

MATH2310: Calculus of Science and Engineering

Callaghan

Semester 1 - 2024



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

OVERVIEW

Course Description	Provides the essential mathematical techniques of Physical Science and Engineering. These are the methods of Multivariable Calculus and Differential Equations. Multivariable Calculus involves a study of the differential and integral calculus of functions of two or more variables. In particular it covers introductory material on the differential calculus of scalar and vector fields, and the integral calculus of scalar and vector functions. Differential Equations arise from mathematical models of physical processes. Also includes the study of the main analytical and numerical methods for obtaining solutions to first and second order differential equations.
Academic Progress Requirements	Nil
Requisites	Students must have successfully completed MATH1120 or MATH1220 before they can enrol in this course.
Contact Hours	Callaghan Lecture Face to Face On Campus 4 hour(s) per week(s) for 13 week(s) starting Week 1 Workshop Face to Face On Campus 2 hour(s) per week(s) for 11 week(s) starting Week 2
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.

COURSE OUTLINE

CONTACTS

Course Coordinator **Callaghan**
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Consultation: open door policy, please email for appointment

Teaching Staff please see "contacts" tab on canvas

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SYLLABUS

- Course Content**
- Real valued functions of several variables.
 - The differential operator "del".
 - Cylindrical and spherical coordinates.
 - General curves and surfaces.
 - Normals, tangents and tangent planes.
 - Double integrals.
 - Iterated integrals.
 - Triple integrals.
 - Line integrals.
 - Surface integrals.
 - Vector valued functions.
 - Divergence and Curl.
 - Line integrals of vector fields.
 - Green's theorem.
 - Stokes' theorem.
 - Divergence theorem.
 - Formulation of differential equations for simple physical processes
 - Interpreting solutions for first order differential equations using appropriate software.
 - Further studies of ordinary differential equations
 - Finding numerical solutions using Runge-Kutta methods via computer software.
 - Laplace transform methods for initial value problems.
 - Solving second order initial value problems with step function forcing terms.
 - Power series solutions to second order differential equations.
 - Boundary-value problems for partial differential equations.

- Course Learning Outcomes**
- On successful completion of this course, students will be able to:**
1. Identify and apply mathematical methods applicable to the differentiation and integration of functions of several variables and to ordinary differential equations.
 2. Apply appropriate mathematical fundamentals to solve a specific mathematical problems involving functions of many variables
 3. Apply mathematical models involving multivariable calculus and ordinary differential equations to solve mathematical problems
 4. Effectively communicate and interpret solutions to mathematical modelling problems.

Course Materials

SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	26 Feb	MVC: Partial derivatives and coordinate systems DE: Introduction to DEs	Lectures No workshops	no assesments
2	4 Mar	MVC: General curves and surfaces DE: Modelling with DEs	Lectures + Workshop 1 on week 1 Lecture material	Workshop Quiz 1 on week 1 Lecture material
3	11 Mar	MVC: Double integrals DE: Linear equations with constant coefficients	Lectures + Workshop 2 on week 2 Lecture material	Workshop Quiz 2 on week 2 Lecture material
4	18 Mar	MVC: Change of variables in integration DE: Existence & uniqueness	Lectures + Workshop 3 on week 3 Lecture material	Workshop Quiz 3 on week 3 Lecture material
5	25 Mar	MVC: Triple Integrals DE: Numerical methods	Lectures as per usual, but NO workshops, No quizzes	NO workshops this week, since Friday 29th of March is a public holiday (Good Friday),
6	1 Apr	MVC: Vector Fields DE: Series revision	Lectures + Workshop 4 on week 4 and 5 Lecture material	Workshop Quiz 4 on week 4 and 5 Lecture material
7	8 Apr	Revision Lecture on Wednesday No lecture on Thursday due to mid-semester test	Revision Lecture on Wednesday, no Lecture on Thursday, Midsemester test during your nominal workshop	Midsemester test conducted in face to face mode during your nominal workshop, 60 minutes The test covers the first 5 weeks of lectures, workshops 1-4, workshop quizzes 1-4
Mid-Semester Recess				
Mid-Semester Recess				
8	29 Apr	MVC: Line integrals DE: Series solutions	Lectures + Workshop 5 on week 6 Lecture material	Workshop Quiz 5 on week 6 Lecture material
9	6 May	MVC: Fundamental theorem of line integrals and Green's theorem DE: Laplace 1	Lectures + Workshop 6 on week 8 Lecture material	Workshop Quiz 6 on week 8 Lecture material
10	13 May	MVC: Curl and divergence DE: Laplace 2	Lectures + Workshop 7 on week 9 Lecture material	Workshop Quiz 7 on week 9 Lecture material
11	20 May	MVC: Surface integrals DE: Laplace 3	Lectures + Workshop 8 on week 10 Lecture material	Workshop Quiz 8 on week 10 Lecture material
12	27 May	MVC: Stokes' and Divergence theorem DE: PDE / BVP	Lectures + Workshop 9 on week 11 Lecture material	Workshop Quiz 9 on week 11 Lecture material
13	3 Jun			
Examination Period				

Examination Period

ASSESSMENTS

This course has 3 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Workshop Quiz	at the end of your timetabled workshop in Weeks 2-4, 6 and 8-12	Individual	25%	1, 2, 3
2	Examination	Formal examination Period	Individual	50%	1, 2, 3
3	Mid Semester Test	Week 7 in your timetabled workshop	Individual	25%	1, 2, 3, 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 - Workshop Quiz

Assessment Type	Quiz
Purpose	To provide regular work and ongoing feedback for student learning.
Description	Each quiz covers the material covered in the lectures of the preceding week(s).
Weighting	25%
Length	25 minutes
Due Date	at the end of your timetabled workshop in Weeks 2-4, 6 and 8-12
Submission Method	In Class
Assessment Criteria	Mathematical correctness
Return Method	In Class
Feedback Provided	In Class - . demonstrators will return the marked quizzes in class
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Examination

Assessment Type	Formal Examination
Purpose	To test individual student's knowledge of the course material and their analytical and problem-solving ability
Description	Formal Examination covers content from Week 1 to Week 12
Weighting	50%
Length	120 minutes + 10 minutes reading time
Due Date	Formal examination Period
Submission Method	Formal Exam
Assessment Criteria	Mathematical correctness
Return Method	Not Returned
Feedback Provided	No Feedback - .
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - Mid Semester Test

Assessment Type	In Term Test
Purpose	To test individual student's progress, knowledge of the first weeks of the course material and their analytical and problem-solving ability.
Description	The Mid semester test covers the first 5 weeks of lectures, workshops 1-4, workshop quizzes 1-4
Weighting	25%
Length	60 minutes + 5 minutes reading time
Due Date	Week 7 in your timetabled workshop
Submission Method	In Class

Assessment Criteria	Mathematical correctness
Return Method	In Class
Feedback Provided	In Class - week 8. The demonstrators will return the marked tests in class.
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.

Other Information

Adversed Circumstances links

https://askuon.newcastle.edu.au/app/answers/detail/a_id/186/~how-do-i-apply-for-adverse-circumstances%3F

<https://www.newcastle.edu.au/current-students/study-essentials/assessment-and-exams/adverse-circumstances>

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.

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