Module Code: CEU22E04
Module Name: Solids and Structures
ECTS Weighting: 5 ECTS
Semester taught: Semester 1
Module Coordinator/s: Professor Alan O’Connor, Dr. Rui Teixeira

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.

Graduate Attributes: levels of attainment
To act responsibly - Enhanced
To think independently - Enhanced
To develop continuously - Enhanced
To communicate effectively - Enhanced

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

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).
### Assessment Details

Please include the following:

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

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### Reassessment Requirements

### Contact Hours and Indicative Student Workload

**Contact hours:** 45h (33 classes + 10 tutorials + 2 lab)

**Independent Study (preparation for course and review of materials):** 40h Independent study (review of materials, lab and tutorial assessment)

**Independent Study (preparation for assessment, incl. completion of assessment):** 35h Independent study (preparation for assessment including completion)

### Recommended Reading List

- Strength of Materials, Timoshenko
- Strength of Materials, GH Ryder, Macmillan
- Mechanics of Materials, EJ Hearn, Pergamon
- Mechanics of Material, Gere and Timoshenko, Wadsworth
- Introduction to Structural Mechanics, Reynolds, Kent and Lazenby Mechanics of Engineering Materials, Bowes, Russell and Suter
- Structural Mechanics, Williams, Morgan and Durka

### Module Pre-requisite

### Module Co-requisite

### Module Website

See Blackboard

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2 [TEP Guidelines on Workload and Assessment](#)
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