Module Specification

Module Summary Information

1	**Module Title**	Advanced Systems Engineering
2	**Module Credits**	20
3	**Module Level**	7
4	**Module Code**	ENG7151

5	**Module Overview**

This module provides you with an awareness of advanced structural techniques used for study of deformable solids, a general knowledge of the techniques employed and skills to perform analysis for selected solid components and structures. It aims to provide you with the following: the skills and confidence to perform advanced analysis of solid components and structures; the knowledge of selected advanced analysis techniques employed on the more common components and structures; and an understanding of the behaviour of solids under two or three dimensional stress fields, and the limitations imposed by assumptions and boundary conditions.

6	**Indicative Content**

- Introduction to module. Intro to FEA. Concept and principles, application to structures, introduction to finite element analysis.
- Hand based calculations – FEA. Derivation of formula, problem solving on simple plane systems.
- Hand based calculations – FEA. Elements with 3-nodes, shape functions, problem solving on plane simple systems.
- Compatibility of Stress and Strain Systems
- Membrane/Diaphragm Analysis. . Circular plates with symmetrical loading, deflection and stress behaviour.
- Analytical 3D Stress Analysis
- Plastic Bending. Yield criteria, plastic limit design, and plastic bending of beams with symmetric and asymmetric sections.
- Fatigue. Fatigue crack growth mechanisms. Fatigue life predictions. Creep
- Fracture Mechanics Fracture toughness, stress intensity factor, Paris-Erdogan law.
- Residual Stresses. Definition and measurement. Effects on safety and failure modes.
- Columns/struts. The buckling of imperfect struts subject to axial and eccentric loads. Euler and Rankine theory of struts. Empirical formulae. Use of British Standards.

7	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Demonstrate in-depth understanding of the fundamental concepts underpinning continuum mechanics and the principles of conservation laws.
	2	Specify and apply appropriate stress analysis techniques in failure analysis for design assurance purposes.
	3	Determine and critically analyse stresses and deformations in complex engineering components.

8	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1 – 3		**X**	

9	Breakdown Learning and Teaching Activities
Learning Activities	**Hours**
Scheduled Learning (SL) includes lectures, practical classes and workshops, peer group learning, Graduate+, as specified in timetable	36
Directed Learning (DL) includes placements, work-based learning, external visits, on-line activity, Graduate+, peer learning, as directed on VLE	0
Private Study (PS) includes preparation for exams	164
Total Study Hours:	200