Engineering Tripos Part IIB, 4D5: Foundation Engineering, 2017-18

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, to drop-and drag-anchors.

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
- appreciate lessons learnt from field data obtained from case histories.

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. The course is widely

illustrated with case studies from the offshore industry.

Foundations Design (2L)

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

Shallow Foundations (6L)

- 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, caissons, drop-anchors;
- 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;
- Offshore solutions: caissons, anchors: installation methods and capacity.

Coursework

The preliminary evaluation of three design solutions for an offshore wind turbine foundation.

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.

Last modified: 10/10/2017 12:07

Source URL (modified on 10-10-17): https://teaching26-27.eng.cam.ac.uk/content/engineering-tripos-part-iib-4d5-foundation-engineering-2017-18

Links
[1] mailto:gb479@cam.ac.uk
[2] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=52191
[3] https://teaching26-27.eng.cam.ac.uk/content/form-conduct-examinations
[4] https://teaching26-27.eng.cam.ac.uk/content/uk-spec