ES4F4-15 Advanced Structural Engineering

26/27

Department
School of Engineering
Level
Undergraduate Level 4
Module leader
Reyes Garcia
Credit value
15
Module duration
20 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES4F4-15 Advanced Structural Engineering

Module aims

The module aims to give students a critical understanding of the behaviour of structural elements and systems built with Fibre Reinforced Polymers (FRP) reinforced concrete (FRP RC) and cold-formed steel. Fundamental theory and advanced methods widely used in everyday design (including Eurocodes) are covered. Strong emphasis is given to composite construction that can offer improved response to load and savings in member sizes, thus leading to more economic designs from a whole-life costing perspective.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

PART 1 – Fibre Reinforced Polymer (FRPs) composites in Concrete

- Introduction to FRPs in concrete
- Materials and constitutive relationships
- Flexural behaviour
- Shear behaviour
- Introduction to Fibre Reinforced Concrete
- Introduction to FRPs for new build structures

PART 2 – Cold-formed steel design

- Introduction (manufacturing methods, modular construction, connections)
- Behaviour of thin-walled components (local, distortional, global buckling, web-crippling, flange curling)
- Design of cross-sections
- Design of members

Learning outcomes

By the end of the module, students should be able to:

- Critically assess the suitability of different structural solutions for new structures based on the desired performance
- Demonstrate forefront knowledge and understanding of theory and concepts used to design structures of FRP RC or cold-formed steel.
- Design advanced composite structural systems of either FRP RC or cold formed steel.
- Interpret and systematically apply international design guidelines for composite construction with FRPs and cold formed steel.
- Demonstrate advanced knowledge and sound understanding on materials, composite processing methods, design, execution, maintenance and sustainability of composite structures.

Indicative reading list

Reading lists can be found in Talis

International

The module has an international dimension as it covers those from Europe, the USA and other countries. This module will expose students to design standards from other countries, which is critical nowadays as the construction industry is more and more global and much of the infrastructure has to be built abroad.

Subject specific skills

- Ability to conceive, make and realise structural components using non-traditional materials.
- Interpret and apply advanced design standards and methods to design different types of non-traditional structural components.

- Ability to seek to achieve more sustainable and economic solutions for the construction industry using non-traditional materials.
- Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, advanced structural solutions to become reality.

Transferable skills

- Apply mathematical methods to communicate parameters, model and optimize structural solutions using non-traditional materials.
- Exercise initiative and personal responsibility, including time management, of a module made of two different parts.
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD which is widely needed in civil engineering.
- Overcome difficulties in structural engineering by employing skills, knowledge and understanding gained in Years 1 to 3 in a flexible and coherent manner.
- Develop awareness of the nature of the global landscape of the construction industry by familiarising, interpreting and applying design standards from inside and outside the UK.

Study

Study time

Type	Required
Lectures	16 sessions of 1 hour (11%)
Seminars	15 sessions of 1 hour (10%)
Demonstrations	1 session of 2 hours (1%)
Other activity	6 hours (4%)
Private study	111 hours (74%)
Total	150 hours

Private study description

111 hours of guided independent learning

Other activity description

2x1 hours revision classes, 4 hrs f2f lectures with document visualiser (Example Classes)

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B4

	Weighting	Study time	Eligible for self-certification
Assessment component			
Centrally-timetabled examination (On-campus) Written Examination	100%		No

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- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper
- Answerbook Pink (12 page)

Reassessment component is the same

Feedback on assessment

Support through advice and feedback hours. Cohort level feedback on the exam.

Past exam papers for ES4F4

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - ES3D1-15 Concrete Structures
  - ES3D2-15 Steel Structures
  - ES3E2-15 Civil Engineering Design II
  - ES2C2-15 Civil Engineering Design 1
  - ES2C3-15 Civil Engineering Materials and Structural Analysis

Courses

This module is Core for:

- Year 4 of UESA-H217 MEng Civil Engineering
- Year 4 of UESA-H219 MEng Civil Engineering with Exchange Year
- Year 5 of UESA-H218 MEng Civil Engineering with Intercalated Year
- Year 4 of UESA-H116 MEng Engineering with Exchange Year

This module is Optional for:

- Year 4 of UESA-H21A MEng Civil Engineering with Exchange Year
- Year 5 of UESA-H213 MEng Civil Engineering with Year in Research
- Year 4 of UESA-H114 MEng Engineering
- Year 4 of UESA-H117 MEng Engineering with Exchange Year
- UESA-H109 MEng Engineering with Intercalated Year
    - Year 5 of H109 Engineering with Intercalated Year MEng
    - Year 5 of H10Q Engineering with Intercalated Year with Appropriate Technology MEng
    - Year 5 of H10U Engineering with Intercalated Year with Automotive Engineering MEng
    - Year 5 of H10N Engineering with Intercalated Year with Business Management MEng
    - Year 5 of H10S Engineering with Intercalated Year with Communications MEng
    - Year 5 of H10T Engineering with Intercalated Year with Computer Engineering MEng
    - Year 5 of H10X Engineering with Intercalated Year with Fluid Dynamics MEng
    - Year 5 of H10R Engineering with Intercalated Year with Instrumentation MEng
    - Year 5 of H10V Engineering with Intercalated Year with Robotics MEng
    - Year 5 of H10P Engineering with Intercalated Year with Sustainability MEng
    - Year 5 of H10W Engineering with Intercalated Year with Systems Engineering MEng
- Year 5 of UESA-H115 MEng Engineering with Intercalated Year
- Year 5 of UESA-H110 MEng Engineering with Year in Research