Module Code	CEU22E04
Module Name	Solids and Structures
ECTS credit weighting	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Julie Clarke Module delivery: Prof. Julie Clarke (50%), Prof. Brendan O'Kelly (50%)
Module Learning Outcomes with embedded Graduate Attributes	On successful completion of this module, students should be able to: LO1. Apply Young's modulus, the shear modulus and Poisson's ratio to solve elastic stress/strain problems. Apply the method of Mohr's circle to Analyse 2D stress states. LO2. Calculate section properties and the stress, deformation and strain responses of structural members under a system of applied loads and calculate the buckling load capacity of struts. LO3. Analyse structural systems to determine sectional axial, shear, torsion and bending forces in statically determinate structures. LO4. Analyse trusses, beams, frames, and calculate deflections using virtual work and other techniques.
Module Content	**Mechanics of Solids** • Elastic–Plastic Behaviour Stress, strain, elasticity and plasticity; one-dimensional stress–strain relationships; Young's modulus of elasticity, shear modulus, bulk modulus and Poisson's ratio; two-dimensional elasticity; volumetric strain; transformation of two-dimensional stress and strain; properties of sections (A and I); axial, shear and bending distortions. • Analysis of Structural Members Bolt/rivet connection design in trusses; stress/strain in composite members under uniaxial loading; torsion of shafts.

Structures

• Statically determinate pin-jointed structures

Analysis using joint-equilibrium, method of sections; statical determinacy; deflection of trusses using principle of virtual work.

• Analysis of Beams and Frames

Shear force and bending moment diagrams.

• Beam Deformations

Theory of bending; beam stresses; shear stress distribution.

• Climate Action in Structural Engineering

Climate change impacts on the built environment; adaptation planning in structural engineering; sustainable structural engineering design.

Teaching and Learning Methods[1]

The module is taught using a combination of lectures, laboratories and tutorials. Most material (notes, textbook, tutorials, examinations) is provided on the College network. Students work in tutorial and laboratory groups in solving problems thereby encouraging teamwork and cooperation. Laboratory Practical Reports are carried out individually.

Associated laboratory/tutorial programme
• Beam bending (laboratory experiment and report);
• Buckling of slender columns (laboratory experiment and report);
• Tutorials (1 - 8).

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
Written Exam	In-person MCQ examination	1 – 4	85%	
Lab Practical Reports	Reports on two laboratory experiments	1 & 3	15%	

Reassessment Requirements

[1] Trinity-INC provides tips and resources on how to make your curriculum more inclusive.
[2] https://www.tcd.ie/academicpractice/resources/assessment/

Contact Hours and Indicative Student Workload[3]	**Contact hours:** 125 **Independent Study (preparation for course and review of materials):** 100 **Independent Study (preparation for assessment, incl. completion of assessment):** 25
Indicative Reading List (approx. 4-5 titles)	· Strength of Materials by GH Ryder (Macmillan) 620.11 K98 · Mechanics of Materials by EJ Hearn (Pergamon) 620.11 L73 · Mechanics of Material, (SI ed.) by Gere and Timoshenko (Wadsorth Int.) · Mechanics of Engineering Materials by PP Benham and RJ Crawford (Longman) · Structures—or why things don't fall down by JE Gordon (Penguin). · Introduction to Structural Mechanics, Reynolds, Kent and Lazenby, 628.17 L38 · Basic Structures by Philip Garrison (Wiley) · Structural Mechanics, Williams, Morgan and Durka, PL 49 111
Module Pre-requisite	1E7 Mechanics
Module Co-requisite	
Module Website	Blackboard
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No

[3] https://www.tcd.ie/academicpractice/resources/assessment_workload/