

## **Engineering Tripos Part IIB, 4D5: Foundation Engineering, 2018-19**

### **Module Leader**

[Dr G Biscontin](#) [1]

### **Lecturers**

Dr G Biscontin and Dr S K Haigh

### **Timing and Structure**

Lent term. 14 lectures. Assessment: 100% exam

### **Prerequisites**

3D2 assumed

### **Aims**

The aims of the course are to:

- introduce the challenges of foundation design and examine possible solutions from simple pad footings, through piles and caissons.

### **Objectives**

As specific objectives, by the end of the course students should be able to:

- assess the design requirements of a foundation.
- deduce appropriate soil properties for foundation design from site investigation data.
- decide whether to use a shallow or deep foundation.
- design shallow and deep foundations against collapse.
- design shallow and deep foundations against excessive settlement.
- explain the difference between drained and undrained response.
- recognise mechanisms which contribute to generating deformations and load capacity.
- back-analyse observed foundation performance

### **Content**

All civil engineering structures from houses to tethered oil platforms require foundations.

The module begins by examining the requirements of a foundation; the applied loading, the acceptable deformations and the derivation of appropriate soil properties for each aspect of design.

The module then builds on material from 3D2 (geotechnical engineering) to examine theoretical solutions for the capacity (strength) and settlement (stiffness) of shallow and deep foundations under simple loading conditions in idealised soils. Strength is dealt with using plasticity. Stiffness is dealt with using elasticity. These theoretical solutions are then extended to more complex loading conditions and less idealised soils.

## Obtaining geotechnical data

- Site investigation methods
- Field measurements of soil stiffness
- Laboratory assessment of soil strength and stiffness parameters
- Small strain stiffness of soils

## Foundations Design

- Foundation types;
- Loading conditions;
- Relevant soil behaviour and soil models;
- Selection of design soil properties

## Shallow Foundations

- Strength: undrained failure of strip footings: vertical (V), horizontal (H) and moment (M) capacity;
- Strength: drained failure of strip footings: V-H-M capacity, superposition of surcharge and self-weight effects;
- Effects of footing shape and embedment, and soil heterogeneity;
- Stiffness: elastic settlement of shallow foundations: drained and undrained;
- Stiffness: settlement of shallow foundations on non-linear soil.

## Deep Foundations (6L)

- Deep foundation types and construction methods; piles and caissons.
- Pile strength: axial and lateral capacity;
- Pile stiffness: axial and lateral deformations;
- Piles: load testing, influence of installation method on performance;
- Pile groups: mutual influence, block behaviour, differential settlement;

## Booklists

Please see the [Booklist for Group D Courses](#) [2] for references for this module.

## Examination Guidelines

Please refer to [Form & conduct of the examinations](#) [3].

## UK-SPEC

This syllabus contributes to the following areas of the [UK-SPEC](#) [4] standard:

[Toggle display of UK-SPEC areas.](#)

### GT1

Develop transferable skills that will be of value in a wide range of situations. These are exemplified by the Qualifications and Curriculum Authority Higher Level Key Skills and include problem solving, communication, and working with others, as well as the effective use of general IT facilities and information retrieval skills. They also include planning self-learning and improving performance, as the foundation for lifelong learning/CPD.

### IA1

Apply appropriate quantitative science and engineering tools to the analysis of problems.

### IA2

Demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs.

#### **KU1**

Demonstrate knowledge and understanding of essential facts, concepts, theories and principles of their engineering discipline, and its underpinning science and mathematics.

#### **KU2**

Have an appreciation of the wider multidisciplinary engineering context and its underlying principles.

#### **E1**

Ability to use fundamental knowledge to investigate new and emerging technologies.

#### **P1**

A thorough understanding of current practice and its limitations and some appreciation of likely new developments.

#### **P3**

Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology, development, etc).

#### **US1**

A comprehensive understanding of the scientific principles of own specialisation and related disciplines.

#### **US4**

An awareness of developing technologies related to own specialisation.

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#### **Links**

[1] <mailto:gb479@cam.ac.uk>

[2] <https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=52191>

[3] <http://teaching.eng.cam.ac.uk/content/form-conduct-examinations>

[4] <http://teaching.eng.cam.ac.uk/content/uk-spec>