



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 3211 : SOIL MECHANICS II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: 15 Dec 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

-Drawing instruments.

This paper consists of five questions.

Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question One

(a) A soil specimen subjected to principal stresses fails in shear under increasing major principal stress. From basic principles, show that on the failure plane:

(i) *Normal stress* $\sigma_{\theta} = \sigma_1 \cos^2 \theta + \sigma_3 \sin^2 \theta$

(ii) *Shear stress* $\tau_{\theta} = \frac{(\sigma_1 - \sigma_3)}{2} \sin 2\theta$

Where σ_1 = major principal stress,

σ_3 = minor principal stress,

θ = inclination of shear plane to the major principal plane.

(20 marks)

(b)

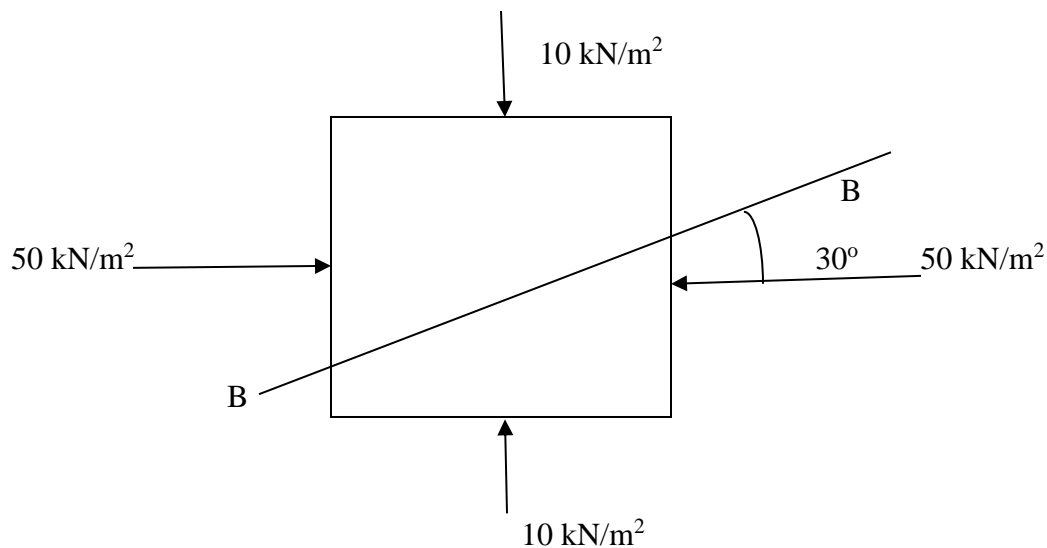


Figure 1.1: Soil mass subjected to principal stresses

Figure 1.1 shows a stressed soil mass. Graphically, determine the stresses on shear plane B-B

(10 marks)

Question Two

(a) On a failure plane, in a cohesionless soil mass, the stresses at failure were: shear 5 kN/m^2 ; normal 15 kN/m^2 .

Determine the:

- (i) resultant stress on the shear plane,
- (ii) angle of internal friction of the soil,
- (iii) angle of inclination of the failure plane to the major principal plane,
- (iv) magnitudes of the principal stresses that induced the shear failure.

(16 marks)

(b) Discuss the merits and demerits of the shear box test over triaxial test.

(4 marks)

Question Three

(a) With the help of a neat sketch, describe the triaxial soil shear test and state the soil types whose soil shear strength parameters can be investigated using it.

(5 marks)

(b) Table 3.1 contains data obtained from consolidated – undrained triaxial shear tests on clay soil. With respect to effective stresses, determine:

- (i) Cohesion
- (ii) Angle of internal friction

Table 3.1: Consolidated – undrained triaxial test results on clay

Cell pressure (kN/m ²)	At failure	
	Deviator stress q (kN/m ²)	Pore water pressure u (kN/m ²)
200	117	110
400	242	227
800	468	455

(15 marks)

Question Four

(a) State and explain any five information items of a site investigation report.

(10 marks)

(b) Name and explain any three methods of collecting soil samples from a prospective construction site for laboratory testing and analysis.

(6 marks)

(c) Name and briefly explain any two methods of soil stabilization.

(4 marks)