School of Information and Physical Sciences

MATH3820: Numerical Methods

Callaghan
Semester 1 - 2024

COURSE OUTLINE

www.newcastle.edu.au
CRICOS Provider 00109J

OVERVIEW

Course Description Numerical methods are now at the heart of applied mathematics. Many significant practical problems cannot be solved by analytical methods - their solutions can only be approximated through numerical methods. Since numerical methods do not give exact solutions to problems it is important to analyse their accuracy. It is also important to understand the stability, efficiency and robustness of a numerical scheme.This course introduces concepts in numerical analysis emphasising the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. This will develop the basic understanding of numerical algorithms, their computer implementation, applicability and limitations.

Academic Progress Requirements Nil

Assumed Knowledge MATH2310 or MATH2340

Contact Hours
Callaghan
Lecture
Face to Face On Campus
3 hour(s) per week(s) for 13 week(s) starting Week 1
Tutorial and computer lab work will be integrated with lectures as required.

Unit Weighting Workload 10
Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator **Callaghan**

Dr Bishnu Lamichhane
Bishnu.Lamichhane@newcastle.edu.au
(61-2) 49215529
Consultation: By appointment

Teaching Staff Other teaching staff will be advised on the course Canvas site.

School Office

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9am-5pm (Mon-Fri)

SYLLABUS

Course Content

- Computer arithmetic
- Solving nonlinear equations
- Interpolation
- Numerical differentiation and integration
- Solving systems of linear equations
- Least squares approximation

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Understand floating point numbers, computer arithmetic and the role of errors in numerical analysis.

2. Understand the applicability and limitations of a range of important numerical schemes and their role in science and mathematics.

3. Develop their own numerical algorithms for real-world problems, implement them in a computer, visualise and interpret their solutions.

4. Understand accuracy, consistency, stability and convergence of a numerical method, and the concepts of well- and ill-conditioned problems.

Course Materials

SCHEDULE

ASSESSMENTS

This course has 4 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Written Assignment 1	Week 6 Tuesday	Individual	14%	1, 2, 3
2	Written Assignment 2	Week 9 Tuesday	Individual	14%	3, 4
3	In-class quiz	Weeks 3, 9 and 10, Wednesday (6% + 6% + 10%)	Individual	22%	2, 4
4	Final examination	In formal exam period	Individual	50%	1, 2, 4

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Written Assignment 1

Assessment Type Written Assignment
Purpose Written assignments meet the course objectives of knowledge acquisition to demonstrate assimilation of data.
Description An articulate and concise document which conveys evidence-based understanding of the concepts and topics.
Weighting 14%
Due Date Week 6 Tuesday
Submission Method In Class
Assessment Criteria Correctness and clarity of solutions
Return Method In Class
Feedback Provided Returned Work - Two academic weeks after submission.
Opportunity to Reattempt Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Written Assignment 2

Assessment Type Written Assignment
Purpose Written assignments meet the course objectives of knowledge acquisition to demonstrate assimilation of data.
Description An articulate and concise document which conveys evidence-based understanding of the concepts and topics.
Weighting 14%
Due Date Weeks 9 Tuesday
Submission Method In Class
Assessment Criteria Correctness and clarity of solutions
Return Method In Class
Feedback Provided Returned Work - Two academic weeks after submission..
Opportunity to Reattempt Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - In-class quiz

Assessment Type Quiz
Purpose To provide students with feedback on their learning
Description Three 50-minute quizzes of written questions; two of them are conducted in a computer lab.
Weighting 22%
Length 50 minutes each of them
Due Date Weeks 3, 9 and 10, Wednesday (6% + 6% + 10%)
Submission Method In Class
Assessment Criteria Correctness and clarity of solutions
Return Method In Class
Feedback Provided Returned Work - Two academic weeks after quiz date..

Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 4 - Final examination

Assessment Type	Formal Examination
Purpose	To test the individual student's knowledge of the course and their ability to describe, analyse and hypothesise from this material
Description	Formal examination
Weighting	50%
Length	Two hours + 10 minutes reading time
Due Date	In formal exam period
Submission Method	Formal Exam
Assessment Criteria	Correctness and clarity of solutions
Return Method	Not Returned
Feedback Provided	No Feedback - .
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Communication Methods

Communication methods used in this course include:

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's

own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.