ES3D2-15 Steel Structures

23/24

Department
School of Engineering
Level
Undergraduate Level 3
Module leader
Irwanda Laory
Credit value
15
Module duration
14 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES3D2-15 Steel Structures

Module web page

Module aims

The appraisal and design of structures is the main activity of many professional civil engineers. (Study of the structural behaviour, analysis and design is therefore a principal part of civil engineering teaching and is essential for professional accreditation.)
Structural engineering is a substantial economic activity.
The study of the design of steel structures is therefore core within an integrated programme leading to a degree in Civil Engineering The ES3D2 module aims to learn the design process according to Eurocode 3. It includes an educational and comprehensive experience in the design of simple steel structures.

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.

Introduction to steel structures: Structures for buildings and bridges and the design process: types and forms of structure; load paths; choice of structural materials (steel grades); design of individual members and connections; influence of imperfections, design for construction methods; H&S issues (e.g. CDM 2014); sustainable construction and the client's view. Eurocode system for limit state design: loads and load combinations and arrangements; ULS (resistance) and SLS; (deflections and vibration), robustness (Building Regulations), frame stability, fire design and durability.

Geometric properties of steel sections.

Design process: Tension struts, Local buckling and classification, Laterally-restrained beams; (bending moment and shear), Uniform and non-uniform torsion: Unrestrained and restrained warping, Laterally-unrestrained beams - lateral-torsional buckling, Column members; buckling curves; interaction of bending and axial compression.

Introduction to Connections and Joints, and flooring systems.

Overall stability of frames: Second-order P- effects; elastic critical buckling loads and beam-column members. Design process: cr and Merchant-Rankine formula modification.

Learning outcomes

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

- Understand function of structures as load-bearers and the response of members, joints and frames.
- Propose concepts for common civil engineering structures of steel, particularly those related to buildings.
- Analyse common building structures to determine response to load.
- Determine form and size of structural elements.
- Sketch structural solutions.
- Prepare structural calculations.
- Appraise alternative structural solutions and examine critically the results of structural analysis.
- Appreciate the needs of clients and relationship between design and safety.

Indicative reading list

Martin, L. and Purkiss, J., Structural Design of Steelwork - To EN 1993 and EN 1994, 3rd Ed., Butterworth-Heinemann, Oxford, 2008.
Davison, B. and Owens, G.W. (Eds.) Steel Designer's Manual, Wiley-Blackwell, 7th edition, 2012.
Roberts, J., Structural Eurocodes - Extracts from the Structural Eurocodes for Students of Structural Design (3rd Edition): (PP 1990:2010), BSI Standards Ltd, 2010.
AccessSteel http://www.steelbiz.org/ (for Eurocode 3)

Subject specific skills

1. Ability to conceive, make and realise a component, product, system or process
2. Ability to develop economically viable and ethically sound sustainable solutions

3. Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality
4. Ability to seek to achieve sustainable solutions to problems and have strategies for being creative and innovative
5. Ability to be risk, cost and value-conscious, and aware of their ethical, social, cultural, environmental, health and safety, and wider professional engineering responsibilities

Transferable skills

1. Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions
2. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
3. Communicate (written and oral; to technical and non-technical audiences) and work with others
4. Awareness of the nature of business and enterprise in the creation of economic and social value
5. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner
6. Ability to formulate and operate within appropriate codes of conduct, when faced with an ethical issue
7. Appreciation of the global dimensions of engineering, commerce and communication

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Study

Study time

Type	Required
Lectures	24 sessions of 1 hour (16%)
Practical classes	3 sessions of 1 hour (2%)
Fieldwork	3 sessions of 1 hour (2%)
Other activity	6 hours (4%)
Private study	114 hours (76%)
Total	150 hours

Private study description

114 hours of guided independent learning

Other activity description

6x1 hr Examples Class

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D7

	Weighting	Study time
Written Report Laboratory written report (maximum length 6 pages)	30%	
Online Examination QMP ~Platforms - AEP,QMP	70%	

- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition

Feedback on assessment

Coursework: individual and cohort level feedback.
Feedback in examples class.
Model solutions to recent past papers.
Cohort level feedback on examination.

Past exam papers for ES3D2

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - ES2C2-15 Civil Engineering Design 1
  - ES2C3-15 Civil Engineering Materials and Structural Analysis

Post-requisite modules

If you pass this module, you can take:

- ES4F4-15 Advanced Structural Engineering
- ES4E3-15 Structural Dynamics and Vibration

Courses

This module is Core for:

- Year 3 of UESA-H216 BEng Civil Engineering
- Year 4 of UESA-H215 BEng Civil Engineering with Intercalated Year
- Year 3 of UESA-H217 MEng Civil Engineering
- Year 4 of UESA-H218 MEng Civil Engineering with Intercalated Year

This module is Core optional for:

- Year 3 of UESA-H218 MEng Civil Engineering with Intercalated Year
- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- Year 3 of UESA-H11L Undergradaute Engineering (with Intercalated Year)

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H11L Undergradaute Engineering (with Intercalated Year)
    - Year 3 of H11L Engineering (with Intercalated Year)
    - Year 4 of H11L Engineering (with Intercalated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- UESA-H112 BSc Engineering
    - Year 3 of H112 Engineering
    - Year 3 of H112 Engineering