

## MODULE SPECIFICATION FORM

Module Title:	<b>Structures</b>	Level:	<b>5</b>	Credit Value:	<b>10</b>
---------------	-------------------	--------	----------	---------------	-----------

Module code: (if known)	<b>ENG502</b>	Cost Centre:	<b>GAME</b>	JACS2 code:	<b>H210</b>
----------------------------	---------------	--------------	-------------	----------------	-------------

Semester(s) in which to be offered:	<b>1</b>	With effect from:	<b>July 2015</b>
-------------------------------------	----------	----------------------	------------------

<b>Office use only:</b> To be completed by AQSU:	Date approved:	July 2015
	Date revised:	
	Version No:	1

Existing/New:	<b>Existing</b>	Title of module being replaced (if any):	N/A
---------------	-----------------	--	-----

Originating Academic area:	<b>Engineering and Applied Physics</b>	Module Leader:	<b>R. Grant</b>
----------------------------	--	----------------	-----------------

Module duration (total hours)	100	Status:	<b>Free-standing 10-credit component comprising first half of ENG522 (Structures, Failure Analysis and FEA).</b>
Scheduled learning and teaching hours	36	core/option/elective (identify programme where appropriate):	
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	<b>0%</b>
---	-----------

<b>Programme(s) in which to be offered:</b> <b>Engineering European Programme</b> (Non Award Bearing)	Pre-requisites per programme (between levels):	<b>None</b>
--	--	-------------

<p><b>Module Aims:</b></p> <p>To develop an understanding and an overall appreciation of the processes that lead to developing an appropriate structure to satisfy given requirements. Design considerations include the assessment: of buckling of struts in structures with various end conditions; of beams deriving equations relating to the Engineer's Theory of Bending and also bending in symmetric and asymmetric structures; leading on to the consideration of shear stress distributions in beams and introducing the concept of shear flows.</p>
--

<p><b>Expected Learning Outcomes</b></p> <p><u>Knowledge and Understanding:</u> At the completion of this module, the student should be able to:</p> <ol style="list-style-type: none"> <li>1. Relate an overall design philosophy to the design of structures.</li> <li>2. Use a range of analysis techniques, namely: buckling analysis on simple struts, E.T.B. on symmetric and asymmetric structures, flexural and shear stress distributions on beams subjected to combinations of loads.</li> <li>3. Ascertain where failure might occur, including the conditions that might produce the failure and evaluate the relevance of results. <span style="float: right;">(KS 3)</span></li> </ol> <p><u>Key skills for employability</u></p> <table style="width: 100%;"> <tr> <td style="vertical-align: top;"> <ol style="list-style-type: none"> <li>1. Written, oral and media communication skills,</li> <li>2. Leadership, team working and networking skills</li> <li>3. Opportunity, creativity and problem solving skills</li> <li>4. Information technology skills and digital literacy</li> <li>5. Information management skills</li> <li>6. Research skills</li> </ol> </td> <td style="vertical-align: top;"> <ol style="list-style-type: none"> <li>7. Intercultural and sustainability skills</li> <li>8. Career management skills</li> <li>9. Learning to learn (managing personal and professional development, self management)</li> <li>10. Numeracy</li> </ol> </td> </tr> </table>	<ol style="list-style-type: none"> <li>1. Written, oral and media communication skills,</li> <li>2. Leadership, team working and networking skills</li> <li>3. Opportunity, creativity and problem solving skills</li> <li>4. Information technology skills and digital literacy</li> <li>5. Information management skills</li> <li>6. Research skills</li> </ol>	<ol style="list-style-type: none"> <li>7. Intercultural and sustainability skills</li> <li>8. Career management skills</li> <li>9. Learning to learn (managing personal and professional development, self management)</li> <li>10. Numeracy</li> </ol>
<ol style="list-style-type: none"> <li>1. Written, oral and media communication skills,</li> <li>2. Leadership, team working and networking skills</li> <li>3. Opportunity, creativity and problem solving skills</li> <li>4. Information technology skills and digital literacy</li> <li>5. Information management skills</li> <li>6. Research skills</li> </ol>	<ol style="list-style-type: none"> <li>7. Intercultural and sustainability skills</li> <li>8. Career management skills</li> <li>9. Learning to learn (managing personal and professional development, self management)</li> <li>10. Numeracy</li> </ol>	

**Assessment:** Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%). **Details of indicative assessment should also be included.**

Assessment is by means of an examination covering outcomes 1 to 3. It is a formal unseen time-constrained written examination..

(This corresponds to 'Assessment 2' of ENG552.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hrs	

### Learning and Teaching Strategies:

Detailed lecture notes (printed and in electronic form) are provided for the student which will allow the optimisation of lecture time, with good opportunity for self study and tutorials. The module will also contain practical laboratory based exercises supported by introductory lectures and demonstrations.

### Syllabus outline:

**Design:** An overview of the design process, with particular focus given towards vehicle structures. Methods of distributing loads through a structure, particularly lightweight constructions.

**Structural Instability:** Classical theory considering Euler buckling of perfect columns. Equations giving theoretical critical buckling loads for given end conditions. The concept of equivalent strut length. Limitations of the theory of Euler buckling.

**Engineers Theory of Bending:** Formal derivation and assumptions of equations of ETB are made with a revision of the concepts of 1<sup>st</sup>, 2<sup>nd</sup> moments of area, including parallel axis theorem. The concept of product moment of area is introduced. ETB is extended to the derivation of the curvature-bending moment relationship.

**Asymmetric Bending:** The theory and method of identifying the location of the principal axes of a unsymmetrical section. Magnitude of the principal and product moments of area and their orientation. Skew loading applied to the section and the position/orientation of the neutral axes. Stresses within a section.

**Shear Stress:** The shear stress distribution due to bending for a given section. Thin-walled sections. Position of the shear centre for open thin-walled sections. The concept of shear flow.

### Bibliography

#### Essential reading:

Benham, P.P. et al. (1996) *Mechanics of Engineering Materials*, 2<sup>nd</sup> Edn., Longman.

Case, J. Et al. (1999) *Strength of Materials and Structures*, 4<sup>th</sup> Edn., Elsevier.

#### Recommended reading:

Megson, T.H.G. (2007) *Aircraft Structures for Engineering Students*, 4<sup>th</sup> Edn., Arnold.

Jones, D.R.H. (2003) *Materials Failure Analysis*, 3<sup>rd</sup> Edn., Pergamon.

Ashby, M.F. (2005) *Materials Selection in Mechanical Design*, 3<sup>rd</sup> Edn., Butterworth-Heinemann.