

## Module Specification

### Module Summary Information

<b>1</b>	<b>Module Title</b>	Advanced Systems Engineering
<b>2</b>	<b>Module Credits</b>	20
<b>3</b>	<b>Module Level</b>	7
<b>4</b>	<b>Module Code</b>	ENG7151

<b>5</b>	<b>Module Overview</b>
<p>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.</p>	

<b>6</b>	<b>Indicative Content</b>
<ul style="list-style-type: none"> <li>• Introduction to module. Intro to FEA. Concept and principles, application to structures, introduction to finite element analysis.</li> <li>• Hand based calculations – FEA. Derivation of formula, problem solving on simple plane systems.</li> <li>• Hand based calculations – FEA. Elements with 3-nodes, shape functions, problem solving on plane simple systems.</li> <li>• Compatibility of Stress and Strain Systems</li> <li>• Membrane/Diaphragm Analysis. . Circular plates with symmetrical loading, deflection and stress behaviour.</li> <li>• Analytical 3D Stress Analysis</li> <li>• Plastic Bending. Yield criteria, plastic limit design, and plastic bending of beams with symmetric and asymmetric sections.</li> <li>• Fatigue. Fatigue crack growth mechanisms. Fatigue life predictions. Creep</li> <li>• Fracture Mechanics Fracture toughness, stress intensity factor, Paris-Erdogan law.</li> <li>• Residual Stresses. Definition and measurement. Effects on safety and failure modes.</li> <li>• 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.</li> </ul>	

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

<b>8</b>		<b>Module Assessment</b>		
<b>Learning Outcome</b>				
		<b>Coursework</b>	<b>Exam</b>	<b>In-Person</b>
<b>1 – 3</b>			<b>X</b>	

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