DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATIONS FOR:

THE DEGREE OF BACHELOR OF SCIENCE/TECHNOLOGY IN CIVIL ENGINEERING

(Y3S2)/(Y2S2)

ECV 4325/ TCV 4227: SOIL MECHANICS II

END OF SEMESTER EXAMINATIONS

SERIES: JANUARY 2025

TIME: 2 HOURS

INSTRUCTIONS TO THE CANDIDATE:

1. You should have the following for this examination:
    - **Answer booklet.**
    - **Mathematical Table/Pocket Calculator.**
2. This paper consists of **FOUR** questions.
3. Answer question **ONE (Compulsory)** and any other **TWO** questions.
4. This paper consists of **FIVE** printed pages.
5. **Do not write on the question paper.**

Question One: Stresses in soils:

(a) Define:

(i) Principal plane,

(ii) Principal stress.

(2 marks)

(b)

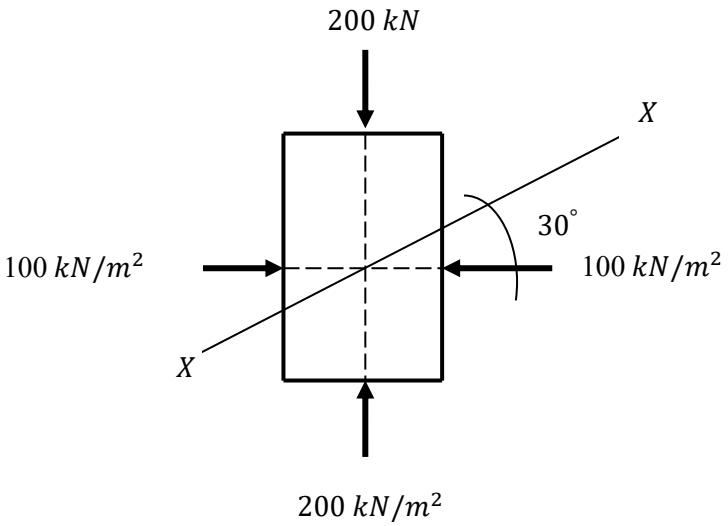

Fig. 1.1: Applied principal stresses

Given stresses as shown in Fig.1.1, graphically or by calculation, determine the stresses on plane $X - X$

(8 marks)

(c) A cohesionless soil is subjected to a minor principal stress of 400 kN/m^2. If the angle of internal friction of the soil is 30^o, determine:

(i) The inclination of the plane of failure θ to the major principal plane,
(ii) The inclination of the maximum shear stress plane to the major principal stress,
(iii) The normal and shear stresses on the failure plane,
(iv) The maximum shear stress induced in the soil.

(20 marks)

Question Two: Direct shear test

(a) State the advantages and disadvantages of the shear box test in determining the soil shear strength parameters

(6 marks)

(b) 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 tests:

Test no.	Normal stress (kN/m^2)	Shear stress (kN/m^2)
1	100	79
2	200	141
3	300	208

For the soil tested, determine:

(i) Cohesion,

(ii) Angle of internal friction,

(iii)The resultant stress on the shear plane for test No. 2

(iv)The magnitudes and directions of principal stresses that would be required to produce stresses in test No. 2

(14 marks)

Question Three: Triaxial test

A series of undisturbed samples from clay was subjected to consolidated undrained triaxial tests.

Results were:

Table 3.1: Results of triaxial tests

Test No	Cell pressure (kN/m^2)	Deviator stress q (kN/m^2)	Pore water pressure U (kN/m^2)
1	200	118	110
2	400	240	220
3	600	352	320

Determine the shear strength parameters with respect to effective stresses.

(20 marks)

Question Four: Site investigation & Soil stabilization

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

(10 marks)

(b) Discuss soil sampling under the following sub-headings:

(i) Sample types,

(ii) Sample spacing in a borehole.

(4 marks)

(c) Briefly, explain the following methods of soil stabilization:

1 Cement stabilization

2 Lime stabilization

(6 marks)