AGRI C3F02: Agricultural Design, Simulation and Analysis

Module Title:	Agricultural Design, Simulation and Analysis
Language of Instruction:	English

Credits:	10

NFQ Level:	7

Module Delivered In	2 programme(s)

Teaching & Learning Strategies:	Lectures, laboratories, demonstrations, research, project work and some study will be used to ensure the student has a wide range of experiences.

Module Aim:	The aim of this module is to provide students with an in-depth knowledge of the design process and design evolution of components as well as failure criteria and stress / strain analysis for agricultural components and machinery.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Describe the stress at a point within a material / component, predicting the behaviour and/or failure of the material / component when subjected to loads with particular emphasis on agricultural applications.
LO2	Apply models of stress / strain to representative agricultural systems in order to determine relationships between loads and the corresponding deflection.
LO3	Develop finite element models of simple agricultural structures to solve for load, deflection and stress.
LO4	Develop mesh generation strategies for two and three-dimensional geometrical arrangements using industry standard software.
LO5	Application of F.E.A. to typical agricultural engineering design problems.
LO6	Quantify, by calculation and experimental measurement, the characteristic response of an agricultural system.

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.*
CAD 1 or equivalent

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Module Content & Assessment

Indicative Content
Stress strain relations • Plane stress. • Mohr's stress circle. • Three-dimensional stress.
Failure Criteria • Rankine, Tresca & von Mises Failure criteria. • Stress concentrations.
Slope and Deflection of Beams • Integration method. • Macaulay functions.
Finite Element Method • Introduction to stiffness matrices. • Finite elements. • Co-ordinates systems. • Types of elements. • Manual analysis of simple structures.
Meshing • ANSYS Meshing Basics • Meshing Methods • Global Mesh Controls • Local Mesh Control • Assembly Meshing • Mesh Quality
Finite Element Analysis • General Pre-processing. • Modelling Connections. • Remote Boundary Conditions and Constraint Equations. • Static Structural Analysis. • Modal Analysis. • Thermal Analysis. • Multistep Analysis. • Results and Post-Processing. Mechanical Nonlinear Connections and Contact • Interface Treatments • Bolt Pretension • Modeling Gaskets • Accessing Advanced Contact Features via MAPDL • General Contact Technology • Best Practices
Shear and Torsion Modulus of elasticity. • Application to compound sections. • Shear stress and shear strain. • Modulus of Rigidity. • Torsion in solid and hollow shafts: Relationship betweentorque, shear stress, polar second moment of area, angle of twist. • Drive shaft configurations, cardinal shafts, balancing effect and coupling arrangements. • Power Transmission.

Assessment Breakdown	%
Continuous Assessment	25.00%
Project	30.00%
Practical	45.00%

Continuous Assessment				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Examination	Class test	1,2,3	25.00	Week 12

Project				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Project	Students will complete projects investigating design issues and redesign solutions using CAD / FEA.	4,5,6	30.00	Sem 1 End

Practical				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Laboratory Experiments utilising engineering labs and FEA software.	3,4,5,6	45.00	Every Week

No End of Module Formal Examination

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	2.00
Laboratory	12 Weeks per Stage	3.00
Lab/Lecture	12 Weeks per Stage	1.00
Independent Learning	15 Weeks per Stage	11.07
	Total Hours	238.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EFARG_B	Bachelor of Engineering (Honours) in Agricultural Systems Engineering	5	Mandatory
CW_EFARG_D	Bachelor of Engineering in Agricultural Systems Engineering	5	Mandatory