

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

SECOND SEMESTER EXAMINATIONS 1999

SECOND ENGINEERING EXAMINATION

SOIL MECHANICS

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Answer 3 Questions
Time Allowed 2 Hours

- Describe how you would measure the *liquid limit* and *plastic limit* of a soil sample in the laboratory.

A vane is used to measure the undrained shear strength of a soil at foundation level. The diameter of the vane is 55mm and its height is 200mm. The maximum recorded torque is 100Nm. Calculate the average undrained shear strength of the soil. Derive any equations used.

- Describe how you would calculate the shear strength of a soil sample using the shear box test.

The following readings were taken during a drained shear box test. The test was carried out three times with three different normal loads. Calculate c' and ϕ' for the soil sample. Say what the soil sample is, and give a reason for your answer.

The sample is 60mm x 60mm x 20mm high.

Time (s)	(Normal Load = 15kg) Shear Stress (N/mm ²)	(Normal Load = 30kg) Shear Stress (N/mm ²)	(Normal Load = 45kg) Shear Stress (N/mm ²)
0	0	0	0
30	2	12	22
60	4.7	14.7	24.7
90	6	16	26
120	7	17	27
150	8.1	18.1	28.1
180	9	19	29
210	9.5	19.5	29.5
240	9.7	19.7	29.7
270	9.9	19.9	29.9
300	10	20	30

3. Briefly explain what is meant by the terms coefficient of consolidation and coefficient of volume change in relation to the consolidation of a soil.

A clay layer 3m thick is loaded in three increments and is allowed to consolidate fully after each load is applied. The settlement of the clay layer and the nett vertical stress increase for each load increment are given in the table below. Estimate the coefficient of volume change for each loading increment.

Load increment	Settlement (mm)	Nett vertical stress increase (kN/m^2)
1	25	20
2	25	20
3	50	40

4. Define the terms, *effective stress*, *pore water pressure* and *total stress*.
- (a) Draw labelled diagrams showing the variation with depth of total stress, pore water pressure and effective stress for the soil profile shown in figure 4.
- (b) Redraw the diagrams in (a) to show the immediate effect of removing the surcharge.

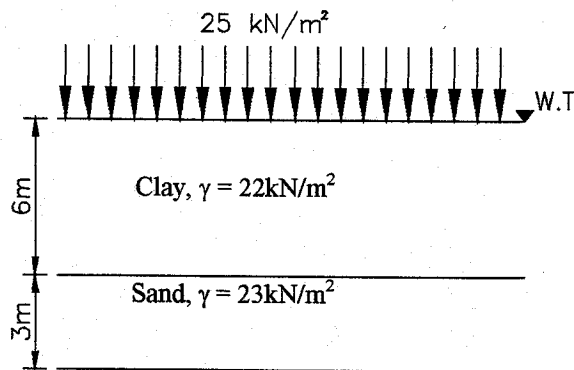


Figure 4