Module Code	CEU33A02
Module Name	3A2 STRUCTURAL DESIGN
ECTS Weighting[2]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Breiffni Fitzgerald
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. describe the engineering properties of structural steel, reinforcing steel and concrete LO2. distinguish between serviceability and ultimate limit states, and apply appropriate partial safety factors LO3. discriminate between the different types of failure observed in reinforced concrete and structural steelwork, and identify when each of these is likely to occur LO4. describe the elasto-plastic response of steel beams and of under- and over-reinforced concrete beams LO5. describe the types of failure displayed by bolted steel connections LO6. calculate the ultimate resistances of steel and RC members from first principles and using design code methods LO7. evaluate the shear and bearing resistances of a bolted connection LO8. draw bending moment and shear force diagrams for statically determinate beams LO9. design structural steel and RC members to possess required bending, shear, buckling and tensile resistances LO10. choose suitable steel and RC beam and column section sizes for given situations LO11. select suitable member sizes in a steel truss LO12. develop bending-shear and bending-axial force interaction diagrams and expressions LO13. observe the experimental response of steel and RC specimens under load, identify and describe the forms of failure displayed, calculate the resistances of the test specimens and compare with theoretical or design values, write a laboratory report **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced

[1] An Introduction to Module Design from AISHE provides a great deal of information on designing and re-designing modules.
[2] TEP Glossary

	To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This module introduces the design of a range of basic structural forms including, beams, trusses, arches, and cable-supported structures. Students learn to design, dimension and detail elementary structural members: beams, columns/struts and ties with reference to the structural design Eurocodes. The module is organised in two parts which explore structural design applications in steelwork and reinforced concrete. The module takes place in the first semester and consists of lectures, tutorials/design studies and laboratories. • *Introduction to Structural Design:* Serviceability and ultimate limit states, forms of failure, partial safety factors, characteristic and design values. • *Material properties:* Uniaxial behaviour of structural steel, reinforcing steel and concrete; engineering properties, design values for steel and concrete grades. • *Steel Tension members:* Examples of members under axial tension; effect of holes, effect of steel grade; design approach; worked example. • *Compression members:* Pure axial compression; axial compression with bending; failure modes; cross-section analysis; member buckling resistance, slenderness, imperfections; buckling curves and design tables, bending moment-axial force interaction in RC members; design code provisions. • *Steel members in bending:* Examples; comparison of truss and I-section behaviour; review of elastic theory, extension to plastic sections, shape factors; local buckling and section classification; elastic shear distribution, shear resistance, coincident high shear and bending moment; web buckling, web bearing

	• *RC members in bending:* Properties of composite, uncracked and cracked sections, ultimate bending moment resistance of RC sections, singly- and doubly-reinforced sections; under- and over-reinforced beams; shear in RC sections.
Teaching and Learning Methods	Lectures, field trips, laboratories, design exercises

Assessment Details[3]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Examination	2 hour written examination	LO1-6	85%	
Coursework	laboratory experiments/reports and design exercises	LO1-6	15%	

Reassessment Requirements

100% written examination

Contact Hours and Indicative Student Workload[3]

Contact hours: 40
Independent Study (preparation for course and review of materials): 20
Independent Study (preparation for assessment, incl. completion of assessment): 40

Recommended Reading List

- Reinforced and Prestressed Concrete Design, O'Brien and Dixon, *Longman*
- Reinforced and Prestressed Concrete, Kong and Evans, *Van Nostrand Reinhold*
- Reinforced Concrete Structures, Park and Paulay, *Wiley*
- Structural Steelwork Design, Dowling, Owens and Knowles, *Butterworths*
- Design of Structural Steelwork, McKenzie, *Macmillan*

Module Pre-requisite

2E4 or similar introduction to structural mechanics

Module Co-requisite

Module Website

[3] TEP Guidelines on Workload and Assessment

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	
Academic Start Year	September 2024
Academic Year of Date	2024-25