Prifysgol Wrecsam
Wrexham University

Module specification

When printed this becomes an uncontrolled document. Please access the Module Directory for the most up to date version by clicking on the following link: Module directory

Module Code	ENG5A5
Module Title	Mechanics, Structures & FEA
Level	5
Credit value	20
Faculty	FACE (Faculty of Arts, Computing & Engineering)
HECoS Code	101396
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
MEng/BEng Aeronautical Engineering	Core
MEng/BEng Mechanical Engineering	Core
MEng/BEng Automotive Engineering	Core
MEng/BEng Renewable and Sustainable Engineering	Core
BEng Aeronautical and Mechanical Engineering	Core
BEng (Hons) Civil Engineering DA (Degree Apprenticeship)	Core
BSc Civil Engineering Studies	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	30 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	10 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	40 hrs
Placement / work-based learning	0 hrs
Guided independent study	160 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	22nd August 2022
With effect from date	September 2022
Date and details of revision	3rd July – Addition of Civil Engineering Programmes (BE revalidation)
Version number	3

Module aims

- To develop an understanding and an overall appreciation of design considerations including the assessment of bucking of struts in structures with various end conditions; of beams deriving equations relating to the Engineer's Theory of Bending and bending in symmetric and asymmetric structures; leading on to the consideration of shear stress distributions in beams and introducing the concept of shear flows.
- To gain a basic practical understanding of the techniques of finite elements for simple problems.

Module Learning Outcomes - at the end of this module, students will be able to:

1	Develop an overall appreciation of load bearing requirements and structure consideration design.
2	Use a range of analysis techniques, namely: buckling of simple struts, E.T.B. on symmetric and asymmetric structures, flexural and shear stress distributions on beams subjected to basic combinations of loads.
3	Ascertain where failure might occur, including the conditions that might produce the failure and evaluate the relevance of results.
4	Simulate with an appropriately specified finite element model a very simple structure and be able to interpret the results.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

A 2-hour examination will be proposed at the completion of the module covering all the learning outcomes but FEA.

A coursework of 2000 words or equivalent will be proposed. This assessment will provide an opportunity to demonstrate FEA understanding and skills.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1,2,3	Examination	50
2	4	Coursework	50

Derogations

A derogation from regulations has been approved for this module which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Learning and Teaching Strategies

The module will be taught through a combination of lectures and workshops. An active and inclusive approach is used to engage students in the topics and will involve individual, group work and flipped learning experiences aligned to the university's Active Learning Framework (ALF). The approach offers students a flexible and adaptive learning experience that can accommodate a range of options that includes both on campus learning and remote learning where appropriate.

The Moodle VLE and other on-line materials and resources will be available to support learning. ALF offers a balance between the classroom elements and digitally enabled activity incorporating flexible and accessible resources and flexible and accessible feedback to support learning.

Detailed printed lecture notes provided for the student 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. The finite element work will be primarily computer laboratory based with practical exercises supported by introductory lectures and demonstrations. The emphasis will be directed towards on hand-on learning via a commercial software package. It is probable that a problem-based learning exercise will provide the basis for Assessment One.

Indicative Syllabus Outline

1st, 2nd moments of area, including parallel axis theorem.
Bending: Formal derivation and assumptions of equations of bending.
Shear Stress: The shear stress distribution due to bending for a given section.
Thin-walled sections, shear flow.
Buckling of perfect columns: Euler's method, critical buckling loads.
Finite Element Analysis using ANSYS to solve simple problem.
In addition: for civil engineers:
Principle of Virtual works and application
Matrix /stiffness methods
Plastic analysis of statically indeterminate beams and frames

Indicative Bibliography:

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads
R.C. Hibbeler, Mechanics of Materials, 9th ed. Singapore: Pearson, 2014.

Other Indicative Reads

Grous A. Applied Mechanical Design: Solved Case Studies and Projects. Somerset: John Wiley & Sons, Incorporated; 2018.

M.F. Ashby, Materials Selection in Mechanical Design, 4th ed. Burlington: Butterworth-Heinemann, 2011.

O.C. Zienkiewicz and R.L. Taylor, The Finite Element Method: Its Basis and Fundamentals, 7th ed. Amsterdam: Elsevier, 2013.