Title:	Numerical Methods II APPROVED
Long Title:	Numerical Methods II

Module Code:	MATH7016	**Duration:**	1 Semester

Credits:	5
NFQ Level:	Intermediate
Field of Study:	Mathematics
Valid From:	Semester 1 - 2018/19 (September 2018)
Module Delivered in	1 programme(s)
Module Coordinator:	David Goulding
Module Author:	Jeremiah McCarthy
Module Description:	This module introduces the student to numerical methods used in the study of both ordinary and partial differential equations.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
LO1	Explain the need for numerical methods in the study of differential equations that arise in engineering problems.
LO2	Obtain approximate solutions to ordinary differential equations with initial/boundary conditions.
LO3	Understand the presence and challenge of error in numerical methods.
LO4	Employ finite differences to approximate partial differential equations, including Laplace's Equation and the Heat Equation.
LO5	Use an appropriate programming language to implement given algorithms.

Pre-requisite learning
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
Co-requisites
No Co Requisites listed

Module Content & Assessment

Indicative Content
First Order Problems Taylor Series. Euler Method. Three Term Taylor Method. Heun's Method. Runge-Kutta Methods. Error.
Second Order Problems Systems of Equations and higher-order equations. Boundary value problems. The Shooting Method. Finite Differences. Error.
2D Laplace's Equation Finite differences. Relaxation Methods. Mean Value Property. Derivative and irregular boundary. Convergence.
1D Heat Equation Implicit and Explicit Finite Differences. Stability and Convergence.

Assessment Breakdown	%
Course Work	100.00%

Special Regulation
Reassessment of this module will consist of a repeat practical/written examination.

Course Work

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Based on weekly 2-hour Laboratory sessions	2,5	20.0	Week 6
Short Answer Questions	Mid-semester 1 hour written assessment	1,2,3	20.0	Week 7
Practical/Skills Evaluation	Based on weekly 2-hour Laboratory sessions	2,4,5	20.0	Week 11
Short Answer Questions	Written assessment	1,2,3,4	40.0	Week 12

No End of Module Formal Examination

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	Theory	2.0	Every Week	2.00
Lab	Practical Lab	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Independent learning	3.0	Every Week	3.00
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.00

Workload: Part Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Theory	2.0	Every Week	2.00
Lab	Computer practical	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Independent learning	3.0	Every Week	3.00
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.00

Module Resources

Recommended Book Resources

- **S.C. Chapra, R. P. Canale 2015, *Numerical Methods for Engineers*, 7th Ed., McGraw-Hill Higher Education [ISBN: 978-007340106]**
- **J. Walkenbach 2010, *Microsoft Excel 2010: Power Programming with VBA*, Wiley [ISBN: 978-047047535]**

This module does not have any article/paper resources

This module does not have any other resources

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_EMECH_8	Bachelor of Engineering (Honours) in Mechanical Engineering	4	Mandatory