ES3E1-30 Design Project with Construction Management (Civil Engineering, BEng)

22/23

Department
School of Engineering
Level
Undergraduate Level 3
Module leader
Stephen Hicks
Credit value
30
Module duration
17 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES2E1-30 Design Project with Construction Management (Civil Engineering, BEng)

Module web page

Module aims

The module aims at providing experience of performing an individual investigative project (projects will be specified to groups and involve group interaction without influencing an individual character). Students will apply and demonstrate their capabilities (engineering knowledge, numeracy, initiative, communication, self-leaerning, creativity) to plan, carry out and control an open-ended design project in civil engineering. Students will consolidate learning from other modules and will investigate aspects of sustainability (carbon minimisation both operational and embodied) and feasibily of engineering and architectural choices with regards to materials and conceptual designs.
Students will enhance their writing, oral and communication skills through writing a technical report

that conforms to predefined specifications, and giving an oral presentation under specific time constraints.

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.

Definition of a realistic project (e.g. bridge, skyscraper, airport) through a design brief that is characterized by diverse and contradictory aspirations as well as numerous (and often obscure) constraints that offer the opportunity of various solutions to emerge based on subjective and challenging judgements. Assessment of the design brief with emphasis on the location, architectural, sustainability and service requirements of the project. Individual investigative research to expand on the design brief by gathering all the required information and data relevant to environmental and planning issues, site conditions, material suppliers, collaborators, specialists and other contractors. Synthesis of all available information to define a set of clear objectives against which a design solution should be tested. ‘Think outside the box’ and renegotiate those constraints of the design brief that prevent an optimum design solution to emerge. Use of standard form of contract documents for the construction project. Conceptual design and use of sketches prepared to scale to describe a solution for the structural system and how loads are transferred to foundations. Methods of construction (on-site/off-site), use of cranes and their capacities, need for lifting, and access to construction site. Describe the construction site organization as well as robust waste management plan. Definition of a set of measures for control of risks and hazards. Choice of structural materials, preliminary design of structural members, and approximate method of analysis. 3D linear elastic analysis using structural analysis software. Structural Eurocodes, resistance of members, loads, load combinations, serviceability and ultimate limit states. Engineering drawings, drawing conventions, tolerances, limits and fits, assemblies, and CAD applications. Building Information Modeling (BIM), teams and collaboration, transfer of information from design to construction, BIM for life-cycle management of construction projects. Sustainability in construction, green economy, climate emergency and assessment of design solution using a set of criteria of the net zero-carbon agenda.

Learning outcomes

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

- Choose a concept for a structural system (“conceptual design”) that satisfies the location, architectural, sustainability and service requirements of a construction project (e.g. bridge, stadium, building, etc).
- Distinguish a range of designs with regards to sustainability and feasibily of engineering and architectural choices
- Synthesize design calculations and engineering drawings.
- Deliver a design that conforms to a detailed specification and in accordance with standards and regulations.
- Demonstrate coherently constructed ideas and information, communicated for a range of work/practice and/or academic audiences.
- Plan and carry out a personal programme of work demonstrating project management by monitoring and adjusting throughout the project lifecycle and exercising initiative and

personal responsibility to perform a complex project autonomously.
- Identify, use and critically analyse the range of processes involved in design, construction and post construction of civil engineering projects (H&S, BIM, contract and procurement strategies, project management etc.).
- Define sustainability in broader environmental, societal, and economical terms and its relation to design, construction and maintenance of structures
- Individually investigate as student-researcher aspects related to future policies for infrastructure, digital applications, the UN Sustainable Development Agenda and the climate emergency.

Indicative reading list

C. Arya. Design of structural elements. Spon Press, 2009.
I.A. MacLeod. Modern Structural Analysis. T. Telford, 2005.
M. Millais. Building structures: from concepts to design. 2nd Ed. Spon Press, 2005.
Standard Method of Detailing Structural Concrete, 3rd ed., Institution of Structural Engineers, 2006.
BS EN 1990: 2002. Eurocode - Basis of structural design
BS EN 1991-1-1: 2002. Eurocode 1: Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings
BS EN 1992-1-1: 2004. Eurocode 2: Design of concrete Structures – Part 1-1: General rules and rules for buildings
BS EN 1993-1-1: 2005. Eurocode 3 Design of steel Structures – Part 1-1: General rules and rules for buildings
BS EN 1994-1-1: 2004. Design of composite steel and concrete structures of – Part 1-1: General rules and rules for buildings
BS EN ISO 4157-1:1999. Construction drawings - Designation systems – Part 1: Buildings and parts of buildings
Code of Practice for Project Management for Construction and Development, Fifth Edition, John Wiley & Sons, 2014
Mohamed A. El-Reedy. Construction Management for Industrial Projects: A Modular Guide for Project Managers, 2011
Nigel J. Smith. Appraisal, Risk and Uncertainty: Construction Management Series, 2003
Tony Merna & Cyrus Njiru. Financing Infrastructure Projects, 2002
Russ J. Martinelli & Dragan Z. Milosevic. Project Management Toolbox, Second Edition, Wiley Online Library, 2015
Hans Sommer, Project Management for Building Construction: 35 years innovation at Drees & Sommer, 2010

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. Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
5. Exercise initiative and personal responsibility, including time management, which may be as a team member or leader
6. Awareness of the nature of business and enterprise in the creation of economic and social value
7. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner
8. Ability to formulate and operate within appropriate codes of conduct, when faced with an ethical issue
9. Appreciation of the global dimensions of engineering, commerce and communication
10. Be professional in their outlook, be capable of team working, be effective communicators, and be able to exercise responsibility and sound management approaches.

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (7%)
Tutorials	14 sessions of 1 hour (5%)
Work-based learning	(0%)
Other activity	10 hours (3%)
Private study	256 hours (85%)
Total	300 hours

Private study description

256 hours of guided independent learning

Other activity description

8 hours of oral presentations
2 hours of written test

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A4

	Weighting	Study time
Technical Report	75%	
Technical report (maximum 50 pages) with verification and validation by oral presentation and logbook		
Written Test QMP	25%	
Written test on construction management.		

Feedback on assessment

Detailed marking and feedback on assignments (technical report including logbook and oral presentation). Verbal feedback during tutorials.

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

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