Engineering Tripos Part IIB, 4D7: Concrete and Prestressed Concrete, 2020-21

Module Leader

Dr J Orr [1]

Lecturers

Dr J Orr and Dr P Desnerck [2]

Timing and Structure

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

Prerequisites

2P8, 3D3

Aims

The aims of the course are to:

- convey the principles of analysis and design of reinforced and prestressed concrete structures
- evaluate the issues associated with reinforced and prestressed concrete structures which are core to the future use of the material, including sustainability, durability, and construction technology
- place concrete into context within the UN sustainable development goals

Objectives

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

- explain the principles of limit state design in the context of sustainability
- analyse how construction processes inform design choices
- evaluate the carbon impacts of concrete structures
- create safe, durable, sustainable, and serviceable reinforced and prestressed concrete designs

Content

Concrete is the world's most widely used man made material. This course will build on the knowledge you already have (2P8 and 3D3) to continue to examine the role of reinforced and prestressed concrete in the built environment. At the end of the course you will be capable in the design of both reinforced and prestressed concrete, understanding when each is appropriate to use. We will also place them in the wider context of sustainable design, examining how good design can save significant amounts of concrete and carbon dioxide emissions.

4D7 content is relevant to UN SDGs 11 (Sustainable cities and communities), 12 (Responsible consumption and production), and 13 (Climate Action).

4D7 Content

Module ILO	**Session/Activity ILOs**	**Activity**
By the end of the course students should be able to:	*By the end of the session or activity, students should be able to:*	
ILO1: Explain the principles of limit state design in the context of sustainability	1.1 Explain the principles of limit state design (2)	1.1: Lecture 1
	1.2 Explain the role of cement and concrete in sustainable design (2)	1.2 Lecture 1
	1.3 Explain the effect of different constituents on the properties of both fresh and hardened concrete (2)	1.3: Lecture 1
ILO2: Analyse how construction processes inform design choices. (4)	2.1 Understand the history of concrete construction (2)	2.1: Lecture 2
	2.2 Illustrate the role of construction practice in sustainability (3)	2.2: Lecture 2
	2.3 Critically analyse how construction practices including modern methods of construction influence design choices (4)	2.3: Lecture 3 (o visit)
ILO3. Evaluate the carbon impacts of concrete structures. (5)	3.1 Explain how embodied carbon is measured (2)	3.1 Lecture 4
	3.2 Apply the principles of embodied carbon measurement to drive carbon reductions in design (3)	3.2: Coursework
	3.3 Analyse material durability and deterioration mechanisms in the context of carbon emissions (4)	3.3 Lecture 5
	3.4 Analyse the limitations of whole life carbon assessments (4)	3.4: Lecture 6 (P Assessment Ses
ILO4. Create safe,durable, sustainable**, and serviceable reinforced and prestressed concrete designs (6)**	4.1 Calculate the strength of members with flexure and axial load (3)	4.1 Lecture 7
	4.2 Calculate the deformation of members with flexure (3)	4.2 Lecture 8
	4.3 Calculate the strength of members with shear and torsion (3)	4.3 Lecture 9
	4.4 Calculate the bond resistance of reinforcement (3)	4.4 Lecture 10
	4.5 Analyse losses in prestressed concrete (4)	4.5 Lecture 11
	4.6 Evaluate designs using both hand calculations and computer tools (5)	4.6 Lecture 12
	4.7 Design concrete elements that meet the constraints of a specified brief (6)	4.7 Coursework

Note: the numbers in ( ) refer to cognitive levels, with higher numbers being higher levels of cognition.

Coursework

Coursework	Format	Due date & marks
Concrete design project Coursework 1: This will consist a conceptual design exercise. Learning objectives: • Critically analyse how construction practices including modern methods of construction influence design choices • Apply the principles of embodied carbon measurement to drive carbon reductions in design • Evaluate designs using both hand calculations and computer tools • Design concrete elements that meet the constraints of a specified brief	Peer assessment Each student will mark two other reports and then reflect on their own submission Anonymously marked	TBC

Booklists

Please refer to the Booklist for Part IIB 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].

UK-SPEC

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

Toggle display of UK-SPEC areas.

General Learning Outcomes

Graduates with the exemplifying qualifications, irrespective of registration category or qualification level, must satisfy the following criteria:

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