STRU H4601: Aircraft Structural Mechanics and Analysis

Module Title:	Aircraft Structural Mechanics and Analysis
Language of Instruction:	English

Credits:	10

NFQ Level:	8

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	The module will be delivered using lectures, tutorials and laboratory sessions.

Module Aim:	To provide the students with the knowledge and skills required for evaluate a range of structures under complex loading condition by analytical and numerical analysis.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Analyse complex stresses and strains due to combined loading and loading on oblique plains.
LO2	Plot the stresses and strains at any plane across the field using graphical methods such as Mohr's circle.
LO3	Apply the theories of elastic failures to composite structures and assymmetric beams.
LO4	Execute the mathematical and physical principles underlying linear static structural Finite Element Analysis (FEA).
LO5	Analyse complex structural problems using commercial FEA software packages. Demonstrate the ability to design a component/assembly and carry out bolted joint analysis using FEA
LO6	Contribute effectively, as an individual or as part of a group, to the planning and realization of investigations in a laboratory environment into the behaviour of structural materials in service.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

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Module Content & Assessment

Indicative Content
Stress Transformations *Two-dimensional stress; Stress on oblique planes; Mohr's circle of stress; Principal stresses. *Application to combined bending and shear stress in beams, combined bending and torsion in shafts
Strain Transformations *Strains on oblique planes; Principal strains; Mohr's circle of strain; Derivation of principal stresses from principal strains; Strain gauge rosettes
Theories of Elastic Failure *Theories of elastic failure for ductile and brittle materials - Rankine, St Venant, Von-Mises, Haigh and Modified Mohr's theory
Bending of Asymmetric Sections *Product second moment of area; *Neutral axis; Maximum stress
Finite Element Analysis Introduction to linear Finite Element static and dynamic analysis for discrete and distributed mechanical and aerospace structures using industry standard software. Theories relating to numerical integration, boundary conditions, element calculations, assembly, solution, error analysis, post processing. 3D FEA of parts and assemblies. Parametric modelling, mesh studies and quality, FEM validation, contact set studies including bolted joints analysis Introduction to natural frequencies, modal analysis, transient response. Introduction to optimization and design, sensitivity analysis, integration of FEM with optimization, applications in the design of solids and structures

Assessment Breakdown	%
Continuous Assessment	20.00%
Practical	20.00%
End of Module Formal Examination	60.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Written Report	Students will be required to submit an report on topics relating to structural Analysis using FEA. Students will also partake in a group design and analysis project.	3,4,5,6	20.00	n/a

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Students will be expected to perform analysis of a part/assembly using FEA software.	3,4,5	20.00	n/a

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	Final exam	1,2,3,4,5	60.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	4.00
Laboratory	12 Weeks per Stage	4.00
Independent Learning Time	15 Weeks per Stage	10.27
	Total Hours	250.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEAER_B	Bachelor of Engineering (Honours) in Aerospace Engineering	8	Mandatory