School of Information and Physical Sciences

MATH2800: Ordinary Differential Equations and Applied Linear Algebra

Callaghan

Semester 1 - 2024

COURSE OUTLINE

OVERVIEW

Course Description

Differential equations provide one of the most powerful mathematical tools for understanding the natural world. Since rates of change are commonly expressed using derivatives, single and systems of differential equations arise whenever some continuously varying quantities and their rates of change in space or time are known or postulated. Whether seeking to understand biological or physical processes, behaviours of solids or liquids, ecological or mechanical systems, differential equations provide essential insights. If only one independent variable is involved, which is often time, these equations are called ordinary differential equations (ODEs). This course introduces students to the world of ODEs. The main focus of the course will be to investigate analytical and numerical solution techniques, qualitative behaviour of solutions and mathematical modelling to explore a wide breadth of application areas. A large component of the analysis of systems of first order linear ODEs and of nonlinear systems near critical points involves applications of linear algebra techniques.

Academic Progress Requirements

Nil

Assumed Knowledge

MATH1120

Contact Hours

Callaghan

Lecture

Face to Face On Campus

3 hour(s) per week(s) for 13 week(s) starting Week 1

Tutorial

Face to Face On Campus

1 hour(s) per week(s) for 13 week(s) starting Week 1

The tutorial may be held in a computer lab when needed.

Unit Weighting

10

Workload

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
Prof Mike Meylan
Mike.Meylan@newcastle.edu.au
(02) 4921 6792
Consultation: By appointment

Teaching Staff

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

School Office

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+61 2 4921 5513
9am-5pm (Mon-Fri)

SYLLABUS

Course Content

Topics will include:

- Differential equations and mathematical modelling
- Analytical solution techniques of ordinary differential equations including systems
- Numerical solution techniques: Taylor series and Runge-Kutta methods, error analysis, step-size control and stability
- Existence, uniqueness and continuous dependence on the data
- Stability of solutions
- Lyapunov techniques
- The phase plane

Course Learning Outcomes

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

1. Formulate differential equation models arising from the mathematical modelling of real-life problems, interpret solutions and assess their implications for answering questions of practical importance.

2. Solve important classes of differential equations analytically and numerically.

3. Analyse important classes of numerical methods to approximate solutions of differential equations.

4. Use qualitative analysis of important classes of differential equations including applications of linear algebra to investigate properties of their solutions.

Course Materials

SCHEDULE

ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Assignments	5pm Monday in weeks 5 and 10, respectively	Individual	10%	1, 2, 3, 4
2	Examination	Completed during the formal examination period for Semester 1	Individual	50%	1, 2, 3, 4
3	Tutorial assessment	Each tutorial	Individual	10%	1, 2, 3, 4
4	Online Quizzes	9am Monday each week from week 2	Individual	10%	2, 3, 4
5	Mid Semester Test	The mid-session test will be held in the third lecture timeslot of week 7.	Individual	20%	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 - Assignments

Assessment Type Written Assignment
Description Two assignments, available in Week 3 and Week 8 respectively. 10% each
Weighting 10%
Due Date 5pm Monday in weeks 5 and 10, respectively
Submission Method Online
Assessment Criteria Mathematical correctness, completeness and clarity of presentation
Return Method Online
Feedback Provided In Class - .

Assessment 2 - Examination

Assessment Type Formal Examination
Purpose To test the student's overall knowledge of the course content
Description The examination will cover the content of the entire course
Weighting 50%
Length 120 minutes
Due Date Completed during the formal examination period for Semester 1
Submission Method Formal Exam
Assessment Criteria Mathematical correctness, completeness and clarity of presentation
Return Method Not Returned
Feedback Provided No Feedback - .

Assessment 3 - Tutorial assessment

Assessment Type Demonstrated competency
Purpose To test knowledge and participation in the tutorial
Description Short verbal or written answer question
Weighting 10%
Length A few minutes
Due Date Each tutorial
Submission Method
Assessment Criteria Reasonable attempt
Return Method In Person
Feedback Provided In Person - .

Assessment 4 - Online Quizzes

Assessment Type Quiz
Description Weekly online quizzes will be available on Canvas

Weighting	10%
Due Date	9am Monday each week from week 2
Submission Method	Online
Assessment Criteria	Correctness of multiple choice selections
Return Method	Online
Feedback Provided	Online - .

Assessment 5 - Mid Semester Test

Assessment Type	In Term Test
Purpose	To test the student's overall knowledge of the course content from weeks 1-6 inclusive
Description	The mid-session test will be held in the third lecture timeslot of week 7, covering material taught in weeks 1 to 6
Weighting	20%
Length	50 Minutes
Due Date	The mid-session test will be held in the third lecture timeslot of week 7.
Submission Method	In Class
Assessment Criteria	Mathematical correctness, completeness and clarity of presentation
Return Method	In Class
Feedback Provided	In Class - .

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.