Module Code	MEP55B10
Module Name	Finite Element Analysis
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Prof. Tríona Lally Dr. Majid Akbarzadeh Khorshidi Dr. Conor O'Keeffe Dr. Claire Conway
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. Perform analytical numerical solutions and also create the finite element code and implement it in Matlab for a range of solid mechanics problems, e.g. trusses, beams, frames, 2D plane strain/plane stress, thermal strain problem. LO2. Clearly demonstrate the matrix relationships between the forces and nodal displacements for different element types. LO3. Calculate the stiffness matrices for triangular and quadrilateral elements. LO4. Implement a linear and non-linear material model in a finite element code. LO5. Be able to critically evaluate the correct boundary/initial conditions for various problems. LO6. Understand the requirements of computational grid/mesh generation for FE applications. LO7. Gain hands-on user experience with well-known FE software packages LO8. Analyse different numerical techniques used to enhance the quality of the simulations. LO9. Implement comprehensive post-processing of numerical simulation results LO10. Assess numerical results both quantitatively and qualitatively to improve accuracy

[1] TEP Glossary

	Graduate Attributes: levels of attainment To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	Finite element (FE) modelling is wide-ranging in its application and is regularly employed across the engineering industry in areas such as biomedical engineering, manufacturing, aeronautical engineering, architecture, automotive, civil and structural engineering. In this module, FE theory and implementation will be introduced and thoroughly covered. The module will focus on linear elastic materials initially then subsequently cover more advanced non-linear materials encountered in bioengineering (e.g. anisotropic soft tissues, metal plasticity). The module will also include hands-on practical classes using MATLAB and a commercial finite element software. Overall, this module will provide the student with the required theoretical basis underpinning finite element simulations, as well as the practical skills to use this simulation tool effectively and accurately.
Teaching and Learning Methods	Finite Element Analysis is an optional course which is offered to 5th year MAI students and graduate students and equips students to apply FE methods as a tool for design, analysis and engineering applications. The course material is presented in a series of lectures. The teaching material is supplemented by frequent laboratory sessions during which the students will apply the information provided during lectures to FE simulations using Matlab and existing College-licenced commercial FE software package(s). With a strong emphasis on understanding and application of the underlying methods, enthusiastic students will gain experience using commercial FE software packages by analysing well established FE problems as well as applying their knowledge to current research projects within the School of Engineering.

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
Exam	Written exam	LO1-LO3, LO5-LO6,LO8, LO10	50%	End of term
Assignments	Continuous assessments will include MATLAB based assignments throughout the semester and a project which will require the use of a commercial FE software package	LO4, LO7, LO9, LO10	20%	Week 10 & 13
Group project	Design project using commercial FE software package	LO4, LO7, LO9, LO10	30%	Week 7, 12, & 15

Reassessment Requirements

N/A

Contact Hours and Indicative Student Workload[2]

Contact hours: 48
Independent Study (preparation for course and review of materials): 20
Independent Study (preparation for assessment, incl. completion of assessment): 60

Recommended Reading List

Finite Element Analysis: theory and practice by M.J. Fagan, *Introduction to Finite Element Analysis Using MATLAB® and Abaqus* by Amar Khennane

Module Pre-requisite

Module Co-requisite

N/A

Module Website

N/A

[2] TEP Guidelines on Workload and Assessment

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	
Academic Start Year	
Academic Year of Date	