



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR IN CIVIL ENGINEERING

ECV 301: SOIL MECHANICS I

DATE: 1/8/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS

Non programmable calculators may be used.

State the assumptions used if any.

Each question has 20 Marks except question

Any experimental procedures should conform to BS 1377

*Diagrams **MUST** be clearly labeled and non-conventional symbols used **MUST** be defined.*

*Answers question **any 3 questions**.*

Conventional symbols used carry the usual meaning unless defined in specific cases.

QUESTION ONE

Two planes A and B are separated by an unknown angle θ . On plane a σ_A and τ_B are 29 kPa and 3 kPa respectively. Plane A acts 20° from the horizontal as shown in **Figure 1**. The stresses on plane b; σ_B and τ_B are 25 kPa and -9 kPa respectively. Using well labelled neat scaled graphical work;

- a) Find major and minor principal stresses and their orientation (10 Marks)
- b) Find the stresses in the horizontal plane and evaluate the angle θ (10 Marks)

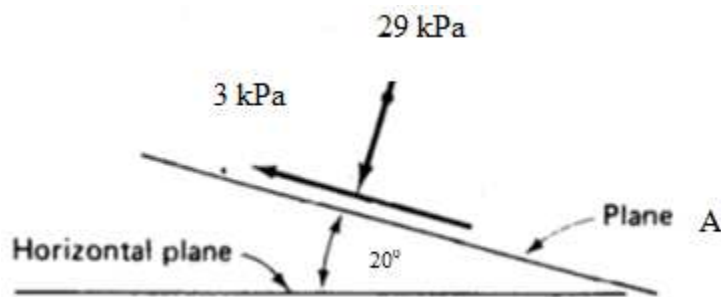


Figure 1

QUESTION TWO

- a) Using a well labelled diagram, describe the shear box test (15 Marks)
- b) Compare and contrast shear box test and triaxial test (5 Marks)

QUESTION THREE

- a) Calculate the factor of safety against shear failure along the slip circle using the $\phi=0$ method in Figure 2. Given the following data $c'=40 \text{ kN/m}^2$ $\gamma_{\text{sat}}=20 \text{ kN/m}^2$. (6 Marks)

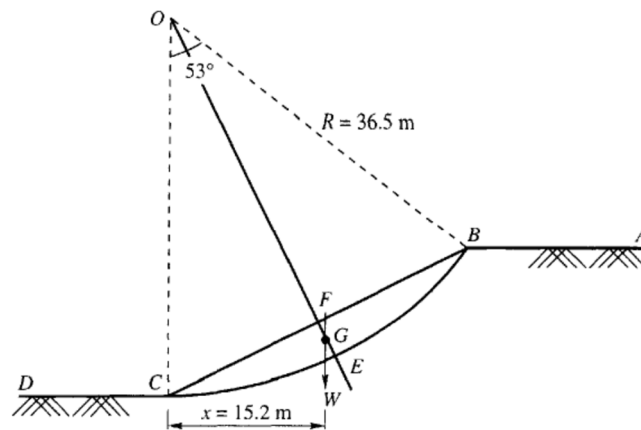


Figure 2

- b) Assume you had used the ordinary method of slices in a) above and got the same factor of safety. Given this slope is in your county and people are living down the slope, if you are the engineer responsible for advising your county government on policy; what would be your advice? Why? (3 Marks)
- c) Explain the following (6 Marks)
- Finite slopes
 - Infinite slopes
- d) List Five (5) possible causes of slope instability and failure? (5 marks)

QUESTION FOUR

- a) Discuss (8 Marks)
- Mechanical stabilization
 - Chemical stabilization
 - Modification
- b) Explain any **Four (4)** soil stabilizers (12 Marks)

QUESTION FIVE

- a) Discuss (18 Marks)
- i. Geosynthetics
 - ii. Geomembrane
 - iii. Geocell
 - iv. Geogrid
 - v. Landfill liners
 - vi. Earth nails
 - vii. Geofoam
 - viii. Geonet
 - ix. Geocomposite
- b) State any two applications of the above (2 Marks)