PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title:	**Complex Structures**	Level:	**6**	Credit Value:	**10**

Module code: **ENG670** (if known)	Cost Centre: **GAME**	JACS2 code: H143

Semester(s) in which to be offered: **1**	With effect from: **July 2015**

Office use only: To be completed by AQSU:	Date approved: **July 2015** Date revised: Version No: 1

Existing/New: **Existing**	Title of module being replaced (if any):

Originating Academic area: **Engineering and Applied Physics**	Module Leader: **Z Chen**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG620 (Vibration Analysis and Complex Structures).**
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To develop an understanding of: methods of structural idealisation; assumptions made in torsional the analyses of thin walled tubes; the behaviour of multi-cell structures when subject to torsional and flexural loads; methods of analysing struts, bars, panels and stiffened panels when considering buckling; the behaviour of thin shells when subject to load.

Expected Learning Outcomes

Knowledge and Understanding:

At the completion of this module, the student should be able to:

1. Analyse an idealised structure and derive, making suitable assumptions, the equations for torsion applied to single celled tubes and for analysis of thin shells;
2. Solve problems involving multi-cell structures subject to torsion and bending loads and, in thin shells, solve for moments, slope and deflection for given boundary conditions and loading scenarios; (KS 3)
3. Derive equations for the analysis of membranes subject to various loading and boundary conditions;
4. Analyse the nature of structural weaknesses, such as panel buckling, and the effects they may have on the integrity of a structure, including the concepts of stress concentration. (KS 5)

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to one-half (part B) of the examination of ENG620.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3, 4	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be presented to students through a series of lectures, tutorials and case studies utilising laboratory equipment where appropriate. Use of computer packages, including specially developed computer aided packages from within the department, will be used to aid learning.

Syllabus outline:

Structural idealisation: The concept of representing a panel in terms as booms and webs for ease of analysis.

Torsion of Multi-Celled Structure: The derivation of equations of torsion, Bredt-Batho and their application to single and multi-celled structures. Combined torsion and bending. Calculating shear stress distributions and stress flow around structure.

Plates and Shells: Definitions and limitations of theory, use in engineering, assumptions in plate theory, boundary conditions and supports are considered with various loading scenarios loading. The bending of thin shells (deflections, slopes) and calculation of membrane and local stresses.

Buckling Analysis: Panel buckling and Euler strut. Boundary conditions: free, fixed and partial clamping. Formulation and application of buckling charts to panels, reinforced panels and composite forms. Local and overall buckling, also crippling. Buckling modes: dimples.

Bibliography:

Essential reading:

Gere, J.M. (2008); *Mechanics of Materials*, 7th Edn., Nelson Engineering.

Recommended reading:

Megson, T.H.G. (2007) *Aircraft Structures for Engineering Students*; 4th Edn., Elsevier.

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

Timoshenko, S.P. and Woinowsky-Krieger, S. (1964) *Plates and Shells*; McGraw-Hill.

Durka, F. Et al. (2010) *Structural Mechanics: Loads, Analysis, Materials and Design of Structural Elements*; 7th Edn., Prentice-Hall.