Module Code	MEU33B03
Module Name	3B3 MECHANICS OF SOLIDS
ECTS Weighting	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Assistant Professor Shuo Yin Assistant Professor Mark Ahearne
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. Comprehend the fundamentals of stress/strain analysis and apply them with confidence to the calculation of loads and deformations in simple structures LO2. Recognise the relationships between commonly used material properties, and recall their value for typical materials used in mechanical engineering structures (e.g., steel, aluminium) LO3. Analyse and examine a physical problem and reformulate it in a frame (e.g., a differential equation or eigenvalue problem) for which he/she has developed the mathematical tools LO4. Develop free-body diagrams which form the basis of many formulations in mechanics, to separate more complex loaded structures into combinations of elemental sections LO5. Critically evaluate and judge the validity of a method of analysis in a solid mechanics problem in terms of its assumptions and simplifications **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively – Enhanced
Module Content	This is a module on the fundamentals of stress analysis which is a central subject in the mechanical engineering discipline. Students learn how to determine the stresses and strains in typical mechanical components, such as beams and pressure vessels, as well as in structures under combined loads of torsion and bending. Buckling and stability of structures is also introduced and experimental strain measurement is covered by lectures and a laboratory session. In addition to the development of modelling skills, the analysis also relies on mathematical techniques commonly used in advanced engineering such as solution of differential equations, Laplace transform and eigenvalue analysis. The subject introduces computing as a tool for the solution of more complex structural problems. However the emphasis is on acquiring theoretical and analytical skills as well as gaining physical insight in how to represent real- life complex structures and loads as a combination of simplified basic cases.

This module completes the essential requirements of a mechanical engineer in the solids and structural mechanics area. It builds on earlier introductory (fundamental and applied) modules in mechanics, mathematics and numerical methods. Its main aim is to provide the theoretical basis for more advanced modules in solid mechanics, fluid mechanics, vibration and bioengineering. The module aims to build up the essential skills and confidence for becoming an expert user of commercial software packages relying on finite element analysis, which will be used extensively in project work after the third year.

Teaching and Learning Methods

Lectures: The teaching strategy follows a single well established text book. This subject has been well developed for teaching at this level so student accessibility and consistency of notation is easily established.

Tutorials: Tutorials follow a series of question sheets, with problems similar to exam questions. The solutions for these are available online and are released gradually as the module progresses. The tutorials are given to class groupings and are informal. Tutorials are attended by teaching assistants and occasionally by the lecturers, to provide formative feedback (e.g., on the micro-project work). No assessment of tutorial performance is noted.

Laboratory Session: Carried out in a small group of up to 5 students, the objectives of this lab session are to learn how to carry out measurements using strain gauge sensors and modern computer-based data acquisition equipment, to determine the surface stress on the beam and evaluate the Poisson's ratio of the material, and compare the findings against theoretical formula using the beam bending equations.

Assessment Details
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	End of semester examination	1-5	70	Exam period
Laboratory	Strain gauge lab report	1-5	10	2 weeks after lab
Assignment	Micro-project poster assignment	1-5	20	Approx. Week 38

Reassessment Requirements

Written examination

Contact Hours and Indicative Student Workload

Contact hours: 46 (33 lectures, 11 tutorials, 1 lab)
Independent Study (preparation for course and review of materials): 30
Independent Study (preparation for assessment, incl. completion of assessment): 45

Recommended Reading List	James M. Gere, Mechanics of Materials
Module Pre-requisite	1E7 Mechanics (or equivalent) and 2E4 Solids and Structures (or equivalent)
Module Co-requisite	None
Module Website	https://www.tcd.ie/Engineering/undergraduate/baiyear3/modules/3B3.pdf
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
COVID-19 contingency statement	While the intention is to deliver all lectures and tutorials face-to-face in a classroom, there is uncertainty due to the Covid-19 situation and part or all of the 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 and tutorials will be delivered online using Blackboard Collaborate Ultra. These sessions will be recorded and available for viewing via Blackboard at a later time. • The mid-term class test and the end of semester exam will be online.
Module Approval Date	
Approved by	
Academic Start Year	
Academic Year of Date	