UNSW Course Outline

MATH3611 Higher Analysis - 2024

Published on the 16 May 2024

General Course Information

Course Code : MATH3611
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Mathematics & Statistics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

<u>Useful Links</u>

<u>Handbook</u> <u>Class Timetable</u>

Course Details & Outcomes

Course Description

This is a third-year course aimed at students completing a mathematics major or program. It is assumed that students are familiar with single and several variable calculus as taught in first and second-year mathematics courses.

The central concepts of calculus are limits and continuity. These concepts can be extended to

quite general situations. The simplest of these is when there is some way of measuring the distance between two objects. Some of the most important examples of these "metric spaces" occur as sets of functions, so this course looks at ways in which one might say that a sequence of functions converges. Taking these ideas one step further, we look at convergence which does not come from a generalised distance function. These are the ideas of point set topology. The course includes topics such as countability, continuity, uniform convergence and compactness, as well as normed vector spaces, which are the central object of study in functional analysis.

This is not a computational course; throughout the emphasis will be on ideas, concepts, and proofs rather than calculations and formulas.

The course consists of 4 hours of lectures per week and 1 hour of tutorial.

Course Aims

The aim of this course is to introduce the foundations of real analysis, which is a central pillar of modern mathematics. Using concrete analytic examples as motivation, the course will first develop the theory of metric spaces, which form a framework for generalising the notion of distance between points. The course will then take a further step toward abstraction and study topological spaces, which generalise the notion of closeness and convergence.

Relationship to Other Courses

Prerequisite: 12 units of credit of Level 2 Mathematics courses with an average mark of at least 70 or higher, including MATH2111 or MATH2011 (Credit), or permission from Head of Department.

Jointly taught with MATH5705 Modern Analysis

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe and apply definitions, theorems, and concepts of basic mathematical analysis, including the theory of metric, topological, and Banach spaces to basic problems.
CLO2 : Apply abstract mathematical theory to concrete problems.
CLO3 : Construct rigorous mathematical proofs and use them to solve problems.
CLO4 : Communicate mathematical reasoning effectively in writing.

Course Learning Outcomes	Assessment Item
CLO1 : Describe and apply definitions, theorems, and concepts of basic mathematical analysis, including the theory of metric, topological, and Banach spaces to basic problems.	• Assignment 1 • Assignment 2 • Assignment 3 • Final Examination
CLO2 : Apply abstract mathematical theory to concrete problems.	• Assignment 1 • Assignment 2 • Assignment 3 • Final Examination
CLO3 : Construct rigorous mathematical proofs and use them to solve problems.	• Assignment 1 • Assignment 2 • Assignment 3 • Final Examination
CLO4 : Communicate mathematical reasoning effectively in writing.	• Assignment 1 • Assignment 2 • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment 1 Assessment Format: Individual	10%	Due Date: Week 2
Assignment 2 Assessment Format: Individual	10%	Due Date: Week 5
Assignment 3 Assessment Format: Individual	20%	Due Date: Week 8
Final Examination Assessment Format: Individual	60%	Due Date: Exam Period

Assessment Details

Assignment 1

Assessment Overview

In Week 2 you will submit a written assignment consisting of solutions to 2 or 3 problems related to the first week's content. The purpose is both to test your understanding of the material and problem-solving skills, as well as for you to practice your mathematical writing. For this reason, clarity and precision of your writing will be the focus of the assessment. You will receive

feedback in the form of marks and possibly comments, and written solutions will be provided afterwards.

Course Learning Outcomes

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Detailed Assessment Description

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Assessment information

UNSW standard Late Submission Penalty applies for courses MATH3611/MATH5705:

• 5% per day, for all assessment tasks where a penalty applies (all assignments), and are capped at five days (120 hours) from the assessment submission deadline.

In case of approved Equitable Learning Plan (ELP) provision, special consideration or short extension, the late penalty applies from the date of approved time extension. After five days from the original or extended deadline, a student cannot submit an assessment, and no permitted variation.

Assignment submission Turnitin type

This is not a Turnitin assignment

Assignment 2

Assessment Overview

In Week 5 you will submit a written assignment consisting of solutions to 2 or 3 problems. The purpose is both to test your understanding of the material and problem-solving skills, as well as to practice your mathematical writing. For this reason, clarity and precision of the writing will be a focus of the assessment. You will receive feedback in the form of marks and comments, and written solutions will be provided afterwards.

Course Learning Outcomes

- CLO1 : Describe and apply definitions, theorems, and concepts of basic mathematical analysis, including the theory of metric, topological, and Banach spaces to basic problems.
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- CLO4 : Communicate mathematical reasoning effectively in writing.

Detailed Assessment Description

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Assignment submission Turnitin type

This is not a Turnitin assignment

Assignment 3

Assessment Overview

In Week 8 you will submit a longer written assignment consisting of solutions to 3-5 problems. These problems will be somewhat more involved than those on the earlier assignments. You will receive feedback in the form of marks and comments.

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Final Examination

Assessment Overview

You will complete a two hour final examination during the formal exam period.

The final examination will assess student mastery of the material covered in the lectures. The exam will include questions requiring knowledge of the definitions, examples and theorems in the course, as well as problems to be solved using such knowledge.

Feedback is provided through inquiry with the course convenor.

Course Learning Outcomes

- CLO1 : Describe and apply definitions, theorems, and concepts of basic mathematical analysis, including the theory of metric, topological, and Banach spaces to basic problems.
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- CLO3 : Construct rigorous mathematical proofs and use them to solve problems.
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Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Topic	Introduction; Sets and cardinality; Metric spaces
Week 2 : 3 June - 9 June	Topic	Metric spaces (continued)
Week 3 : 10 June - 16 June	Topic	Metric spaces (continued)
Week 4 : 17 June - 23 June	Topic	Metric spaces (continued)
Week 5 : 24 June - 30 June	Topic	Sequences and series of functions; Topological spaces
Week 7 : 8 July - 14 July	Topic	Topological spaces (continued)
Week 8 : 15 July - 21 July	Topic	Topological spaces (continued)
Week 9 : 22 July - 28 July	Topic	Topological spaces (continued); compactness
Week 10 : 29 July - 4 August	Topic	Compactness
	Topic	Compactness (continued)

Attendance Requirements

Please note that lecture recordings are not available for this course. Students are strongly encouraged to attend all classes and contact the Course Authority to make alternative arrangements for classes missed.

Course Resources

Recommended Resources

The text "Introductory Real Analysis" by Kolmogorov and Fomin is recommended textbook for this course.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Denis Potapov		H13 Anita B. Lawrence Centre 6111			No	Yes
	Alan Stoneham					No	No

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/

referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student

email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines

School-specific Information

School of Mathematics and Statistics and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site. Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the web site starting at: The School of Mathematics and Statistics assessment policies

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the

Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Special Consideration - Short Extension Policy

The School of Mathematics and Statistics has carefully reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. Upon comprehensive examination of our course offerings that incorporate these types of assessments, we have concluded that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School of Mathematics and Statistics has decided to universally opt out of the Short Extension provision for all its courses, having pre-emptively integrated flexibility into our assessment deadlines. The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

Computing Lab

The main computing laboratory is room G012 of the Anita B.Lawrence Centre (formerly Red Centre). You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, located on the mezzanine level through the glass door (and along the corridor) opposite the School's entrance.

For more information, including opening hours, see the computing facilities webpage. Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

School Contact Information

Please visit the School of Mathematics and Statistics website for a range of information.

For information on Courses, please go to "Student life & resources" and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within "Student life & resources" page. We also post notices in "Student noticeboard" for your

information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

Undergraduate

E: ug.mathsstats@unsw.edu.au

P: 9385 7011 or 9385 7053

Postgraduate

E: pg.mathsstats@unsw.edu.au

P: 9385 7053

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please use your UNSW student email and state your student number in all emails to us.**