University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Structural Integrity			
Code: ENGG11041	**SCQF Level: 11 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: 10 (European Credit Transfer Scheme)**
School:	School of Computing Engineering and Physical Sciences		
Module Co-ordinator:	Dr Tony Murmu		

Summary of Module

This module will study the complex theories of advanced mechanics of materials and structural integrity when allied to structures and components.

The theory of shells will investigate axisymmetric loading on axisymmetric vessels, and primary and secondary stresses in cylinders. Fracture and fatigue will explore elastoplastic fracture mechanics, J-Integral, and failure assessment diagrams. Non-linear behavior such as creep, stress relaxation, stress redistribution, creep rupture and creep laws will be applied to high temperature components. Plastic behavior will be investigated such as the stress- strain relationships, incremental theory, plastic deformation theory, residual stresses, and shakedown theorems.

The module will be delivered via traditional lectures, tutorials, with the theories exemplified using real design situations. The module will integrate advanced mechanics of materials with techniques being delivered in applied finite element analysis.

The assessment for this module will be by one major coursework and a final exam During the course of this module students will develop their UWS Graduate Attributes

(https://www.uws.ac.uk/current-students/your-graduate-attributes/). Universal: Academic attributes - critical

thinking and analytical & inquiring mind, Professional: research minded; Work-Ready: Academic attributes - knowledge of complex mechanics of materials and structural integrity theories and industrial applications and relevant ICT skills; Successful : autonomous, driven and resilient.

This module has been reviewed and updated, taking cognisance of the University's Curriculum Framework principles. Examples of this are found within the module such as active and engaging practical testing laboratory, module assessment which reflects industry design activities, learning synergies across modules and levels of study, recorded lecture content supporting students to organise their own study time and the use of real-world practical student generated data with to compare with and validate simulation activity developing digital intelligence meta- skills.

Module Delivery Method					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**Hybrid 0**	**Work-Based Learning**
☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

Campus(es) for Module Delivery						
The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☐	Term 2	☒	Term 3	☐

Learning Outcomes: (maximum of 5 statements) At the end of this module the student will be able to:	
L1	Develop a critical and comprehensive understanding a a range of complex and specialised theories and concepts.
L2	Apply advanced theories and concepts to the design and analysis of components to reach substantiated conclusions, discussing the limitations of techniques employed
L3	Apply fracture mechanics to the design and assessment of components and systems
L4	Apply theory to the design of pressure vessels and compare to experimental testing
L5	Apply non linear material behaviour to the design and assessment of components and systems

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	During completion of this module, there will be an opportunity to achieve core skills in:

Knowledge and Understanding (K and U)	SCQF Level **11** A critical knowledge and understanding of advanced mechanics of materials and structural integrity theories and concepts, and how these fit into engineering and design strategies. Specific and detailed knowledge and understanding of the application, techniques and practices associated with structural analysis of engineering and design problems. Detailed knowledge of appropriateness of methods and techniques to different problems/scenarios
Practice: Applied Knowledge and Understanding	SCQF Level **11** Select and critically evaluate technical literature and other sources of information to solve complex problems Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards Applying knowledge and understanding to develop modelling and analysis strategies for a wide range of engineering and design problems, using finite element method techniques. Assessing different strategies with respect to obtaining appropriate efficient solutions to engineering and design problems. Making use of failure theories to solve engineering and design problems such as optimisation methods or open ended problems.
Generic Cognitive skills	SCQF Level **11** Undertaking, evaluating and assessing component behaviour. Making judgements on appropriate analytical approaches and their findings. Being able to develop conceptual solutions and strategies to complex design problems. Dealing with idealisation of problems in relation to results and making critical comparative assessments between theoretical, simulation, and experimental predictions. Bringing information together from a variety of sources during problem solving and being able to perceive potential problems with methods and strategies.
Communication, ICT and Numeracy Skills	SCQF Level **11**

	Ability to perform, interpret and evaluate complex numerical, geometrical and graphical data and using it to solve problems. Ability to use variables and equations. Ability to integrate existing software with other applications such as spread sheets. Make use of multi-purpose integrated software systems to solve complex problems. Using communications skills to write detailed, critical technical reports, including text and illustration. Using software and associated ICT equipment and systems such as networks to support and perform a wide range of problem solving tasks.	
Autonomy, Accountability and Working with others	SCQF Level **11** Identifying and addressing their own learning needs both during and out with class time. Identifying solution routes and strategies using their own initiative and informed judgements.	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code:	**Module Title:**
	Other:	Or equivalent
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching	
This module will be delivered via a blend of lectures, laboratory examples of real engineering problems. Assessment will be via a major coursework/case Investigation assignment of a real design problem which will be compared with actual test results. The module will also be assessed via a final examination. The examination/case study will only assess any LO once, thus allowing variability in the question paper.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	18

Tutorial/Synchronous Support Activity	18
Laboratory	2
Independent Study	162
	Hours Total 200

****Indicative Resources: (eg. Core text, journals, internet access)**
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: Fracture Mechanics: Fundamentals and Applications, Third Edition Hardcover – 24 Jun 2005 by Ted L. Anderson Theory of Shell Structures, Cambridge University Press, February 2010, By C. R. Calladine Theory of Plasticity (Third Edition), Jagabanduhu Chakrabarty , 2005 Elsevier Ltd Matrix Analysis of Structures, Aslam Kassimali, Cengage Learning, 2011 Stress Analysis for Creep, J.T. Boyle and J. Spence, Butterworths,
(**N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements
In line with the Student Attendance and Engagement Procedure: Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	Engineering and Physical Sciences
Assessment Results (Pass/Fail)	Yes ☐No ☒

School Assessment Board	Engineering
Moderator	Tony Leslie
External Examiner	M Ghaleeh
Accreditation Details	This module is part of the IMechE accredited programmes MEng (Hons) Mechanical Engineering.
Changes/Version Number	1.13 (was 1.12) Module Delivery Changed to Face-To-Face from Hybrid C. Modules hours updated to reflect Curriculum Framework

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment Category 1: Unseen Open Book Examination 50%
Assessment Category 2: Case study/investigation 50%
(N.B. (i) **Assessment Outcomes Grids** for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An **indicative schedule** listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Assessment Outcome Grids (See Guidance Note)

Component 1							
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Learning Outcome (5)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Unseen Open Book Examination	✓	✓	✓	✓	✓	60	2

Component 2							
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Learning Outcome (5)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Case study	✓	✓	✓	✓	✓	40	0
Combined Total for All Components						**100%**	**2 hours**