Title:	Advanced Structural Analysis APPROVED
Long Title:	Advanced Structural Analysis

Module Code:	CIVL8039	**Duration:**	1 Semester

Credits:	5
NFQ Level:	Advanced
Field of Study:	Civil Engineering
Valid From:	Semester 1 - 2019/20 (September 2019)
Module Delivered in	2 programme(s)
Module Coordinator:	DES WALSH
Module Author:	John Murphy - Civil
Module Description:	This module addresses advanced topics in Structural Engineering. Topics such as energy methods, elasticity, dynamic analysis, buckling analysis and analysis of plates and shells are introduced.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
LO1	Model, analyse and evaluate dynamically loaded simple beams and frames.
LO2	Model, analyse and evaluate elastic plates and shells.
LO3	Model, analyse and evaluate beams using the theory of elasticity.
LO4	Model, analyse and evaluate beams on elastic foundations.
LO5	Model, analyse and evaluate the critical buckling loads of framed structures.
LO6	Model, analyse and evaluate beams, frames, trusses and arches using energy methods.

Pre-requisite learning

Module Recommendations
This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named MTU module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).

Incompatible Modules
These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.

No incompatible modules listed

Co-requisite Modules

No Co-requisite modules listed

Requirements
This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.

No requirements listed

Module Content & Assessment

Indicative Content
Dynamic Analysis Introduction; Structures with degrees of freedom; Natural frequencies; forced vibrations; Matrix formulation; Eigenvalues of matrix; Applications.
Elasticity Flexural modulus of thin plates; Plates subjected to edge moments; Laterally loaded plates; Differential equations of equilibrium; Equations of compatibility; Boundary conditions; Membrane stress analysis of shells of revolution and cylindrical shells; Beam on elastic foundations; Applications.
Buckling Forces transmitted by slender members; Differential equilibrium relationships; Singularity functions; Euler buckling load; Elastic stability of flexible columns; Instability as a mode of failure; Plastic buckling; Stability coefficients; Applications.
Energy Methods Elastic energy; Determination of deformations - beams, frames, trusses and arches; Indeterminate structures; Redundants; Flexibility method; Applications.

Assessment Breakdown	%
Course Work	50.00%
End of Module Formal Examination	50.00%

Course Work

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Project	Model, analyse and evaluate dynamically loaded structures including degrees of freedom, natural frequencies, and mode of vibrations. Undertake laboratory experiment and/or computer analysis to compare results with those obtained using traditional calculations. Peer learning to be incorporated by presentation and discussion of results in class.	1	25.0	Week 3
Project	Model, analyse and evaluate the behaviour of shell and plate structures. Use both traditional calculation techniques and proprietary software applications to model and analyse shell/thin plate structures. Evaluate outcomes from both approaches to analysis. Peer learning to be incorporated by presentation and discussion of results in class.	2	25.0	Week 6

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	End of semester formal examination.	3,4,5,6	50.0	End-of-Semester

Reassessment Requirement
Repeat examination *Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.*

The institute reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Presentation of theory and examples	3.0	Every Week	3.00
Lecturer-Supervised Learning (Contact)	Problem framing; Problem solving; Project work	1.5	Every Week	1.50
Independent & Directed Learning (Non-contact)	Self directed study	2.5	Every Week	2.50
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.50

Workload: Part Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Presentation of theory and examples	3.0	Every Week	3.00
Lecturer-Supervised Learning (Contact)	Problem framing; Problem solving; Project work	1.5	Every Week	1.50
Independent & Directed Learning (Non-contact)	Self directed study	2.5	Every Week	2.50
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.50

Module Resources

Recommended Book Resources

- **Amin Ghali, Adam Neville 2017, *Structural Analysis: A Unified Classical and Matrix Approach*, 7th Ed., CRC Press [ISBN: 9781498725064]**

Supplementary Book Resources

- **T.H.G. Megson 2019, *Structural and Stress Analysis*, 4th Ed., Butterworth-Heinemann [ISBN: 9780081025864]**
- **Russell C. Hibbeler 2016, *Structural Analysis in SI Units*, 9th Ed., Pearson Education Limited [ISBN: 9781292089461]**
- **R. C. Coates, M. G. Coutie, F. K. Kong 1988, *Structural analysis*, 3rd Ed., Chapman & Hall [ISBN: 9780412379802]**
- **Martin S. Williams, J D Todd 2000, *Structures: Theory and analysis*, 1st Ed., Palgrave [ISBN: 9780333677605]**
- **David Johnson 2004, *Linear analysis of skeletal structures*, 1st Ed., Thomas Telford [ISBN: 9780727732767]**

This module does not have any article/paper resources

Other Resources

- **IStructE Essential Knowledge Series: David Cormie 2016, *Essential Knowledge Text No.16: Stability* , The Institution of Structural Engineers http://www.istructe.org/resources-centre /essential-knowledge-series/stability**
- **IStructE Essential Knowledge Series: Martin Williams 2016, *Essential Knowledge Text No.17: Dynamics* , The Institution of Structural Engineers http://www.istructe.org/resources-centre /essential-knowledge-series/no-17-dynami cs**

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_CSTRU_8	Bachelor of Engineering (Honours) in Structural Engineering	7	Elective
CR_CSTEN_9	Master of Engineering in Structural Engineering	7	Mandatory