University of the West of Scotland

Module Descriptor

Session: 2023/24

Last modified: 19/03/2023 12:50:00
Status: Proposal

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:	Tony Murmu		

Summary of Module

This module will study the complex theories of advanced mechanics of materials and strucural 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 elasto-platic 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 behaviour 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 : autonomus, driven and resillient.

- 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	HybridO	Work-based Learning
			✓		

Face-To-Face
Term used to describe the traditional classroom environment where the students and the lecturer meet synchronously in the same room for the whole provision.

Blended
A mode of delivery of a module or a programme that involves online and face-to-face delivery of learning, teaching and assessment activities, student support and feedback. A programme may be considered "blended" if it includes a combination of face-to-face, online and blended modules. If an online programme has any compulsory face-to-face and campus elements it must be described as blended with clearly articulated delivery information to manage student expectations

Fully Online
Instruction that is solely delivered by web-based or internet-based technologies. This term is used to describe the previously used terms distance learning and e learning.

HybridC
Online with mandatory face-to-face learning on Campus

HybridO
Online with optional face-to-face learning on Campus

Work-based Learning
Learning activities where the main location for the learning experience is in the workplace.

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)						
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)

On successful completion 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:	
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	16
Tutorial/Synchronous Support Activity	18
Laboratory/Practical Demonstration/Workshop	2
Independent Study	164
	200 Hours Total

****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)

Engagement Requirements

In line with the Academic Engagement Procedure, Students are defined as academically engaged if they are regularly engaged with timetabled teaching sessions, course-related learning resources including those in the Library and on the relevant learning platform, and complete assessments and submit these on time. Please refer to the Academic Engagement Procedure at the following link: Academic engagement procedure

Supplemental Information

Programme Board	Engineering
Assessment Results (Pass/Fail)	No
Subject Panel	Engineering
Moderator	T.Leslie
External Examiner	M Ghaleeh
Accreditation Details	
Changes/Version Number	1.12 Hybrid C Selected in lieu of Blended/Face-To-Face Learning Activites updated to reflect delivery. Equality and Diversity Statement Updated. V1.08 LO's updated to reflect AHEP4 more accurately for assessment AHEP4 M4 &M5 included in Practice: Applied Knowledge and Understanding. as inherent in module materials. Utilised in assessments. Module summary updated to reflect Curriculum Framework principles. Learning and Teaching updated to reflect restructuring of module delivery involving greater focus on practical laboratory and tutorial sessions. Reference to 'unseen closed book examination' replaced with 'unseen open book examination' as per revised University policy. Change confirmed with accrediting body. v1.07 Summary of module updated to reflect removal of Matrix analysis of structures, this is a very specific topic and not particularly relevant to modern industry. Module moderator updated to T.Leslie from TBC. Unseen closed book examination added in lieu of Unseen open book examination, assessment outcome grids updated accordingly. V1.06 As a result of the Covid-19 situation, assessment component 1 changed from Unseen Closed Book to Unseen Open Book and Blended added as a Module Delivery Method. v1.05 4. MC changed to Tony Murmu. 9. Contact revised to Lecture 24h, Tutorial 12, Lab 0, to reflect delivery 20. MM changed to TBC V1.04 (18.03.2019) Module coordinator and moderator changed. Summary text correction, updates and UWS Graduate Attributes addition. Typo correction to LO's and Employability PDP Skills. Lecture delivery corrected from 36 to 24 hours. Laboratory hours corrected to 6 hours. Independent study increased to 158 hours. Component 2 contact hour corrected to 0. V1.1 (22/08/201) post validation updates

Assessment: (also refer to Assessment Outcomes Grids below)
Unseen open book examination 50% 2hrs Duration
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 Handbook.)

Assessment Outcome Grids (Footnote A.)

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	✓	✓	✓	✓	✓	50	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	✓	✓	✓	✓	✓	50	0
					Combined Total For All Components	100%	2 hours

Footnotes
A. Referred to within Assessment Section above
B. Identified in the Learning Outcome Section above

Note(s):
1. More than one assessment method can be used to assess individual learning outcomes.
2. Schools are responsible for determining student contact hours. Please refer to University Policy on contact hours (extract contained within section 10 of the Module Descriptor guidance note).
   This will normally be variable across Schools, dependent on Programmes &/or Professional requirements.

Equality and Diversity

Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. Specialist assistive equipment, support provision and adjustment to assessment practice in accordance with the University's policies and regulations. More information on the University's EDI policies can be accessed at: https://www.uws.ac.uk/about-uws/uws-commitments/equality-diversity-inclusion/
UWS Equality and Diversity Policy

(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)