



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2414 FOUNDATION ENGINEERING II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 16 May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attempt question ONE (Compulsory) and any other TWO questions.

QUESTION ONE (COMPULSORY)

- a) Label the different parts of the reinforced earth structure shown on Figure Q1a

(4marks}

- b) With reference to the labeled sketch discuss likely failure mechanism and the basis of design of the earth retaining wall

(6marks}

- c) Details of a mass concrete retaining wall are shown on Figure Q1b. The unit weight of the masonry is 24kN/m^3 . The density of the retained soil is 18kN/m^3 . The safe bearing

capacity is 200kN/m^2 . The angle of friction for the backfill is 38° . The value of δ between the wall and the foundation is 25° .

Determine

The factor of safety against overturning

The factor of safety against sliding

The maximum and minimum pressures below the base

(15marks}

Aide memoir

$$q = \frac{P}{BL} \left(1 \pm \frac{6e}{L} \right)$$

Question Two

- a) Your client is politically correct and has acquired a plot in a steep forested area. He has engaged you as the foundation engineering consultant. Discuss the difficulties that you might experience in design of foundations of the palatial double storied home.

(8) Marks

- b) The vertical loads on columns A and B shown on Figure Q2 below are 500 and 1000kN respectively. The stratum on which the columns are to be founded is dense compact gravel. The estimated allowable bearing capacity of the strata is 200kN/m^2

Design

- i) A suitable combined trapezoidal foundation for the two column loads if the foundation cannot extend beyond the boundaries. **(8) Marks**
- ii) A suitable separate foundation for either column A or B **(4) Marks**

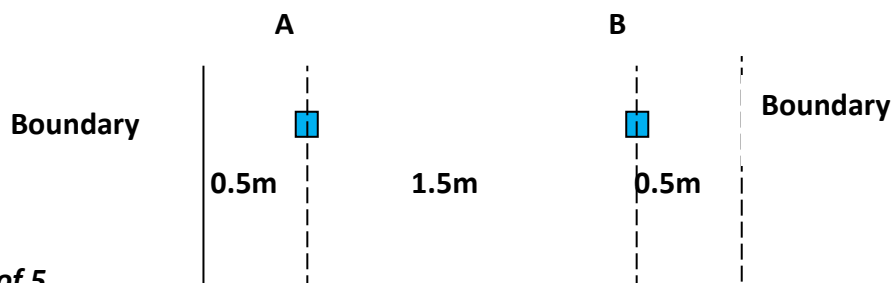


Figure Q2 Two Columns – General arrangement

Question Three

You have been assigned the task of designing the foundation of a 30 storied ultramodern office block for the Technical University of Mombasa with three basement levels. Site investigation for the site is summarised on Table Q2.

- a) Discuss the various methods of estimating the allowable bearing capacity of a rock stratum **[5 marks]**
- b) Discuss the foundation challenges for this site and make a proposal of a suitable foundation type. In particular:
 - ii) Critique different types of foundations and then propose one type of foundation
 - iii) Describe the construction procedure for the proposed foundation. **[10 marks]**
- c) With only the information given in Table Q2 design the foundation of a column in the teaching block whose working service load has been estimated at 12,000kN. **[5 marks]**

Table Q2 Site investigation summary

Material encountered	Depth range (m)	SPT N values	Unconfined compression strength (kN/m²)
Completely Weathered rock	0-12	20	-
Volcanic Ash	12-19	2	-
Weathered rock	19-22	50	-
Un-weathered Rock	22-30	-	20,000

[20marks]

Question Four

You have been appointed the project engineer for the proposed second Nyali Bridge. The bridge like the existing one is envisaged to be a long stressed type parallel to the existing bridge

Discuss: -

- i. The scope and detail of a site investigation needed to establish the geotechnical parameters for the design of the bridge foundations for the proposed bridge
- ii. The scope and detail of a site investigation needed for the preliminary design of the road pavement structure of the approach roads

[20marks]

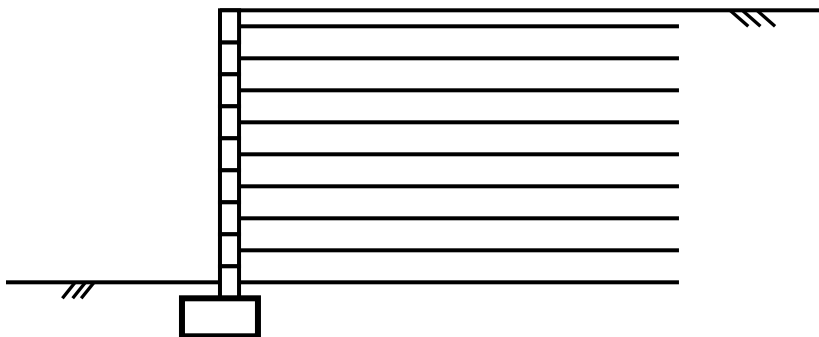


Figure Q1a Reinforced Earth

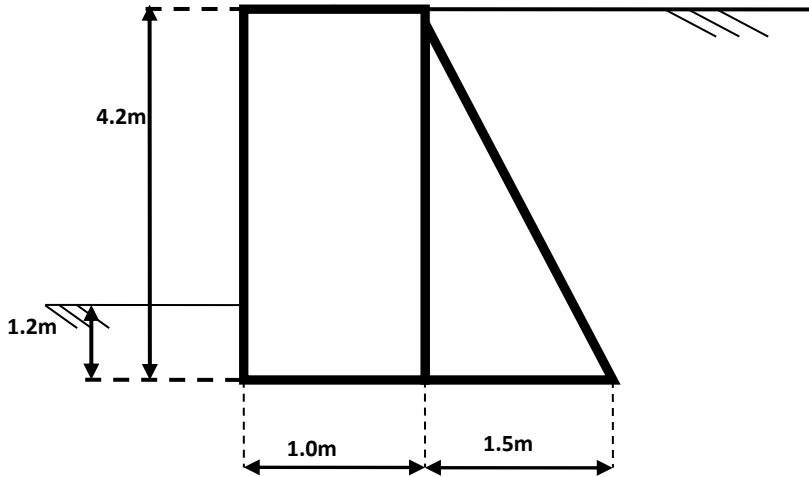


Figure Q1b. Mass concrete Retaining wall