MATERIALS AND MANUFACTURING SUSTAINABILITY - 2024/5

Module code: ENGM294

Module Overview

The human race is transiting from an era of material plenty where material supply and disposal has not been an issue. With the global population now exceeding 7.7 billion, and with rising global affluence and increased environmental awareness, it is evident that this era is now coming to an end. Sustainable use of materials means living in this altered environment, where our society is reliant on water, energy and materials in order to maintain quality of life, without compromising that of future generations. This module will build on earlier modules to provide a deeper understanding of materials extraction and processing, product design, manufacturing and materials recovery in the context of sustainability. Alongside this it will equip participants with tools to quantifiably evaluate the materials, manufacturing and design choices made with respect to their environmental and sustainability impact.

Module provider

Mechanical Engineering Sciences

Module Leader

DOREY Robert (Mech Eng Sci)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 7

Module cap (Maximum number of students): N/A

Overall student workload

Workshop Hours: 11

Independent Learning Hours: 84

Lecture Hours: 11

Guided Learning: 11

Captured Content: 33

Module Availability

Semester 2

Prerequisites / Co-requisites

none

Module content

Indicative content includes: • Extraction and refinement of materials • Manufacturing of materials • Recovery of materials • Design for sustainability • Sustainability tools • Corporate and individual responsibility and ethics within an engineering context

Assessment pattern

Assessment type	Unit of assessment	Weighting
Examination Online	ONLINE (OPEN BOOK) EXAM within 4 hour window	100

Alternative Assessment

N/A

Assessment Strategy

The assessment strategy is designed to provide students with the opportunity to demonstrate the learning outcomes of the module.

The summative assessment for this module consists of an online examination in the form of a sustainability assessment [learning outcomes 1, 2, 3, 4, 5];

The formative assessment for this module consists of an on-line test exploring aspects of a sustainability assessment.

Feedback will be provided via multiple routes:

- Verbal feedback for guided learning tasks and formative assessment will be provided in discussion workshops and within lectures
- Model answers will be provided for guided learning tasks and formative assessments

Module aims

- To build on previous modules to develop an understanding of the non-fiscal costs of producing advanced materials and engineering products
- To provide an introduction to designing for sustainability
- To equip the participants with a tool kit for evaluating sustainability practices
- To examine corporate, societal and individual responsibilities in the context of sustainability

Learning outcomes

Ref		Attributes Developed	
001	Summarise, compare and evaluate impacts of different manufacturing routes with a focus on energy, water and material consumption	KC	M1, M4, M7
002	Use the sustainability tools to support how choices in inputs can impact the final outputs	KC	M2, M7, M8, M13
003	Propose design best-practice for ensuring effective material recovery at end of life	KCP	M5, M13
004	Evaluate and assess the cradle to grave sustainability of manufacturing processes with reference to materials and design choices	KCP	M5, M7
005	Communicate recommendations for manufacturing and materials sustainability	PT	M17

Attributes Developed

C - Cognitive/analytical

K - Subject knowledge

T - Transferable skills

P - Professional/Practical skills

Methods of Teaching / Learning

The learning and teaching strategy is designed to introduce and develop an understanding of sustainability as it relates to materials, design and manufacturing. This is achieved through lectures, discussion workshops, guided learning resources, and online resources, integrated with formative assessments.

The learning and teaching methods include a mix of workshop discussions lectures, pre-recorded pod casts, and guided learning tasks each week for 11 weeks alongside a mid-semester class test and end of module revision lecture workshop. This allows students to first gain a holistic overview of each learning topic and then develop a deeper understanding through active application of the key learning concepts within guided learning exercises, supported by focused pod casts. The key learning points are then re-visited and reinforced through discussion workshops and formative assessment.

Indicated Lecture Hours (which may also include seminars, flipped learning, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

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Reading list

https://readinglists.surrey.ac.uk
Upon accessing the reading list, please search for the module using the module code: ENGM294

Other information

The School of Mechanical Engineering Sciences is committed to developing graduates with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability and Resourcefulness and Resilience. This module is designed to allow students to develop knowledge, skills and capabilities in the following areas:

Employability: This module provides students with knowledge about the fundamental processes that occur during a variety of manufacturing processes. The module builds on this to develop the student's understanding of the interrelationship of processes occurring from extraction through to eventual end of life. Students will work in small discussion groups – sharing and critiquing ideas and concepts – to refine and test their fundamental understanding of the subject. Students will become familiar with open discussion methods and supportive collaborative environments.

Digital capabilities: Students will use digital platforms to evaluate and gain understanding of the process variables in determining energy and material usage in a range of manufacturing processes. This is conducted as part of the guided learning activities which then feed into the class discussions

Global and Cultural Capabilities: A sustainability analysis requires students to demonstrate an appreciation of the societal impacts of the whole cradle-to-grave lifecycle of a manufactured product. By its very nature this will require students to demonstrate global culture awareness due to the global nature of any engineered product. In group discussion workshops, students are encouraged to learn and share from each other's personal and cultural knowledge and perspectives.

Sustainability: The ultimate learning outcome of this module is for the students to demonstrate their ability to complete a sustainability assessment for a product or process making use of an industry-standard assessment framework. In doing so the students need to address and compare the environmental, social and manufacturing capitals involved, linking to the UN sustainability goals, in order to both define the sustainability of a product and its manufacturing process and also suggest ways in which the product and processes could be made more sustainable.

Resourcefulness and resilience: Students will develop resourcefulness in responding to problem-based task requirements through sharing ideas and experiences both individually and collectively, appreciating potential barriers and challenges faced by others, providing support and showing empathy towards each other in working towards achieving successful outcomes.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Advanced Mechanical Engineering MSc	2	Optional	A weighted aggregate mark of 50% is required to pass the module
Aerospace Engineering MEng	2	Optional	A weighted aggregate mark of 50% is required to pass the module
Automotive Engineering MEng	2	Optional	A weighted aggregate mark of 50% is required to pass the module
Mechanical Engineering MEng	2	Optional	A weighted aggregate mark of 50% is required to pass the module