TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECE 2508: GEOTECHNICAL ENGINEERING
SPECIAL SUPPLEMENTARY EXAMINATION
SERIES: SEPT. 2017
TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of five questions.
Answer question ONE (COMPULSORY) and any other TWO questions
Do not write on the question paper.

QUESTION ONE (COMPULSORY)

a) Briefly discuss the THREE field tests commonly used in sub-surface soil investigations. **(6marks)**
b) Outline the principal objectives of in-situ field testing. **(3marks)**
c) A soil sample in its natural state has a mass of 2.35kg and a volume of $1.15x10^{-3}{}_m{}^3$. Under an oven dried state, the dry mass of the sample is 2.035kg. The specific gravity of the solids is 2.68. Determine the following;-
   i) Total density **(1.5marks)**
   ii) Water content **(1.5marks)**
   iii) Porosity **(1.5marks)**
   iv) Degree of saturation **(2.5marks)**
   v) Void ratio. **(3marks)**
d) Highlight the areas of application for geotechnical engineering. **(3marks)**
e) Briefly discuss the main objectives of ground investigation. **(8marks)**

ATTEMPT ANY TWO QUESTIONS
QUESTION TWO

a) Discuss deformations of interest in embankment settlement. Use illustrations. (**8marks)**
b) Define "Frost Action" and how it can be mitigated. **(4marks)**
c) Describe the **Stages** of ground investigation prior to the design of major works. **(8marks)**

QUESTION THREE

a) An under-reamed bored pile is to be installed in stiff clay. The diameters of the pile shaft and under-reamer base are 1.05m and 3.0m respectively. The pile is to extend from a depth of 4m to a depth of 22m in the clay, the top of the under-reamer being at a depth of 20m. At the base level, the un-drained strength is 220kN/$m^2$and average value of un-drained strength between depths 4m and 18m is 130kN/m^2. The bearing capacity factor N_c is 9.0 and the adhesion coefficient α is 0.4. Determine;

i) The Ultimate load carrying capacity of the pile. **(4marks)**

ii) Allowable load when allowing for a factor of safety of 2 and 3 for side friction and base resistance respectively. **(3marks)**

b) What are the factors that determine tunnel stand-up time? **(5marks)**

c) Outline the main factors influencing choice of Tunneling methods. **(8marks)**

QUESTION FOUR

a) Describe three types of "Piles" according to their materials of composition. **(6marks)**

b) Briefly discuss **Four (4)** types of geo-synthetics. **(8marks)**

c) Using illustrations, describe the following structural features;

i) Bedding planes ii) Faults iii) Folds iv) Joints v) Dykes. (**6marks)**

QUESTION FIVE

a) Briefly discuss the factors affecting the choice of embankment type. **(15marks)**

b) Describe the following geo-mechanical properties of discontinuities;

i) Spacing ii) Persistence iii) Rock Quality Designation (RQD) **(5marks)**