Module Code	CEU22E04
Module Name	Solids and Structures
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Alan O'Connor & Prof. Julie Clarke
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	• Calculate section properties. • Calculate stress, deformation and strain responses of structural members under a system of applied loads. • Analyse structural systems to determine sectional forces and demonstrate an understanding of their influence on overall structural response. • Examine possibilities for alternate structural arrangements where the structure as detailed is insufficient. • Differentiate between various limit states in structural analysis. • Analyse bolted connections. • Demonstrate an ability to visualize, understand and appraise structural behaviour in statically determinate structures. • Understand the concepts of climate change mitigation and climate change adaptation within the context of structural engineering design and analysis **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.

[1] TEP Glossary

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 and Poisson's ratio; two-dimensional elasticity; isotropic and homogeneous materials; ductile and brittle materials; transformation of stress and strain; properties of sections (A and I); axial, shear and bending distortions.

- Analysis of Structural Members
  Connection design in trusses; torsion of shafts; buckling of struts; lateral torsional buckling; factors of safety

Structures

- Statically determinate pin-jointed structures
  Analysis using joint-equilibrium, method of sections and by inspection; statical determinacy; deflection of trusses using principle of virtual work

- Analysis of Beams and Frames
  Axial, shear force and bending moment diagrams; equation of condition, load function equation, qualitative analysis for two-dimensional frames; analysis for bending stress; cover plate design; analysis for shear stress and torsional stress

- Beam Deformations
  Bending deflections using moment-curvature equation; Mohr's moment area theorems; shear deformations, torsional deformations

- Climate Action in Structural Engineering
  Climate change impacts on the built environment; adaptation planning in structural engineering; sources of carbon emissions in buildings; embodied energy for construction materials; sustainable structural engineering design

Teaching and Learning Methods	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 whereas the research reports are carried out individually. Associated laboratory/project/tutorial programme • Beam bending (laboratory experiment and research report); • Buckling of slender columns (laboratory experiment and research report); • Tutorial assignments (1 - 10). • Projects (x2) – Engineering in Climate Action (a) Adaptation, (b) Mitigation

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
Continuous Assessment	Tutorials and Laboratory Reports		20%	
Project Work	2 No. Projects on Climate Change (a) Adaptation and (b) Mitigation		20%	
Final Exam (MC)			60%	

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

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

Recommended Reading List

- Strength of Materials, Timoshenko
- Strength of Materials, GH Ryder, Macmillan
- Mechanics of Materials, EJ Hearn, Pergamon
- Mechanics of Materials, Ugural, Wiley
- Mechanics of Material, Gere and Timoshenko, Wadsorth
- Mechanics of Engineering Materials, PP Benham and RJ Crawford, Longman
- Structures—or why things don't fall down, JE Gordon, Penguin
- Introduction to Structural Mechanics, Reynolds, Kent and Lazenby
- Mechanics of Engineering Materials, Bowes, Russell and Suter
- Structural Mechanics, Williams, Morgan and Durka
- Understanding Structural Analysis, Brohn

Module Pre-requisite

Module Co-requisite

Module Website	https://www.tcd.ie/Engineering/undergraduate/baiyear2/modules/2E4.pdf
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	
Module Approval Date	
Approved by	
Academic Start Year	
Academic Year of Date	2021