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

Module Leader
Prof C Middleton

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.

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<th>Coursework</th>
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<tr>
<td>[Coursework activity #1 title / Interim]</td>
<td>Individual/group</td>
<td>day during term</td>
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<td>Coursework 1 brief description</td>
<td>Report / Presentation</td>
<td>Thu week 3</td>
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<td>Learning objective:</td>
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<td>[Coursework activity #2 title / Final]</td>
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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

The UK Standard for Professional Engineering Competence (UK-SPEC) [4] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the 'Accreditation of Higher Education Programmes' (AHEP) document [5] which sets out the standard for degree accreditation.

The Output Standards Matrices [6] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

Last modified: 25/09/2018 07:39

Source URL (modified on 25-09-18): http://teaching.eng.cam.ac.uk/content/engineering-tripos-part-iib-4d7-concrete-structures-2018-19

Links
[1] mailto:crm11@cam.ac.uk