

<b>Module Title:</b>	Materials Engineering
<b>Language of Instruction:</b>	English
<b>Credits:</b>	10
<b>NFQ Level:</b>	8
<b>Module Delivered In</b>	<a href="#">2 programme(s)</a>
<b>Module Aim:</b>	To provide the student with a advanced understanding of materials, material science and the methods of altering material properties. To provide the student with a specialized knowledge of the internal effects of forces applied to structures, as evidenced by the stresses and deformations produced. To provide the student with a specialized knowledge of the response of structures due to the properties of materials

Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Analyse and predict properties of engineering materials.
LO2	Relate and contrast the functionality of materials in engineering through the mathematics, scientific, engineering, and technological analyses.
LO3	Examine and distinguish the selection and behaviour of materials in service.
LO4	Differentiate relationships between stress and strain in mechanical systems to predict the behaviour and/or failure of mechanical systems subjected to loads for the purposes of design.
LO5	Model and infer, by calculation and experimental measurement, the characteristic response of mechanical systems.

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

## Module Content & Assessment

### Indicative Content

#### Advanced mechanical properties and testing

Time-dependent and environmentally-sensitive properties and testing, Understand the link between microstructure and properties, deformation phenomena, Fracture Mechanics, Ductile-Brittle Transformation.

#### Advanced ferrous metals & heat treatments

Metallic Bonding and Crystal structures, Influence of Carbon and Alloying Elements, Heat Treatments, TTT/CCT curves, Martensite, Bainite.

#### Advanced non-ferrous metals

Alloying, Environmental Properties, Influence of Unit Cell and Alloying, Property Control.

#### Advanced ceramics, semiconductor materials & Bio-Materials

Bonding and Failure Modes, Applications: Wear, Biomaterial, Thermal.

#### Advanced polymers & composites

Polymerisation methods, Molecular Bonding, Temperature- and Time- Dependence, Viscoelasticity, Failure Mode Analysis.

#### Stress-strain relations

Plane stress Mohr's strain circle Strain gauge rosettes Stress-strain transformations in composites

#### Bending

Bending of composite beams Asymmetric bending Beams with axial loads Bending and shear stress in I beams Shear stress in thin-walled open sections

#### Stress and Strain Variation

Stress, strain and displacement relationships Thick walled cylinders

#### Failure Criteria

Buckling of slender struts

Assessment Breakdown	%
Continuous Assessment	10.00%
Practical	30.00%
End of Module Formal Examination	60.00%

### Continuous Assessment

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Examination	Class Test (MCQ)	1,2	5.00	Week 3
Examination	Class Test (MCQ)	1,2	5.00	Week 6

No Project

### Practical

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Labs: Environmental Creep, Fatigue Testing, Failure Analysis, 3-/4-Point Bending, Thick walled cylinders, Buckling of struts. Lab Report/Assessment	1,2,3,4,5	20.00	Week 10
Practical/Skills Evaluation	Computer Competencies Assignment	3,4	10.00	Week 9

### End of Module Formal Examination

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	n/a	1,2,3,4	60.00	End-of-Semester

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

**Module Workload**

<b>Workload: Full Time</b>		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	12 Weeks per Stage	3.00
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Laboratory	12 Weeks per Stage	2.00
Independent Learning	15 Weeks per Stage	10.27
Total Hours		250.00

**Module Delivered In**

Programme Code	Programme	Semester	Delivery
CW_EFARG_B	<a href="#">Bachelor of Engineering (Honours) in Agricultural Systems Engineering</a>	7	Mandatory
CW_EMMEC_B	<a href="#">Bachelor of Engineering (Honours) in Mechanical Engineering</a>	7	Mandatory