

ACE Network Subject Information Guide

Advanced Numerical Analysis

Semester 2, 2022

Administration and contact details

Host Department	Mathematics	
Host Institution	University of Newcastle	
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Subject details

Handbook entry URL	Click here to enter text.	
Subject homepage URL	Click here to enter text.	
Honours student hand-out URL	Click here to enter text.	
Start date:	July 19, 2022	
End date:	Oct 29, 2022	
Contact hours per week:	2	
Lecture day and time:	Thursday 10am-12pm AEST	
Description of electronic access arrangements for students (for example, WebCT)	Course materials will be shared via DropBox	



Subject content

1. Subject content description

Data interpolation and fitting, numerical differentiation and integration, numerical solutions of ordinary and partial differential equations (ODEs and PDEs)

2. Week-by-week topic overview

Week 1-2: Data interpolation and fitting

Week 3: Numerical integration and differentiation

Week 4: Boundary value problem for ODEs: Shooting method

Week 5: Finite difference method for linear and non-linear ODEs

Week 6-7: Finite difference method for partial differential equations

Week 8: Weak formulation of partial differential equations

Week 9: Sobolev spaces, existence and uniqueness of the solution

Week 10-12: Finite element method and its implementation

3. Assumed prerequisite knowledge and capabilities

Second year level analysis and differential equations. MATLAB.

4. Learning outcomes and objectives

- 1. Apply numerical techniques to approximate functions, their derivatives and integrals arising from problems in science, mathematics and engineering.
- 2. Develop numerical algorithms for differential equation problems, implement them in a computer, visualise and interpret their solutions.
- 3. Apply the idea of accuracy, consistency, stability and convergence in numerical approximation techniques.

AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes addressed in	Associated AQF Learning Outcome Descriptors	
this subject	for this subject	
Insert Program Learning Outcome here	Choose from list below	
Insert Program Learning Outcome here	Choose from list below	
Insert Program Learning Outcome here	Choose from list below	
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Insert Program Learning Outcome here	Choose from list below	



Learning Outcome Descriptors at AQF Level 8

Knowledge

K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines

K2: knowledge of research principles and methods

Skills

S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence

S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas

S3: cognitive skills to exercise critical thinking and judgement in developing new understanding

S4: technical skills to design and use in a research project

S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences

Application of Knowledge and Skills

A1: with initiative and judgement in professional practice and/or scholarship

A2: to adapt knowledge and skills in diverse contexts

A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters

A4: to plan and execute project work and/or a piece of research and scholarship with some independence

5. Learning resources

R.L. Burden and J.D. Faires, Numerical Analysis, 9th edition, Brooks and Cole Lecture notes will be provided for the course.

6. Assessment

Exam/assignment/classwork breakdown						
Exam	50 %	Assignment	50%	Class work	Enter 0%	
Assignment due dates		Week 5	Week 9			
		<u>.</u>				
Approximate exam date 8 Nov - 26 Nov)V			

Institution Honours program details

	in total honours assessmer	nt at Click here to ent	Click here to enter text.	
host department				
Thesis/subject spl	it at host department	Click here to ent	Click here to enter text.	
Honours grade ranges at host department:				
H1	85-100	H2a	75-84	
H2b	65-74	Н3	50-64	