FACULTY OF ENGINEERING SCIENCE AND THE BUILT ENVIRONMENT

Unit title:	Geotechnical Engineering	
Unit number:	BCE/3/123	
Unit level:	3	
Unit value:	1.0	
Unit co-ordinator:	M. Gunn	
Contact time:	Lectures	25 hours
	Tutorials	15 hours
Private study time:	110 hours	
Total study time:	150 hours	
Unit pre-requisites:	BCE/2/122 or equivalent	

SHORT DESCRIPTION

This unit shows how the soil mechanics theories introduced in Soil Mechanics are applied to the design of geotechnical structures.

AIMS

To develop an appreciation and understanding of the theories of Soil Mechanics are applied in geotechnical design.

LEARNING OUTCOMES

The student should be able to:

- calculate the collapse load (or factor of safety) for the undrained collapse of a geotechnical structure
- estimate the immediate (undrained) settlement under a flexible foundation using elastic stress distributions
- design an embedded (propped or unpropped) retaining wall using a factor of safety based on soil strength
- design a simple shallow or deep foundation
- calculate the factor of safety for a slope using the infinite slope method, and the methods of Fellenius and Bishop
- draw a flownet and calculate the rate at which water flows through it and the pore water pressures within it
- predict time dependent settlements under a surface load using Terzaghi's one dimensional consolidation theory

TEACHING AND LEARNING PATTERN

Lectures and tutorials.

INDICATIVE CONTENT

Plastic collapse methods

Theory of plasticity. Collapse loads and factor of safety. Upper and lower bounds on collapse loads. Application to foundations, slopes and retaining walls.

Groundwater flow

Definition of total head. Darcy's Law. Flownets for confined and unconfined steady flow. Groundwater and geotechnical design.

Simple foundation design

Bearing capacity factors for shallow foundations. Influence of water. Piles.

Retaining walls: earth pressure theory

Active and passive earth pressure coefficients. Design of unpropped and singly propped cantilever walls using factor of safety based on soil strength. Influence of water.

Slope Stability

Infinite slope solutions. Limit equilibrium solutions (Swedish & Bishop's Routine Method). Influence of water.

Soil Deformations

Overview of soil deformation theories. Elasticity. Standard solutions for stresses and settlements (Boussinesq, plane strip load, flexible foundations of different plan shapes, use of Fadum's chart). Terzaghi's one dimensional consolidation theory and its use in calculating settlements in design.

ASSESSMENT METHOD

The unit is assessed by a combination of examination and coursework with the proportion of marks allocated to each component given below:

Examination : 70%

Coursework: 30%

INDICATIVE SOURCES

Atkinson, J.H., An Introduction to the Mechanics of Soils and Foundations, Mc-Graw-Hill, London, 1993.

Budhu, M., Soil Mechanics and Foundations, Wiley, 2000.

Craig, R.F., Soil Mechanics, Chapman Hall, London, 2004 (7th ed).

Liu, C. & Evett, J.B., Soils and Foundations, Prentice Hall, 2001 (6th ed).

McCarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Prentice Hall, 1998 (5th ed)

Powrie, W., Soil Mechanics: Concepts and Applications, Spon, 2004 (2nd ed).

Whitlow, R., Basic Soil Mechanics, Prentice Hall, 2001 (4th ed).