration test used in the determination of bearing capacity of soils.

(4 marks)

- e) A smooth backed vertical wall, 6m high retains a soil with a unit weight of 20kN/m^3 and an angle of repose of 20° . The top of the soil is level with the top of the wall and its surface is horizontal. It also carries a uniformly distributed load (surcharge) of 20kN/m^2 .
Using Rankine's theory, determine the resultant active lateral thrust on the wall and its point of application. (8 marks)

QUESTION TWO (20 MARKS)

- a) With the aid of sketches, describe three principal modes of shear failure in soils. (9 marks)
- b) A rectangular pad foundation, $2.0 \times 4.0\text{m}$ is founded at a depth of 1m below the surface of a deep stratum of saturated clay of unit weight 20kN/m^3 .
Undrained and consolidated undrained triaxial tests established the following soil parameters.
 $\phi_u = 0^\circ$, $c_u = 24\text{kN/m}^2$, $\phi' = 20^\circ$, $c' = 0$.
Determine the ultimate bearing capacity of the foundation:
- i Immediately after construction
 - ii Several years after construction (11 marks)

QUESTION THREE (20 MARKS)

- a) Illustrate three types of lateral earth pressures. (6 marks)
- b) Using Rankine's theory, determine the resultant thrust on a vertical retaining wall 4m high if the retained soil has a horizontal surface level with the top of the wall and has the following properties: Unit weight = 20kN/m^3 , angle of internal friction = 35° (14 marks)

QUESTION FOUR (20 MARKS)

- a) Explain four factors that influence the ultimate bearing capacity of a soil. (8 marks)
- b) A reinforced concrete foundation of dimensions $40\text{m} \times 20\text{m}$ exerts a uniform pressure of 200kN/m^2 on a semi-infinite layer.
Determine the value of immediate settlement under the foundation. $E = 50\text{MN/m}^2$. (12 marks)

QUESTION FIVE (20 MARKS)

A vertical retaining wall, 5m high retains a saturated soil with a unit weight of 22kN/m^3 and an angle of repose of 30° . The top of the soil is level with the top of the wall and its surface is horizontal. The ground water level is established at 2m from the top of the wall. Using Rankine's theory, determine the resultant active lateral thrust on the wall and its point of application and hence draw the pressure diagrams.