ENGR C2F04: Materials Science in Engineering

Module Title:	Materials Science in Engineering
Language of Instruction:	English

Credits:	5

NFQ Level:	6

Module Delivered In	4 programme(s)

Teaching & Learning Strategies:	This module introduces a contemporary materials science education curriculum, with the aim of helping technological development and increasing innovations. The Material's Science in Engineering will combine visual and tactile experiences in order to develop an understanding of materials. These contemporary content delivery techniques will be embelished with in-class discussion, Active & Cooperative Learning experiences, combined with exposure to relevant integrating technologies and supported independent learning.

Module Aim:	To provide the student with a broad knowledge of Materials, Material Science and the methods of altering material properties. To provide the student with an understanding of the internal effects of forces applied to members in structures and mechanisms, as evidenced by the stresses and deformations produced. To provide the student with an understanding of the response of structures due to the properties of materials.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Describe and apply the basic fundamentals of Material Science for Mechanical Engineering
LO2	Explain the characteristics, properties, degradation phenomena, and identification of ferrous/non-ferrous metals and alloys, polymers, ceramics, hybrids/composites, and biomaterials.
LO3	Analyse loads on mechanical components in order to determine the type and distribution of resulting reactions and the type and distribution of induced stress and strain.
LO4	Apply simplified models of stress and strain to representative systems in order to determine relationships between loads and the corresponding stress and strain using mechanical material properties.
LO5	Quantify, by calculation and experimental measurement, the characteristic response of materials and mechanical systems.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

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Module Content & Assessment

Indicative Content
Atoms, Molecules and Crystals Electron, Proton, Neutron Structure of the atom, states of matter Chemical bonding of atoms, Carbon and its compounds, Intermolecular forces Lattice structures, Dendritic solidification, Impurities in Cast metals, Influence of cooling rates on crystal size.
Non-ferrous metals Introduction to Non-Ferrous metals and alloys, including binary and eutectic phase diagrams.
Ferrous Metals & Heat Treatments Introduction to Steels and Cast Irons, including the Fe-C phase diagram.
Ceramics, semiconductor materials & Bio-Materials Introduction to Ceramics and Bio-Materials.
Polymers & Composites Introduction to Thermoplastics, Thermosets, and Elastomers.
Mechanical Properties and Testing Stress (Tensile, Compressive, Shear, Impact), Strain, Young's Modulus of Elasticity, Hooke's law, Static and Dynamic Testing, Hardness, Impact Strength, Wear and Corrosion and mitigating techniques.
Production techniques Introduction to traditional and modern (additive, subtractive) manufacturing techniques.
Uniaxial Stress Statically indeterminate force/stress systems Induced stress due to changes in volume and thermal effects
Torsion Statically Indeterminate Systems, Torsion in thin walled shells.
Couplings Standard pin couplings, calculations and detailing; Shear pins and mechanical overload devices. Fluid couplings.
Beams and Bending Bending Equation, Normal stress due to bending moment.
Energy Theorems Helical Springs

Assessment Breakdown	%
Continuous Assessment	20.00%
Practical	30.00%
End of Module Formal Examination	50.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Examination	Online in-term tests.	1,2,3	10.00	Ongoing
Presentation	Screencast laboratory presentation.	1,2,3,4,5	10.00	Week 10

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Complete experiments and submit technical reports.	1,2,3,4,5	20.00	n/a
Practical/Skills Evaluation	Computer Competencies Assignment	3,4	10.00	End-of-Semester

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	End of term examination.	1,2,3,4,5	50.00	End-of-Semester

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Multiple Choice Questions	Online in-term tests.	1,2,3	10.00	Ongoing
Presentation	Screencast laboratory presentation.	1,2,3,4,5	10.00	Week 10

No Project

Practical				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Complete experiments and submit technical reports.	1,2,3	30.00	n/a

End of Module Formal Examination				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	End of term examination.	1,2,3,4,5	50.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	2.00
Lecture	12 Weeks per Stage	2.00
Laboratory	12 Weeks per Stage	1.00
Independent Learning	15 Weeks per Stage	4.33
	Total Hours	125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EFARG_B	Bachelor of Engineering (Honours) in Agricultural Systems Engineering	4	Mandatory
CW_EMMEC_B	Bachelor of Engineering (Honours) in Mechanical Engineering	4	Mandatory
CW_EFARG_D	Bachelor of Engineering in Agricultural Systems Engineering	4	Mandatory
CW_EEMEC_D	Bachelor of Engineering in Mechanical Engineering	4	Mandatory