**ACE Network Subject Information Guide**

**Advanced Numerical Analysis**

**Semester 2, 2025**

**Administration and contact details**

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| **Host Department** | **Mathematics** |
| **Host Institution** | **University of Newcastle** |
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| **Name of lecturer** | **A/Prof Bishnu Lamichhane** |
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|  |  |
| **Name of Honours coordinator** | **A/Prof Bishnu Lamichhane** |
| **Phone number** | 0422437170 |
| **Email Address** | Bishnu.lamichhane@newcastle.edu.au |

**Subject details**

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| --- | --- |
| **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:** | **21st of July** |
| **End date:** |  |
| **Contact hours per week:** | **24th of October** |
| **Lecture day and time:** | **To be decided later** |
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| **Description of electronic access arrangements for students (for example, WebCT)** | **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)**

1. **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: The Rayleigh-Ritz method**

**Week 7-8: Finite difference method for partial differential equations**

**Week 9: Weak formulation of partial differential equations**

**Week 10: Sobolev spaces, existence and uniqueness of the solution**

**Week 11-12: Finite element method and its implementation**

1. **Assumed prerequisite knowledge and capabilities**

**Second year level analysis and differential equations. MATLAB.**

1. **Learning outcomes and objectives**
2. **Apply numerical techniques to approximate functions, their derivatives and integrals arising from problems in science, mathematics and engineering.**
3. **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 |
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**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

1. **Learning resources**

R.L. Burden and J.D. Faires, Numerical Analysis, 9th edition, Brooks and Cole

Lecture notes will be provided for the course.

1. **Assessment**

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| **Exam/assignment/classwork breakdown** | | | | | |
| **Exam** | 50 % | **Assignment** | 50% | **Class work** | Enter 0% |
|  | | | | | |
| **Assignment due dates** | | **Week 5** | **Week 9** | Click here to enter a date. | Click here to enter a date. |
|  | | | | | |
| **Approximate exam date** | | | | |  | | --- | | TBA | | |

**Institution Honours program details**

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| **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 % |