MODULE SPECIFICATION

Part 1: Information			
Module Title	Solid Mechanics, Materials and Manufacturing		
Module Code	UFMFLS-30-1	Level	Level 4
For implementation from	2020-21		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Faculty of Environment & Technology	Field	Engineering, Design and Mathematics
Department	FET Dept of Engin Design & Mathematics		
Module type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description

Overview: This introductory module considers a wide range of engineering analysis of static solid structures and their manufacture, setting examples in an industrial context where possible, otherwise using key learning examples.

The module explores how engineering principles are related to properties of materials, product design and environmental sustainability. Mathematics and numerical modelling are presented in an engineering context in order to strengthen the students' confidence to address future design engineering challenges.

Reflective practice is encouraged throughout the module where students are working in groups to allow them to share and discuss any aspects or challenges that the module may bring to light. The module takes the students through a journey of examples and applications based around a single platform example, where learning is reinforced with numerical modelling, laboratory based activities and interactive quizzes, allowing the students to practise their maths and challenge their understanding.

Educational Aims: The module covers a range of theory and techniques that are central to sound core engineering. This includes the study of statics both in theory and practice, associated analytical methods, materials science and manufacturing techniques.

The module explains key engineering principles integrating them with mathematical techniques, numerical modelling and design methodologies, to give the students a basic toolkit to allow them to further investigate and tackle real engineering problems.

Outline Syllabus: Statics:
* Introduction to statics; static equilibrium equations, reactions at supports, distributed and concentrated loading:
* Pin-jointed framework; compression and tension. Method of Joints; Method of sections. Frames and machines.
* Properties of materials, stress, strain, Young's Modulus.
* Shear Force & Bending Moment Theory. Bending moment and shear diagrams, integration theory.
* Stresses in beams & Second Moment of Area, Parallel axis theorem.
* Combined bending and end load; Bi –axial bending. Thermal Strain & Intro to 2D & 3D theory.
* Torsion, derivation of the engineering torsion formula.

Materials:

* Classification of Materials; Metals, Polymers, Composites and Ceramics. Atomic structure and bonding.
*Environmental impact of materials and manufacturing processes.
* Material property and sustainability selection, using Ashby charts.
* Mechanical properties of materials and their measurement; e.g. tensile, bending, hardness, impact.
* Metals: Crystal structures and crystal defects; strengthening processes: alloying, work hardening, grain refinement and heat treatment; simple phase transformations and microstructures; basic heat treatment.
* Polymers: structure, properties and manufacturing of polymers.
* Composites: structure, properties and manufacturing of composites.
* Primary and secondary bonding and the structure of materials.

Manufacturing:

* Classification of Manufacturing: Job, Batch and Continuous manufacture. Economies of scale. Breakeven Analysis.
* Primary Processes: Rolling, casting, extrusion and forging of metals.
* Presswork and Associated Processes: Sheet metal blanking, piercing, shearing and forming. Press tools, drawing and extrusion.
* Material Removal Processes: Conventional metal cutting processes. Turning, milling and grinding. CNC machining. Calculation of power required to cut and Taylor's tool life equation.
* Introduction to assembly and joining techniques: Welding, adhesives and fasteners.

Teaching and Learning Methods: The module delivery is designed to bring together engineering theory and concepts, analysis and practical experience together so that students consolidate theoretical knowledge through practice and observation.

The module combines lectures, lectorials, class-based interactive workshops, technical workshops and introduces students to the experience of working on real engineering challenges.

The module devotes time to the use of numerical modelling tools as well as laboratories in order to demonstrate the importance of both approaches to solving problems and allowing the students to develop skills to work in a safe and professional manner with their peers.

Part 3: Assessment

The module brings together three areas of engineering knowledge and practice that are essential elements in the education of a graduate engineer; namely solid mechanics, materials and manufacturing. The assessment is designed to ensure that students have secure knowledge in the underpinning engineering analysis before attempting assessment tasks that integrate these areas of knowledge.

Students build confidence with applying the fundamental engineering principles of solid mechanics and structural analysis (statics) through an end of semester e-assessment taken under controlled conditions. Students will have the opportunity to take short practice tests throughout the semester.

Statics, materials and manufacturing principles will be brought together through a group work project on an engineering challenge assessed during the second Project Week held in Semester 2. This is a coordinated assessment shared with Engineering Practice 1 and Dynamics Modelling and Simulation. The activity is designed to allow students to demonstrate learning outcomes relevant to this module.

Students will work in their groups on a defined problem that they select at the end of Project Week 1 that involves the application of these subjects to real engineering problems. The students will demonstrate their achievement through the submission of a group poster at the end of the Project Week 2.

At the end of the module there will be controlled assessment in the form of a written examination that focuses on engineering design problems that requires knowledge of the different elements covered in the module. This module will be scenario based meaning students will be provided with outline design tasks to work on prior to the examination but the actual questions will be unseen.

The resit assessment will have the same format as above with the exception that the poster will be an individual submission of the problem worked on during the project week.

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Examination (Online) - Component A		35 %	Statics e-assessment (end of TB1) (2 hours)
Poster - Component B		25 %	Group poster and questions for assessment of statics, materials and manufacturing (typically during project week 2) (15 mins)
Presentation - Component B	✓	40 %	Group Presentation
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Examination (Online) - Component A		35 %	Statics e-assessment under controlled conditions (2 hours)
Presentation - Component B	✓	65 %	Individual design assignment assessed by a presentation

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will achieve the following learning outcomes:

Module Learning Outcomes	**Reference**
Accurately identify and explain the relationship between material properties and their structure at the atomic/molecular level (SM1b)	MO1
Evaluate materials and manufacturing processes to meet requirements with relationship to manufacturing volume, mechanical properties, economic, ethical and environmental cost, dimensional accuracy and automation (EL4, P2, P3)	MO2
Analyse engineering problems by applying analytical skills and models using fundamental and well-understood static principles. (SM1b, EA1b)	MO3
Analyse test results in comparison to theory and ideal manufacturing methods using static analysis to demonstrate an understanding of material and manufacturing uncertainty. (EA2, G1, G4)	MO4

Contact Hours

Independent Study Hours:

Independent study/self-guided study	228
Total Independent Study Hours:	228

	Scheduled Learning and Teaching Hours:	
	Face-to-face learning	72
	Total Scheduled Learning and Teaching Hours:	72
	Hours to be allocated	300
	Allocated Hours	300
Reading List	*The reading list for this module can be accessed via the following link:* https://rl.talis.com/3/uwe/lists/C5B3A940-8B98-70BB-79DF-665139E5CE16.html	

Part 5: Contributes Towards

This module contributes towards the following programmes of study:

Aerospace Engineering [Sep][FT][Frenchay][3yrs] BEng (Hons) 2020-21

Aerospace Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2020-21

Aerospace Engineering [Sep][FT][Frenchay][4yrs] MEng 2020-21

Aerospace Engineering [Sep][SW][Frenchay][5yrs] MEng 2020-21

Aerospace Engineering with Pilot Studies [Sep][FT][Frenchay][3yrs] BEng (Hons) 2020-21

Aerospace Engineering with Pilot Studies [Sep][SW][Frenchay][4yrs] BEng (Hons) 2020-21

Aerospace Engineering with Pilot Studies [Sep][FT][Frenchay][4yrs] MEng 2020-21

Aerospace Engineering with Pilot Studies [Sep][SW][Frenchay][4yrs] MEng 2020-21

Aerospace Engineering {Apprenticeship} [Sep][FT][UCW][3yrs] BEng (Hons) 2020-21