Module Code	CEU44A62 & CEU5A62
Module Name	4A6(2) Structures 2 [Advanced Design of Structures] 5A6(2) if taken in the MAI Year
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Alan O'Connor
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: Have knowledge to: 1. Recognize the principle of permissible stresses (SLS &ULS) and their significance 2. Discuss concepts of flexural strength of concrete and fully and partially pre-stressed structures 3. Assess the losses that occur in pre-stress force at transfer and during the service life of the member 4. Distinguish between Elastic analysis, elasto-plastic analysis and plastic analysis 5. Explain, locate and calculate levels of plastic moment re-distribution at the ULS 6. Recognise the differences between Reinforced Concrete and Pre-stressed concrete, and, to choose which one is appropriate in any given circumstance 7. Describe the components of steel-concrete composite beams and their modes of failure 8. Distinguish between the different behaviour of full and partial shear connections in composite beams Have gained practical skills to: 9. Perform ULS analysis of pre-stressed concrete members from 1st principles 10. Estimate suitable cross-sections, identify the minimum pre-stress force required and determine suitable eccentricities of the tendons 11. Derive Magnel equations from 1st Principles and hence, sketch and use efficiently Magnel Diagrams to determine optimal combinations of pre-stressing force and eccentricity. 12. Calculate pre and post-transfer losses 13. Evaluate the parasitic effects in indeterminate structures

[1] TEP Glossary

14. Apply elacto-plastic analysis to evaluate the ULS capacity of reinforced concrete beams
15. Use yield-line analysis to determine the ultimate capacity of reinforced concrete slabs
16. Calculate the bending moment and shear force capacities of composite beams
17. Choose an appropriate grade and number of shear connectors in the design of composite beams

Have gained intellectual skills to:

18. Estimate and visualize the structural behaviour of beams and slabs
19. Develop expressions for capacity using their knowledge of 1st principles

Graduate Attributes: levels of attainment

To act responsibly - Choose an item.
To think independently - Choose an item.
To develop continuously - Choose an item.
To communicate effectively - Choose an item.

Module Content

Please provide a brief overview of the module of no more than 350 words written so that someone outside of your discipline will understand it.

This module aims to build on design principles presented in the first semester SS module (4A6 (1)) so as to:

- Provide students with the ability to design prestressed concrete structures
- Develop an understanding for plastic ULS analysis of concrete structures, the basic principles of which may equally be applied for any material
- Enable students to design composite steel-concrete structures building on the steel design principles covered in previous JS and SS modules.

This module builds on work established in previous years of the undergraduate curriculum and, is relevant to all civil and structural engineers as the principles taught are important for anyone working in the design or construction of structures.

Module content

1. The principle of permissible stresses
2. Minimum section moduli
3. Pre-stressing force and eccentricity (Magnel Diagram)
4. Tendon profile (Post-tesnioned) and de-bonding (pre-tensioned)
5. PSC losses
6. Secondary effects of pre-stress

	7. Ultimate moment capacity of PSC 8. Partially pre-stressed members 9. Plastic moment redistribution 10. Yield line analysis of slabs 11. Hillerbourg strip analysis of slabs 12. Bending moment and shear force capacities of composite beams 13. Partial shear connections in composite beams
Teaching and Learning Methods	e.g., lectures, seminars, online learning via VLE, field trips, laboratories, practice-based etc… This module is taught by a combination of lectures and tutorial sessions. The tutorial sessions are overseen by a Teaching assistant as well as the lecturer. During these sessions students are encouraged to work in groups to develop their communication and teamwork skills. The teaching approach in the lectures combines theory with as many practical examples as possible.

Assessment Details[2]
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 etc	85%	
Coursework			15%	

Reassessment Requirements

100% written Examination

Contact Hours and Indicative Student Workload[2]

Contact hours: 36
Independent Study (preparation for course and review of materials):
Independent Study (preparation for assessment, incl. completion of assessment):

Recommended Reading List

- *Reinforced and pre-stressed Concrete Design: The complete process* – O'Brien and Dixon (Longman)

- *Reinforced and Pre-stressed Concrete* – Kong and Evans (Nelson)

- *Structural Steel Design* – Owens and Knowles. (Butterworths)

Module Pre-requisite

Module Co-requisite

Module Website

https://www.tcd.ie/Engineering/undergraduate/baiyear4/modules/4A62.pdf

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.

[2] TEP Guidelines on Workload and Assessment

Module Approval Date	
Approved by	
Academic Start Year	January 2022
Academic Year of Date	2021-22

COVID-19 contingency statement:

While the intention is to deliver some lectures, tutorials and labs face-to-face, there is uncertainty due to the Covid-19 situation and the entire module delivery may need to change to an online delivery if required by government restrictions. In the case of a possible new lockdown scenario during teaching term:

- All lectures, tutorials and labs will be delivered online using Blackboard. Some of these sessions will be ***live*** sessions and your attendance at live sessions is required.
- Assignments and examinations will be conducted and submitted online.