UNSW Course Outline

ECON7004 Mathematical Economics - 2024

Published on the 28 Jan 2024

General Course Information

Course Code : ECON7004
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : UNSW Business School
Academic Unit : School of Economics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course is an introduction to mathematical techniques that are widely used in economics. We study the properties of sets, vector spaces, functions and equations and use them to describe economic environments. We employ mathematical techniques such as solving

equations and finding fixed points, calculus, and static and dynamic optimisation to analyse economic problems.

Course Aims

This course builds on undergraduate courses in quantitative methods, linear algebra and calculus. You will be expected to have a working knowledge of elementary algebra and introductory calculus including the differentiation and integration of real-valued functions.

Relationship to Other Courses

This course builds on undergraduate courses in quantitative methods, linear algebra and calculus. You will be expected to have a working knowledge of elementary algebra and introductory calculus including the differentiation and integration of real-valued functions.

Course Learning Outcomes

Course Learning Outcomes	Program learning outcomes
CLO1 : knowledge and understanding of the mathematical concepts and methods used by professional economists	• PLO1 : Research Excellence • PLO2 : Academic Excellence
CLO2 : The facility to express economic ideas in the language of mathematics.	• PLO3 : Leadership
CLO3 : The expertise to analyse economic models by using formal mathematical methods.	• PLO1 : Research Excellence • PLO2 : Academic Excellence

Course Learning Outcomes	Assessment Item
CLO1 : knowledge and understanding of the mathematical concepts and methods used by professional economists	• Take-home Assignments • In-class Presentations • Final exam
CLO2 : The facility to express economic ideas in the language of mathematics.	• Take-home Assignments • In-class Presentations • Final exam
CLO3 : The expertise to analyse economic models by using formal mathematical methods.	• Take-home Assignments • In-class Presentations • Final exam

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

Learning Activities and Teaching Strategies

The (two-hour) lectures and seminars, reading assignments, tutorial assignments, presentation and exams are designed to challenge you and to support the achievement of the desired learning outcomes. Your engagement in discussions during lectures and seminars will assist you in achieving the learning outcomes.

The examinable content of the course is defined by the references given in the lecture schedule, the content of lectures, and the content covered in the seminars.

Lectures

The purpose of lectures is to provide a logical structure for the topics that make up the course; to emphasise the important concepts and methods of each topic; and to provide relevant examples to which the concepts and methods are applied.

Seminars

The purpose of the seminars is to reinforce and clarify the concepts and issues covered in the lectures, and identify and remedy any problems with understanding. Students are expected to prepare for, and contribute to, seminar discussion.

Out-of-Class Study

While students may have preferred individual learning strategies, it is important to note that most learning will be achieved outside of class time. Lectures can only provide a structure to assist your study, and in-class time is limited.

An “ideal” strategy (on which the provision of the course materials is based) might include:

- Reading of the relevant chapter(s) of the text and any readings before the lecture. This will give you a general idea of the topic area.
- Attending lectures and seminars. The context, importance, and relevance of course material is identified and clarified here.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Program learning outcomes
Take-home Assignments Assessment Format: Individual	40%	Start Date: At the start of Weeks 2 and 6 Due Date: At the end of Weeks 4 and 8 respectively	• PLO1 : Research Excellence • PLO2 : Academic Excellence
In-class Presentations Assessment Format: Group	20%	Due Date: Will be conducted in the Week 9 seminars	• PLO1 : Research Excellence • PLO2 : Academic Excellence • PLO3 : Leadership
Final exam Assessment Format: Individual	40%		• PLO1 : Research Excellence • PLO2 : Academic Excellence • PLO3 : Leadership

Assessment Details

Take-home Assignments

Assessment Overview

There will be two take-home assignments, each worth 20%. More details will be announced on Moodle in due course.

Course Learning Outcomes

- CLO1 : knowledge and understanding of the mathematical concepts and methods used by professional economists
- CLO2 : The facility to express economic ideas in the language of mathematics.
- CLO3 : The expertise to analyse economic models by using formal mathematical methods.

Detailed Assessment Description

There will be **two** take-home assignments. Each Assignment is worth 20% of your total mark. Assignments must be submitted **individually**. The assignments will test your knowledge of the material discussed during the lecture for the weeks prior. Answers to select questions in each Take-home assignment will be discussed in the Lecture following the week in which the assignment is due.

Assignment 1 and 2 will be posted in Weeks 2 and 6 respectively, and are due on **Friday 11.59:59pm** in Weeks 4 and 8 respectively.

Submissions must be done **online via Moodle**. Your name and ZID must be on the cover page. Both handwritten and LaTeX-typed submissions (or a combination of both) will be accepted.

However, if equations / words / pictures are written by hand, please ensure that your handwriting is legible. Additional instructions will be given in the first lecture, and can be found on the assignment document.

Assessment Length

N/A

Submission notes

Submissions must be done via moodle, and in a pdf form

Assignment submission Turnitin type

Not Applicable

In-class Presentations

Assessment Overview

Students will be divided into groups of 3-4, and work together to answer one of several possible questions. They will have to present their answer to the class in the seminar of Week 9. More details will be announced on Moodle in due course.

Course Learning Outcomes

- CLO1 : knowledge and understanding of the mathematical concepts and methods used by professional economists
- CLO2 : The facility to express economic ideas in the language of mathematics.
- CLO3 : The expertise to analyse economic models by using formal mathematical methods.

Detailed Assessment Description

Students will have to work in groups of 3-4 to present one of several questions. The presentation is worth 20% of the total mark. The presentation questions are based on course content covered in weeks up to 8, and consists of 3-5 subquestions. Each group has a total of **30 minutes** to present the question, with 5 minutes afterwards dedicated to questions from the audience / discussion. Marks will be given based on the group's presentation as a **whole**. Each group member must be part of presenting one subquestion (or more).

Presentations will be held in Week 9 (order TBA). Presentation questions will be released at the start of Week 5. Additional instructions will be given in the first lecture, and can be found in the presentation question document.

All students are expected to attend all presentations. Students who are unable to attend the in-

class presentations and have a valid reason with documentation should apply for Special Consideration as prescribed by UNSW policy.

Final exam

Assessment Overview

The final examination will be held during the University's examination period and will cover all the material for the term. The exam is designed to test your knowledge of the subject matter covered in the lectures, practice problems, assignments, and in-class presentations. Further information about the content of the final exam will be provided in class discussions.

Course Learning Outcomes

- CLO1 : knowledge and understanding of the mathematical concepts and methods used by professional economists
- CLO2 : The facility to express economic ideas in the language of mathematics.
- CLO3 : The expertise to analyse economic models by using formal mathematical methods.

Detailed Assessment Description

Subject to Faculty approval, the final exam will be in-person and invigilated.

Submission notes

N/A

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Grading Basis

Standard

Requirements to pass course

In order to pass this course students must:

- Achieve a composite mark of at least 50 out of 100
- Engage actively in course learning activities and attempt all assessment requirements
- Meet any additional requirements specified in the assessment details
- Meet the specified attendance requirements of the course (see Schedule section)

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	• Introduction to the course • Foundational topics (Sets, Logic, Proofs) • Relations and Functions, Binary relations • Real-valued Functions, real numbers (Includes content for both lecture and seminar) See Moodle for additional details
Week 2 : 19 February - 25 February	Lecture	• Introduction to Normed Spaces • Open, closed, and compact sets • Continuous functions • Sequences, subsequences and limits (Includes content for both lecture and seminar) Take-home Assignment 1 is announced at the start of the week See Moodle for additional details
Week 3 : 26 February - 3 March	Lecture	• Introduction to Linear Spaces • Linear Functions • Change of basis • Solving systems of linear equations (Includes content for both lecture and seminar) See Moodle for additional details
Week 4 : 4 March - 10 March	Lecture	• Geometric properties of Euclidean Space • Eigenvalues and Eigenvectors, Spectral Decomposition • Derivatives in Euclidean Space (Includes content for both lecture and seminar) Take-home Assignment 1 is due at the end of the Week See Moodle for additional details
Week 5 : 11 March - 17 March	Lecture	• Derivatives in Euclidean Space continued • Convex sets in normed spaces • Hyperplane theorems in Euclidean Space • Concave functions • Quasiconcave functions (Includes content for both lecture and seminar) Several take-home Assignment 1 questions will be reviewed in the Wednesday lecture Presentation questions announced See Moodle for additional details
Week 6 : 18 March - 24 March	Lecture	• Inverse Function Theorem • Implicit Function Theorem • Fixed-point / existence theorems (Includes content for both lecture and seminar) Take-home Assignment 2 announced at the start of the week See Moodle for additional details
Week 7 : 25 March - 31 March	Lecture	• Fixed-point / existence theorems continued • Unconstrained optimization - first and second-order conditions • Constrained optimization with equality constraints (Theorem of the Lagrange) (Includes content for both lecture and seminar) See Moodle for additional details
Week 8 : 1 April - 7 April	Lecture	• Constrained optimization with equality constraints continued (Theorem of the Lagrange) • Constrained optimization with inequality constraints (Karush-Kuhn-Tucker Conditions) (Includes content for both lecture and seminar) Take-home Assignment 2 is due at the end of the Week See Moodle for additional details
Week 9 : 8 April - 14 April	Lecture	• Comparative statics in optimization problems (Envelope Theorem, using the implicit function theorem, etc) (Includes content for both lecture and seminar) Several take-home Assignment 2 questions will be reviewed in the Wesneday lecture

		Presentations will be held both in the lecture and seminar (order TBA) See Moodle for additional details
Week 10 : 15 April - 21 April	Lecture	• Correspondences, Hemicontinuity, Theorem of the Maximum • Review of course content (Includes content for both lecture and seminar) See Moodle for additional details

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

Prescribed Resources

Texts

The main course material are the lecture slides posted on Moodle. These will be revised frequently during the course.

The lecture slides draw upon material from the following textbooks (and so, you are recommended to review both of them). Relevant chapters will be mentioned on the lecture slides.

- Sundaram, Rangarajan K., A First Course in Optimization Theory, Cambridge University Press, 2011
- de la Fuente, Angel, Mathematical Methods and Models for Economists, Cambridge University Press, 2000.

Practice Questions can also be found in the exercise book uploaded onto Moodle.

Recommended Resources

If you would like some preliminary reading to improve your background in mathematics, I recommend you go through the first of the books below. If you want additional reading or an alternative approach to the material, I recommend the second of these textbooks:

- Sydster, Knut, Peter Hammond, Arne Strm and Andrs Carvajal, Essential Mathematics for Economic Analysis, Fifth Edition, Pearson, 2016.
- Sydster, Knut, Peter J. Hammond, Atle Seierstad, and Arne Strm, Further Mathematics for Economic Analysis, Second Edition, Pearson, 2008.

Both books are in the High Use Collection in the UNSW library.

There are numerous books that cover similar material at various levels. If you would like some supplementary reading or extra exercises on some topics, I recommend any of the following:

- Chiang, Alpha C. and Kevin Wainwright, Fundamental Methods of Mathematical Economics, McGraw-Hill, 2005.
- Novshek, W., Mathematics for Economists, Academic Press, 1993.
- Simon, Carl P., and Lawrence Blume, Mathematics for Economists, Norton, 1994.
- Efe, Ok A., Real Analysis with Economic Applications, 2007.

These are listed in order of difficulty (easiest first). Several of these may be found in the UNSW library in the High Use Collection.

Moodle

Subject documents, notifications, assignments, lecture notes, and exams from previous years may be obtained on UNSW Moodle. Also, discussion forums for topics related to the course will be conducted on this site.

To obtain access to Moodle with your browser and enter your student number prefixed with a lower case z and your zPass.

Library

The texts for this course are available in the High Use Collection in the UNSW Library.

UNSW IT Service Desk

The UNSW IT Service Desk offers technical support for problems with the IT services on campus.

Course Evaluation and Development

Feedback is regularly sought from students and continual improvements are made based on this feedback. At the end of this course, you will be asked to complete the myExperience survey, which provides a key source of student evaluative feedback. Your input into this quality enhancement process is extremely valuable in assisting us to meet the needs of our students and provide an effective and enriching learning experience. The results of all surveys are carefully considered and do lead to action towards enhancing educational quality.

The School of Economics strives to be responsive to student feedback. If you would like more

information on how the design of this course and changes made to it over time have taken students' needs and preferences into account, please contact the Director of Education at the School of Economics.

Consent for De-Identified Data to be Used for Secondary Research into Improving Student Experience

To enhance your student experience, researchers at UNSW conduct academic research that involves the use of de-identified student data, such as assessment outcomes, course grades, course engagement and participation, etc. Students of this course are being invited to provide their consent for their de-identified data to be shared with UNSW researchers for research purposes after the course is completed.

Providing consent for your de-identified data to be used in academic research is voluntary and not doing so will not have an impact on your course grades.

Researchers who want to access your de-identified data for future research projects will need to submit individual UNSW Ethics Applications for approval before they can access your data.

A full description of the research activities aims, risks associated with these activities and how your privacy and confidentiality will be protected at all times can be found here.

If you **consent** to have your de-identified data used for academic research into improving student experience, you do not need to do anything. Your consent will be implied, and your data may be used for research in a format that will not individually identify you after the course is completed.

If you **do not consent** for this to happen, please email the opt-out form to seer@unsw.edu.au to opt-out from having your de-identified data used in this manner. If you complete the opt-out form, the information about you that was collected during this course will not be used in academic research.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Christopher Teh				Wednesday (W1 - W10) 5:00 - 6:00 pm and by appointment	Yes	Yes

Other Useful Information

Academic Information

COURSE POLICIES AND SUPPORT

The Business School expects that you are familiar with the contents of this course outline and the UNSW and Business School learning expectations, rules, policies and support services as listed below:

- Program Learning Outcomes
- Academic Integrity and Plagiarism
- Student Responsibilities and Conduct
- Special Consideration
- Protocol for Viewing Final Exam Scripts
- Student Learning Support Services

Further information is provided on the key policies and support page.

Students may not circulate or post online any course materials such as handouts, exams, syllabi or similar resources from their courses without the written permission of their instructor.

STUDENT LEARNING OUTCOMES

The Course Learning Outcomes (CLOs) – under the Outcomes tab – are what you should be able to demonstrate by the end of this course, if you participate fully in learning activities and successfully complete the assessment items.

CLOs also contribute to your achievement of the Program Learning Outcomes (PLOs), which are developed across the duration of a program. PLOs are, in turn, directly linked to UNSW graduate capabilities. More information on Coursework PLOs is available on the key policies and support page. For PG Research PLOs, including MPDBS, please refer to the UNSW HDR Learning Outcomes.

Academic Honesty and Plagarism

As a student at UNSW you are expected to display academic integrity in your work and interactions. Where a student breaches the UNSW Student Code with respect to academic integrity, the University may take disciplinary action under the Student Misconduct Procedure. To assure academic integrity, you may be required to demonstrate reasoning, research and the

process of constructing work submitted for assessment.

To assist you in understanding what academic integrity means, and how to ensure that you do comply with the UNSW Student Code, it is strongly recommended that you complete the Working with Academic Integrity module before submitting your first assessment task. It is a free, online self-paced Moodle module that should take about one hour to complete.

Submission of Assessment Tasks

SPECIAL CONSIDERATION

You can apply for special consideration when illness or other circumstances beyond your control interfere with your performance in a specific assessment task or tasks, including online exams. Students studying remotely who have exams scheduled between 10pm and 7am local time, are also able to apply for special consideration to sit a supplementary exam at a time outside of these hours.

Special consideration is primarily intended to provide you with an extra opportunity to demonstrate the level of performance of which you are capable. To apply, and for further information, see Special Consideration on the UNSW Current Students page.

Special consideration applications will be assessed centrally by the Case Review Team, who will update the online application with the outcome and add any relevant comments. The change to the status of the application immediately sends an email to the student and to the assessor with the outcome of the application.

Please note the following:

1. Applications can only be made through Online Services in myUNSW (see the UNSW Current Students page). Applications will not be accepted by teaching staff. The lecturer-in-charge/ course coordinator will be automatically notified when your application is processed.
2. Applying for special consideration does not automatically mean that you will be granted a supplementary exam or other concession.
3. If you experience illness or misadventure in the lead up to an exam or assessment, you must submit an application for special consideration, either prior to the examination taking place, or prior to the assessment submission deadline, except where illness or misadventure prevent you from doing so.
4. If your circumstances stop you from applying before your exam or assessment due date, you must apply within 3 working days of the assessment or the period covered by your supporting documentation.

5. Under the UNSW Fit To Sit/Submit rule, if you sit the exam/submit an assignment, you are declaring yourself well enough to do so and are cannot subsequently apply for special consideration.
6. If you become unwell on the day of – or during – an exam, you must stop working on your exam, advise your course coordinator or tutor and provide a medical certificate dated within 24 hours of the exam, with your special consideration application. For online exams, you must contact your course coordinator or tutor immediately via email, Moodle or chat and advise them you are unwell and submit screenshots of your conversation along with your medical certificate and application.
7. Special consideration requests do not allow the awarding of additional marks to students.

Further information on Business School policy and procedure can be found under "Special Consideration" on the key policies and support page.

LATE SUBMISSION PENALTIES

For assessments other than examinations, late submission will incur a penalty of 5% per day or part thereof (including weekends) from the due date and time. An assessment will not be accepted after 5 days (120 hours) of the original deadline unless special consideration has been approved. An assignment is considered late if the requested format, such as hard copy or electronic copy, has not been submitted on time or where the 'wrong' assignment has been submitted.

For assessments which account for 10% or less of the overall course grade, and where answers are immediately discussed or debriefed, the LIC may stipulate a different penalty. Details of such late penalties will be available on the course Moodle page.

FEEDBACK ON YOUR ASSESSMENT TASK PERFORMANCE

Feedback on student performance from formative and summative assessment tasks will be provided to students in a timely manner. Assessment tasks completed within the teaching period of a course, other than a final assessment, will be assessed and students provided with feedback, with or without a provisional result, within 10 working days of submission, under normal circumstances. Feedback on continuous assessment tasks (e.g. laboratory and studio-based, workplace-based, weekly quizzes) will be provided prior to the midpoint of the course.

Faculty-specific Information

PROTOCOL FOR VIEWING FINAL EXAM SCRIPTS

UNSW students have the right to view their final exam scripts, subject to a small number of very specific exemptions. The UNSW Business School has set a protocol under which students may view their final exam script. Individual schools within the Faculty may also set up additional local processes for viewing final exam scripts, so it is important that you check with your School.

If you are completing courses from the following schools, please note the additional school-specific information:

- Students in the **School of Accounting, Auditing & Taxation** who wish to view their final examination script should also refer to this page.
- Students in the **School of Banking & Finance** should also refer to this page.
- Students in the **School of Information Systems & Technology Management** should also refer to this page.

COURSE EVALUATION AND DEVELOPMENT

Feedback is regularly sought from students and continual improvements are made based on this feedback. At the end of this course, you will be asked to complete the myExperience survey, which provides a key source of student evaluative feedback. Your input into this quality enhancement process is extremely valuable in assisting us to meet the needs of our students and provide an effective and enriching learning experience. The results of all surveys are carefully considered and do lead to action towards enhancing educational quality.

QUALITY ASSURANCE

The Business School is actively monitoring student learning and quality of the student experience in all its programs. A random selection of completed assessment tasks may be used for quality assurance, such as to determine the extent to which program learning goals are being achieved. The information is required for accreditation purposes, and aggregated findings will be used to inform changes aimed at improving the quality of Business School programs. All material used for such processes will be treated as confidential.

TEACHING TIMES AND LOCATIONS

Please note that teaching times and locations are subject to change. Students are strongly advised to refer to the Class Timetable website for the most up-to-date teaching times and locations.