ACE Network Subject Information Guide

Advanced Numerical Analysis

Semester 2, 2023

Administration and contact details

Host department	Mathematics
Host institution	University of Newcastle
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Subject details

Handbook entry URL	TBD
Subject homepage URL	TBD
Honours student hand-out URL	TBD
Teaching period (start and end date):	**17/07/2023- 27/10/2023**
Exam period (start and end date):	**Monday 6 Nov -- Friday 30 Nov 2023**
Contact hours per week:	**2**
ACE enrolment closure date:	**TBA**
Lecture day(s) and time(s):	**Mon 10AM-12PM AEST**
Description of electronic access arrangements for students (for example, LMS)	**To be decided later** **I used Dropbox to share the course materials in the past. I will see if there is a better alternative.**

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**

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 this subject	Associated AQF Learning Outcome Descriptors for this subject

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

- Brockwell, P. and Davis, R., An Introduction to Time Series and Forecasting, Springer-Verlag, 1996.

6. Assessment

Exam/assignment/classwork breakdown					
Exam	50%	**Assignment**	50%	**Class work**	0 %
Assignment due dates		**Week 5**	**Week 9**	Click here to enter a date.	Click here to enter a date.
Approximate exam date				**Monday 6 Nov -- Friday 30 Nov 2023**	

Institution honours program details – To Be Determined

Weight of subject in total honours assessment at host department	Click here to enter text.
Thesis/subject split at host department	Click here to enter text.
Honours grade ranges at host department	
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
H3	Enter range %

Institution masters program details – To Be Determined

Weight of subject in total masters assessment at host department	Click here to enter text.
Thesis/subject split at host department	Click here to enter text.
Masters grade ranges at host department	
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
H3	Enter range %