PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title:	**Mechanics of Materials**	Level:	**4**	Credit Value:	**10**

Module code: (if known)	**ENG408**	Cost Centre:	**GAME**	JACS2 code:	**H142**

Semester(s) in which to be offered:	**2**	With effect from:	**September 2014**

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

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

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 second half of ENG458 (Mechanical Science).**
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:	Pre-requisites per programme (between levels): **None**
Enginering European Programme (Non Award Bearing)	

Module Aims:
To extend knowledge of mechanical science to analyse stresses and strains in more depth and to include electrical circuit theory in the consideration of applications.

Expected Learning Outcomes

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

1. Solve problems involving the principles of stress and strain analysis relating to simple and compound bars, loaded beams, bending and torsion; *(KS 10)*

2. To apply the analysis techniques to beam analysis in practical situations;

3. Apply basic principles to practical design problems. *(KS 3)*

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 (%). ***Details of indicative assessment should also be included****.*

Assessment is by means of an unseen formal examination at the end of the module.
(This corresponds to 'Assessment 1' of ENG458.)

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

Learning and Teaching Strategies:

The module will be presented to the students through a specified series of lectures, supported by problem-solving practice carried out in interactive tutorials. About one-third of contact time will be devoted to practical laboratory-based exercises and to the study of computer-based modelling.

Syllabus outline:

Stress and Strain: material classification: isotropic, orthotropic, anisotropic. Poisson's ratio. Two dimensional problems. Volumetric strain. Bulk modulus. Elastic constants.

Complex Stress and Strain: Complementary shear stress. Complex stress situation/formulae. *Principal stresses*, maximum shear stress and associated planes. Mohr's circle. *Principal strains*. Direct strain measurements. Relationship and calculation of principal stresses from principal strain values.

(Thin Cylinder and Thick Cylinder Theory: Thin cylinder: Stresses, increase in volume due to internal pressure. Lame's equations for thick cylinders. Lame's equations to solve engineering problems.)

Torsion Analysis: Torsion of a circular bar; Torsion of a hollow circular bar; Strain energy in torsion; Thin-wall tubes; Inelastic torsion bars.

Theorem of Parallel Axes. Second moment of area about the neutral axis for common sections. Stress distribution diagrams for combinations of direct and bending stress

Beam Analysis: Differential equation of bending. Applications to beams. Formulae for slope and deflection. Macaulay's method for determining slope and deflection, various loading conditions.

Statically Indeterminate Beams: Statically indeterminate beams; Differential equation of the deflection curve; Method of superposition; Moment area method; Finite difference Method.

Bibliography

Essential Reading

Hibbeler, R.C. (2011) *Engineering Mechanics: Statics*, 13th Edn., Prentice Hall.

Hearne, EJ (2004); *Mechanics of Materials, vol 1*; (Butterworth Heinemann)

Recommended Reading

Ashby, M.F. (2010) *Materials Selection in Mechanical Design,* 4th Edn., Butterworth-Heinemann Ltd.

Schaum Series (2000); *Theory and Problems of Dynamics*; (McGraw-Hill)

Bolton, W. (2006) *Mechanical Science*, 3rd Edn., Blackwell Publishing.

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

Case, J. et al. (1999) *Strength of Materials and Structures*, 4th Edn., Butterworth-Heinemann Ltd.