Engineering Tripos Part IIB, 4D10: Structural Steelwork, 2017-18

Module Leader

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Lecturer

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Lab Leader

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Timing and Structure

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

Prerequisites

3D4 assumed, 3D3 useful.

Aims

The aims of the course are to:

- bridge some of the gap between structural analysis, as taught in Parts I and IIA, and practical steel design as presented in design codes; however, although it will refer to the appropriate codes, it will not be an "introduction to the code" module.

Objectives

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

- show an understanding of the background to the major codes of practice for structural steel work.
- apply these codes thoughtfully to the design of real steel structures.
- differentiate between the functions of compact, prefabricated sections and lightweight, thin-walled plate-girder members.
- appreciate the vital function of joints and connnectors, and understand the limitation of various jointing techniques.
- understand the performance of civil engineering composite structures.

Content

A separate handout with numerous worked examples covers each of the sections below.

Preliminary Details (1L)

- Steel properties and grading;
- Types of section;
- Principles of Limit-States design;
- Partial safety factors;
- British and European Standards.

Compact Member Design (6L)

- Flexural buckling of columns (axial loads) and effect of elastic restraints;
- Lateral torsional buckling of beams (transverse loads);
- Beam-column buckling using Interaction Equations.

Thin-walled Member Design (3L)

- Local buckling modes for a plate due to compression, bending and shearing;
- Definitions of compactness and effective sections for beams and columns;
- Panel performances in stiffened sections.

Joints and Composite Construction (3L)

- Connections for simple and continuous construction;
- Bolted joints using bearing bolts and friction bolts;
- Welded joints using butt and fillet welds;
- Fatigue life of welds;
- Classification of weld joints;
- Detailing of joints;
- Composite section types;
- Composite section design using headed shear connectors;
- Composite floor slabs using profiled decking.

Coursework

Design of a simple steel structure, using methods from the course. Formal report for assessment. (Dr Seffen)

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 [3] for references to this module.

Examination Guidelines

Please refer to Form & conduct of the examinations [4].

UK-SPEC

This syllabus contributes to the following areas of the UK-SPEC [5] 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.

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).

P4

Understanding use of technical literature and other information sources.

P6

Understanding of appropriate codes of practice and industry standards.

US1

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

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Links
[1] mailto:fam10@cam.ac.uk
[2] mailto:fam@eng.cam.ac.uk
[3] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=52221
[4] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations
[5] https://teaching.eng.cam.ac.uk/content/uk-spec