Module Code	MEU11E12
Module Name	Engineering Materials and Their Applications
ECTS Weighting[1]	10 ECTS
Semester taught	Semester 1
Module Coordinator/s	Mechanical Engineering: Dr. Amir Pakdel (pakdela@tcd.ie) Electronics Engineering: Dr. Declan O'Loughlin (doloughlin@tcd.ie) Civil Engineering: Dr. David Igoe (igoed@tcd.ie) and Mr Peter Flynn (peter@flynnemail.com.ie)
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	Upon completion of this module, students will be able to: LO1. Identify the classes of materials, including metals, ceramics, polymers, composites, and semiconductors, and explain how their properties can be determined and exploited. LO2. Comprehend the correlation between the atomic/molecular structure of materials and their macroscopic properties, such as mechanical, structural, and electrical properties. LO3. Recognize the environmental impact of materials and the importance of sustainability in materials engineering. LO4. Work in teams on projects that require laboratory and hands-on experience in testing and analysis, leading to improved communication and collaboration skills. **Graduate Attributes: levels of attainment** To act responsibly - Introduced To think independently - Introduced To develop continuously - Introduced To communicate effectively - Introduced

[1] TEP Glossary

Module Content	• Principles of mechanical behaviour of materials, including concepts like stress, strain, deformation, and failure. • Mechanical properties including strength, stiffness, ductility, toughness, and fracture toughness. • Fracture mechanisms, including: ductile fracture, brittle fracture, creep, fatigue, and wear in materials. • Atomic structure, microstructure, strengthening mechanisms, and phase diagrams. • Measurement of mechanical, structural and electrical properties. • Introduction to concrete technology, reinforced and prestressed concrete. • Introduction to semiconductor technology. • Principles of transducers (strain gauges, thermocouples, displacement sensors, pressure transducers, Hall sensors). • Design, manufacture and testing of new materials, structures and devices (structural, mechanical, electronic)
Teaching and Learning Methods	The module will be divided proportionately into three sections to be delivered by the Mechanical, Civil and Electronic disciplines within the School of Engineering. There will be a taught component of the course involving three podium lectures and a tutorial session each week. The module will be examined at the end of the semester. A similar division will apply to the practical work. Students will work in teams to design, develop and test their own novel sustainable material/structure and associated sensors. This will involve a briefing session and up to a 2-hour laboratory each week for each student. The work will be group-based and project oriented and will involve defined experiments as well as design, construction and testing work on a multi-disciplinary novel sustainable element as a final goal.

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
Examination	Examination	1,2,3	50	Examination Week
Continuous Assessment	Quizzes, reports on laboratory experiments and design challenges.	4	50	Various times throughout the semester

Reassessment Requirements

Reassessment will be by examination only.

Contact Hours and Indicative Student Workload[2]

Contact hours: 66 hours
Independent Study (preparation for course and review of materials): 60 hours
Independent Study (preparation for assessment, incl. completion of assessment): 50 hours

Recommended Reading List

Engineering Materials 1: An Introduction to Properties, Applications and Design, Ashby and Jones

Materials: Engineering, Science, Processing and Design, Ashby, Shercliff, Cebon

The Science and Engineering of Materials, Askeland, Fulay, Wright

Concrete Practice, BCA, provided free-of-charge by Irish Cement Ltd.

Solid State Electronic Devices, Streetman B.G. & Banerjee S., 7th ed., Prentice-Hall, 2015.

Module Pre-requisite

None

[2] TEP Guidelines on Workload and Assessment

Module Co-requisite	Not applicable
Module Website	None
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No other schools, three Engineering departments (MMBE, EEE, CEE), in equal amounts
Module Approval Date	
Approved by	
Academic Start Year	September 2024
Academic Year of Date	2024/25