MODULE SPECIFICATION

Part 1: Information			
Module Title	Structural Design & Inspection		
Module Code	UFMFE9-30-3	Level	Level 6
For implementation from	2018-19		
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		
Contributes towards			
Module type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description

Overview: The course aims to provide a rounded understanding of structural design and inspection (mechanics of materials, FEA, composites engineering and inspection) so that students are competent with the subject when they work in industry.

Educational Aims: See Learning Outcomes.

Outline Syllabus: The syllabus includes:

Mechanics of Materials and FEA

Energy Methods in Structural Analysis:
Strain energy and complementary energy; The principle of the stationary value of the total complementary energy; Unit load method; Flexibility method; Application to deflection problems; Application to the solution of statically indeterminate systems; Total potential energy; The principle of the stationary value of the total potential energy.

Weighted Residuals:
Approximation of differential equations by the weighted residuals method; Galerkin's, collocation's and subdomains' methods; Application of the weighted residuals to the beam-deflection second order differential equation; Weak formulations; Weighted residuals for the theory of elasticity.

Finite Element Method:
Derivation of the FEM from the weighted residuals method; Shape functions, integration and derivation in the FEM; Finite elements for plane stress, plane strain, beam analysis, plates and shells, and 3D continuum structures; ABAQUS finite element software; Defining a FE model with ABAQUS/CAE; ABAQUS implicit versus ABAQUS explicit; Boundary conditions and loads in ABAQUS; Finite elements for plane stress, plane strain, beams, plates and shells and 3D solids in ABAQUS; Material models and yield criterions in ABAQUS.

Composite Engineering

Classification and structure of composite materials, composition and structural relationships.
Composite materials: matrix materials, fibres, fabrics, core materials.
Calculation of physical and mechanical properties: rule of mixtures, Hart-Smith and the Classical Laminate Analysis method.
Design of composite structures: fundamental principles, design guidelines, balance, symmetry, thickness law.
Testing of composite materials: reasons for importance, destructive and non-destructive methods.
Performance of composite structures: tension, compression, bending, shear, impact toughness, fatigue, failure criterion.
Sustainability and recycling of composites: natural fibres and matrices, reduced weight, conflicts.

Component Inspection

Inspection principles using machine vision.
Use of software for image-based inspection.
Surface and subsurface inspection techniques.

Teaching and Learning Methods: Large group lecture supported by small group tutorial sessions. Study time outside of contact hours will be spent on going through exercises and example problems.

Lab sessions will provide experience of empirical methods, modelling and simulation and will require time outside for assignment preparation.

Scheduled learning: lectures, tutorials, laboratory work and FEA activities.

Independent learning: essential reading, preparation, assignment preparation and completion.

Contact Hours:

Activity:
Contact: 75 hours
Assimilation and skill development: 150 hours
Coursework: 19 hours
Exam preparation: 56 hours
Total: 300 hours

Contact hours include workshop time under technician supervision.

Part 3: Assessment			
The examination (component A) is summative and assesses the students' understanding of concepts and techniques, and their ability to apply them to relatively straightforward problems. The coursework (component B) is both summative and formative. The assignments provide the students with the opportunity to apply theory and test their understanding of the course material through an applied learning cycle. Feedback from the coursework is intended to assist students with their preparations for the end-of-year examination.			
First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Written Assignment - Component B		25 %	Finite element analysis assignment
Written Assignment - Component B		25 %	Composite engineering/inspection assignment
Examination - Component A	✓	50 %	Summer Examination (3 hrs)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Written Assignment - Component B		50 %	Assignment
Examination - Component A	✓	50 %	Examination (3 hrs)

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will be able to:

	Module Learning Outcomes
MO1	Show a detailed knowledge and understanding of key theoretical principles and results
MO2	Model and simplify real engineering problems
MO3	Demonstrate key transferable skills in problem formulation and decision-making
MO4	Design optimum solutions with composite materials
MO5	Appraise the performance and discuss the key conflicts with composite materials with regard to sustainability and recyclability
MO6	Calculate the mechanical properties of composite materials and justify their application
MO7	Appraise the use of machine vision in inspection and testing, its advantages and limitations
MO8	Develop simple machine vision computer scripts for image-based inspection tasks

Contact Hours

Contact Hours	
Independent Study Hours:	
Independent study/self-guided study	225
Total Independent Study Hours:	225
Scheduled Learning and Teaching Hours:	
Face-to-face learning	75
Total Scheduled Learning and Teaching Hours:	75
Hours to be allocated	300
Allocated Hours	300

Reading List

The reading list for this module can be accessed via the following link:

https://uwe.rl.talis.com/modules/ufmfe9-30-3.html