TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2311 : 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) $Shear\ stress\ \tau_\theta = \frac{(\sigma_1 - \sigma_3)}{2}\ sin2\Theta$
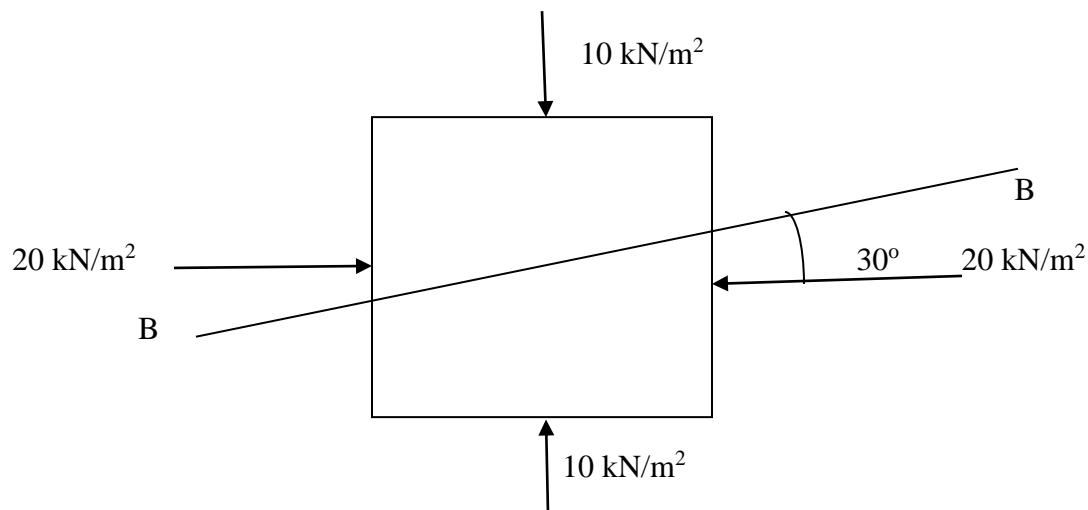
    Where σ_1 = major principal stress,

      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. Determine the stresses on the plane B – B.

(10 marks)

Question Two

(a) A shear box test carried out on a soil sample gave the data presented in table 2.1.

Table 2.1: Results of shear box test:

Test no.	Normal stress (kN/m^2)	Shear stress (kN/m^2)
1	100	98
2	200	139
3	300	180
4	400	222

For the soil tested, determine:

(i) Cohesion,

(ii) Angle of internal friction,

(iii) The resultant stress on the shear plane when the normal and shear stresses were
200 kN/m^2 and 139 kN/m^2, respectively.

(iv) The magnitudes and directions of principal stresses that would be required to produce
stresses on a shear plane as obtained in test No. 2.

(18 marks)

(b) Discuss the advantages and disadvantages of the shear box test over triaxial test.

(2 marks)

Question Three

(a) Explain the following types of triaxial shear tests:

(i)   Undrained,

(ii)   Drained,

(iii)   Consolidated, undrained,

(iv)   Unconfined.

(6 marks)

(b) Results obtained from undrained triaxial tests on a soil 3

(c) are given in table 3.1:

Table 3.1: Undrained triaxial tests' results

Cell pressure (kN/m²)	Additional axial stress at failure (kN/m²)
200	700
400	855
600	1040

Determine the coulomb's equation for the shear strength of the soil in terms of total stresses.

(14 marks)

Question Four

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

(10 arks)

(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)