Engineering Tripos Part IB, 2P8: Civil and Structural Engineering, 2021-22

Course Leader

Dr S Selvakumaran [1]

Lecturers

Dr S Selvakumaran, Dr S Stanier, Prof A McRobie [2]

Timing and Structure

Weeks 1-4 Easter Term. 16 lectures / design workshops, 4 classes/week

Prerequisites

Engineering Part I

Aims

The aims of the course are to:

- Act as a shop window for the techniques and technologies of civil engineering seen as a practical and scientific discipline.
- Create interest in the design, construction and maintenance of the built environment, using floating offshore wind turbines as an example.
- Provide illustrations from real life schemes, and in combining theory in context with real life examples, highlight the role of the professional.
- Introduce the topics of structural materials (with more detailed introduction to structural concrete), structural stability, geotechnical engineering, and using data for smart infrastructure and construction.

Objectives

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

- Introduce students to the range of disciplines within civil engineering;
- Develop awareness of the integrated civil engineering projects that they might work on as professional engineers;
- Learn to use Part I theory in simple integrated design applications;
- Recognise limitations with Part I theory; and
- Develop an awareness of potential courses of study that will address these limitation in Part II.

Content

The intention is that the course will be structured around a conceptual Civil Engineering mega-project - in this case a Floating Offshore Wind Turbine (FOWT) - which will (i) illustrate to students how their foundation Part I knowledge might be used immediately.

The course will also highlight a wide spectrum of Division D Part II module offerings that will provide extensions to specialist knowledge in specifc areas. A real life project such as the Hywind Floating Offshore Wind project in

Scotland will provide a common thread between the four sections of the course.

Integrated Civil Engineering Introduction

This will be an online video made available by the start of the course, for students to get an idea about the opportunties for engineers in the civil engineering sector, what global challenges they face and why this space has an exciting future ahead of it. We will also introduce the topic of this course: Floating Offshore Wind Turbines (FOWTs).

Structural Materials (2L + 2 Design Workshops)

- **Lectures**: overview of structural aspects related to FOWT design (steel for turbine, and an introduction to concrete for base design); development of simple analysis techniques from Part I material, highlighting limitations and scope for knowledge extension in Part II through the design of reinforced concrete sections;
- **Design classes**: two hours of interactive design classes to help students work through producing a design for the FOWT base.

Structural Stability (2L + 2 Design Workshops)

- **Lectures**: overview of structural stability and buoyancy considerations related to FOWT design, extending basic stability from Part I to how we float and move a FOWT safely into place;
- **Design classes**: two hours of interactive design classes to help students work through producing a design for the FOWT main section.

Geotechnical Engineering (2L + 2 Design Workshops)

- **Lectures**: overview of geotechnical aspects related to FOWT design (seabed); development of simple analysis techniques from Part I material, highlighting limitations and scope for knowledge extension in Part II;
- **Design classes**: two hours of interactive design classes to help students work through producing a design for the FOWT cables and anchor to the seabed.

Smart Infrastructure and Construction (2L + 2 Design Workshops)

- **Lectures**: overview of sensing and data aspects related to FOWT design (Big Data, smart sensing, AI, ML and other data-driven methods); developing an understanding of how we can derive value from data, rather than simply collecting it.
- **Design classes**: two hours of interactive design classes talking with an industry guest speaker to work out why they want to measure followed by a simple Python-based exercise to analyse real data collected from a FOWT.

Examples papers

Example papers will not be issued as part of this course, and **there will be no examination**. Students will work through design workshops and hand in their completed assignments for assessment over the 4-week period.

Coursework

There is no examination for this course. Assessment is via coursework submitted in the duration of the course.

Coursework exercises will be delivered during the design workshops, where students will have time and support in working on their designs. There will be 4 exercises, one for each lecture topic:

1. Structural Materials
2. Structural Stability
3. Geotechnical Engineering
4. Smart Infrastructure and Construction

Booklists

Please refer to the Booklist for Part IB Courses for references to this module, this can be found on the associated Moodle course.

Examination Guidelines

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

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Links
[1] mailto:ss683
[2] mailto:ss683@cam.ac.uk, sas229@cam.ac.uk, fam20@cam.ac.uk
[3] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations