Engineering Tripos Part IIB, 4D7: Concrete Structures, 2018-19

Module Leader

Prof C Middleton [1]

Lecturers

Prof C Middleton, Dr J Orr, Dr P Desnerck

Lab Leader

Dr J Orr

Timing and Structure

Michaelmas term. 12 lectures + 2 examples classes + coursework. Assessment: 75% exam/25% coursework.

Prerequisites

3D3 assumed

Aims

The aims of the course are to:

- carry further basic material on reinforced concrete studied in Part IIA, treat such matters as durability and corrosion, design of beams, slab, columns & frameworks (for shear and torsion as well as bending), but leaving prestressed concrete to 4D8.

Objectives

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

- have a good basic appreciation of the constituents and properties of concrete.
- understand deterioration processes affecting reinforced concrete, and how to control them.
- analyse simple concrete structural components and frameworks, and design them to practical requirements.

Content

Background to cement and concrete (1L)

Recent developments

Limit state design (1L)

- Probability concepts: partial safety factors (brief survey)
- Failure case studies.

Material properties (2L)

- Hydration and strength of cement paste;
- Uniaxial properties of concrete;
- Concrete under multiaxial stress.

Durability (2L)

- Net Present Value: whole life costing;
- Deterioration of concrete;
- Water migration through concrete; concrete in fire (brief mention)
- Corrosion of steel in concrete; preventative measures.

Reinforced concrete structures (6L)

- Serviceability: crack widths, deflections (revision)
- Initial sizing of members (revision of 3D3)
- Beams, slabs and frameworks at ultimate limit state;
- Column design, instability;
- Shear failure (and fracture mechanics);
- Truss analogy, torsion;

Coursework

This will consist of two parts (i) witnessing experimental laboratory techniques in the context of reinforced concrete testing, plus short write-up, and (ii) a short design exercise.

Coursework	Format	Due date & marks
[Coursework activity #1 title / Interim] Coursework 1 brief description Learning objective: • •	Individual/group Report / Presentation [non] anonymously marked	day during te Thu week 3 [xx/60]
[Coursework activity #2 title / Final] Coursework 2 brief description Learning objective: • •	Individual Report anonymously marked	Wed week 9 [xx/60]

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.

S1

The ability to make general evaluations of commercial risks through some understanding of the basis of such risks.

E1

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

E2

Ability to extract data pertinent to an unfamiliar problem, and apply its solution using computer based engineering tools when appropriate.

E3

Ability to apply mathematical and computer based models for solving problems in engineering, and the ability to assess the limitations of particular cases.

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).

P8

Ability to apply engineering techniques taking account of a range of commercial and industrial constraints.

US1

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

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Links
[1] mailto:crm11@cam.ac.uk
[2] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=52211
[3] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations
[4] https://teaching.eng.cam.ac.uk/content/uk-spec