University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Design Analysis 3			
Code: ENGG10020	**SCQF Level: 10 (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

Analysis and synthesis of linear translational, torsional and combined (coupled) translational and torsional vibrations, with and without damping. The method of solution will be based on modeling of engineering systems and matrix methods allied to computerised solutions.

Shear stress distribution in beams will be introduced as will shear centre and shear flow.

A range of experimental methods will be investigated for simple continuous systems focusing on experimental modal testing.

The application of modern methods and equipment for the measurement and analysis of experimental vibration data. Analysis of creep in components operating at elevated temperature.

Plastic analysis of components subject to axial and bending loads.

The analysis of components containing crack like defects using LEFM and Paris Law.

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);

Work-Ready: Academic attributes (knowledge); Personal (motivated);

Successful: Academic attributes (autonomous), Personal (imaginative and resilient), Professional (Driven)

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 laboratory and tutorial activity, module assessment which reflects industry design activities, learning synergies across modules and levels of study and recorded lecture content supporting students to organise their own study time.

Scope of the Module:

Shear stress distribution, shear centre and shear flow topics are introduced.

Analysis and synthesis of multi mass transverse beam vibrations for multi-degree of freedom problems based upon the transfer matrix approach using field, point (mass), and support matrices excluding damping. The method of solution will be based on modeling of engineering systems and matrix methods allied to computerised solutions.

Analysis and synthesis of torsional vibrations for multi-degree of freedom problems including gear inertias and branching effects with and without damping, and based upon the matrix approach. The method of solution will be based of engineering systems and matrix methods allied to computerized solutions. Vibration of Structures.

The creep process and the simple secondary creep power law is applied to the range of components to predict failure/rupture, life times and relaxation/recovery in a range of materials including viscoelastic.

Shape factors, plastic moment of resistance for symmetrical and unsymmetrical sections. Residual stress and spring back effects. Application to simple engineering components.

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	Apply a comprehensive knowledge of engineering principles and techniques of fracture and fatigue to appropriate engineering components.
L2	Apply a comprehensive knowledge of engineering principles and techniques creep and plastic analysis to appropriate engineering components.

L3	Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed. Thus solve complex problems in structural analysis.
L4	Formulate and analyse complex design problems of multi degree of freedom vibrational engineering systems using matrix methods.

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 **10** A critical knowledge and understanding of advanced mechanics of materials and multi degree of freedom dynamics methods and techniques and how these can be applied to engineering and design strategies. Specific and detailed knowledge and understanding of the application, techniques and practices associated with matrix methods of 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 **10** Appling knowledge and understanding to develop modelling and analysis strategies for a wide range of engineering and design problems, using advanced mechanics of materials and multi degree of freedom dynamics techniques. Assessing different strategies with respect to obtaining appropriate efficient solutions to engineering and design problems. Select and critically evaluate technical literature and other sources of information to solve complex problems
Generic Cognitive skills	SCQF Level **10** Undertaking, evaluating and assessing complex engineering analysis Making judgments on analytical data and results. Being able to develop conceptual solutions and strategies to advanced mechanics of materials and multi degree of freedom dynamics problems. Awareness of the limitations of the techniques and theories employed.

Communication, ICT and Numeracy Skills	SCQF Level **10** 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 adapt standard/existing software such as spread sheets to solve complex problems. Using communications skills to write detailed, critical technical reports, including text and illustration.	
Autonomy, Accountability and Working with others	SCQF Level **10** 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: ENGG09020	**Module Title:** Design Analysis 2
	Other:	or equivalent HN qualification
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching	
The learning and teaching activity for this module include lectures, tutorials and problem based learning.	
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: (e.g. Core text, journals, internet access)**
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: “The Theory of Vibration with Applications”, W. T. Thomson, Taylor Francis, 1st Ed, 2004 “Mechanics of Engineering Materials Vol 2”, E. J. Hearn, Butterworth, 3rd Ed, 1996 “Mechanics of Engineering Materials”, Benham & Crawford & Armstrong, Addison Wesley Longman Higher Education, 3rd Ed, 1997 “Mechanics of Solids & Structures”, D. W. A. Rees, World Scientific Publishing Company; 1st Edition, 2000 ‘Vibration of Mechanical and Structural Systems : With microcomputer applications’, James M.L, Smith G.M., Wolford J.C., Whaley P. W Harper and Row
(**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	Obeid Obeid
External Examiner	M Ghaleeh
Accreditation Details	This module is part of the IMechE accredited programmes BEng/Meng (Hons) Mechanical Engineering.
Changes/Version Number	2.15 (was 2.14) Module Delivery Changed to Face-To-Face from Hybrid C.

Assessment: (also refer to Assessment Outcomes Grids below)
Unseen Open Book Examination 60%
Coursework 1- 20%
Coursework 2 -20%
(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)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Unseen open book examination	✓	✓	✓	✓	60	3

Component 2						
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Case study	✓	✓			20	0

Component 3						
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Case study			✓	✓	20	0
Combined Total for All Components					**100%**	**0 hours**