# ACE Network Subject Information Guide

## Advanced Numerical Analysis

## Semester 2, 2021

## Administration and contact details

| | |
|---|---|
| **Host Department** | **Mathematics** |
| **Host Institution** | **University of Newcastle** |
| | |
| **Name of lecturer** | **Dr Bishnu Lamichhane** |
| **Phone number** | **0422437170** |
| **Email Address** | **Bishnu.lamichhane@newcastle.edu.au** |
| **Homepage** | **https://www.newcastle.edu.au/profile/bishnu-lamichhane** |
| | |
| **Name of Honours coordinator** | **Dr Judy-anne Osborne** |
| **Phone number** | 02 4921 5543 |
| **Email Address** | judy-anne.osborn@newcastle.edu.au |

## 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 20, 2021** |
| **End date:** | **Oct 29, 2021** |
| **Contact hours per week:** | **2** |
| **Lecture day and time:** | **Tuesday 10-12** |
| **Census date:** | **13 August** |
| **Description of electronic access arrangements for students (for example, WebCT)** | **To be decided later**<br>**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**

## 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 |
| 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 |
| Insert Program Learning Outcome here | Choose from list below |
| 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

## 3. Learning resources

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

**Lecture notes will be provided for the course.**

## 4. Assessment

| **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** | | | | Monday 8 Nov -- Friday 26 Nov 2021 | |

## Institution Honours program details

| | |
|---|---|
| **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 % |