

CE203 GEOTECHNICS: SOIL MECHANICS

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Lecturers: Dr J R Standing (JRS) (& Laboratory Coordinator)
Dr L. Zdravkovic, (LZ), Mr M.C. Callow, (MCC),
Department of Geology

Structure: This module is split into two sections (A) Soil Mechanics
and (B) Geology. 21 hours of practicals and 12 hours of lectures.

Links: see below

Module Structure

The module continues from the introductory First Year module, with 30 lectures in Soil Mechanics and 12 lectures in Geology, together with tutorials, practicals and laboratory classes.

(A) Soil Mechanics

Introduction

This module continues the study of geotechnical engineering methods that commenced with the Geotechnics module in Part I. The various elements in Part II include (given by JRS) seepage, consolidation theory, the principle of effective stress, the shear strength of soil, and (LZ) the analysis of geotechnical structures.

The section of the module given by Dr Zdravkovic will cover general design requirements, fundamental theoretical considerations and the discussion of the various methods of analysis currently used in geotechnical engineering. Examples of the use of these different methods of analysis as applied to slopes, foundations and earth pressure problems will be presented.

The teaching of geology as an important element of geotechnics continues from Part I.

Aims

To develop a familiarity with the different soil types, to understand the physical basis of patterns of water flow and water pressures in soils, the processes of primary consolidation, and the basics of the shear strength of soil. To have an awareness of the different methods of analysis used in geotechnical engineering, and a knowledge of basic geology and geological terminology.

Links with Other Course Modules

This module follows from Part I Geotechnics (CE106), and in turn leads to the Third Year core module on Soil Mechanics (CE303), and the Third and Fourth Year Elective modules Engineering Geology (CE309), Rock Mechanics (CE310), Slope Stability (CE404) and Advanced Soil Mechanics (CE405).

SYLLABUS

Soil Mechanics: seepage and effective stress; one-dimensional consolidation; shear strength of soil. General requirements of geotechnical analysis; plasticity bound theorems; closed-form solutions; limit equilibrium and stress fields;

Laboratory work

Two sessions in the laboratory deal with the measurement of permeability, the results of which are used subsequently to make predictions of the flow of water in a model dam.

Coursework and submission dates

Reports are required on the laboratory work (carried out in the Autumn Term), to be submitted two weeks after the laboratory class.

A short project will involve the limit equilibrium analysis of a slope, to be submitted in Week 16.

Assessment

Progress test (1 hour) at the end of the autumn term.

One 3-hour written examination at end of session: Part II, containing 8 (6+2) questions in 2 parts. Rubric: "Answer 5 questions, at least 3 questions from Part A, and at least 1 question from Part B". Formulae sheets are not provided.

Recommended Textbooks/Reading

As in Part I, the module does not follow a particular text, but again the following are recommended:

R.F.CRAIG, 'Soil Mechanics' (5th Ed., Chapman & Hal) I

G.N.SMITH, 'Elements of Soil Mechanics for Civil and Mining Engineers' (Granada)

F.G.H.BLYTH AND M.H.DE FREITAS, 'Geology for Engineers' (7th Ed., Arnold).

Learning Outcomes

By the end of the module students will be familiar with:

- the patterns of water flow and their relations with water pressures in soils
- the prediction of the magnitude and rate of settlement of buildings on compressible soils
- the shear strength behaviour of soils, enabling the investigation of the stability of slopes and foundations.
- different methods of analysis, some of which will have been used to investigate the stability of simple building foundations, slopes and retaining walls

(B) Geology

Structure: 21 hours of practicals and 12 hours of lectures

Lecturer: Mr M. Callow (MC) (Room 2.40 RSM)

Introduction

It is important to have some understanding of the earth's natural materials and the processes that take place on the surface. This is because engineering construction is influenced by the geomorphology and the strength of soils and rocks.

Aims

The object of the module is to give the students a good understanding of the basic principles of geology so that they will be prepared for the Easter field course. The module is structured so that the earth's natural materials, the rocks and soils, are studied at the beginning of the module. This is then followed by a series of exercises on geological map interpretation.

The rest of the module deals with the various natural processes that take place on the earth's surface and the topography that develops as a result. Examples of engineering problems associated with the geology and landforms are given, where possible, throughout the module.

Links with Other Course Modules

The geology and geotechnics module taught in the first year along with the one day field course are pre-requisites to this module, which in turn leads to the Third Year core module on Soil Mechanics (CE303), and the various Third and Fourth Year geotechnical Elective modules.

SYLLABUS

1. Earth Materials (1 hour)
2. Groundwater (1 hour)
3. Introduction to map work (1 hour)
4. Coastlines (1 hour)
5. Weathering and erosion (1 hour)
6. Fluvial terrains (1 hour)
7. Glacial terrains (1 hour)
8. Periglacial terrains (1 hour)
9. Desert terrains (1 hour)
10. Plate tectonics (1 hour)
11. Volcanoes and volcanic eruptions (1 hour)

Coursework and submission dates

1. Earth materials (6 hours)
 2. Map work problem sheets (9 hours)
 3. Geological maps (6 hours)
- Assessed practical week 21 (Spring term)
 - Easter field report week 33 (Summer term)

Assessment

Practical on earth materials and a geological map (3 hours) in the spring term. One week's field course in either the Mendips, Somerset or Ingleton, Yorkshire during either the first or last week of the Easter vacation. Each student will be expected to submit a field report of the week's work. Further details will be given prior to the module.
Examination: see Soil Mechanics Assessment above.

Recommended Textbooks/Reading:

BLYTHE, F.G.H. & DE FREITAS, M.H. A Geology For Engineers (Arnold)

Learning outcomes

- Recognise simple rock types
- Interpret problem and geological maps
- Understand the formation of landforms as a result of the affects of water, ice and wind
- Be aware of weathering and its affect on the properties of earth materials
- Relate the above to civil engineering