EMET1001
Foundations of Economic and Financial Models
(An Introduction to Mathematical Economics)

The course teaches the mathematical foundations of models in economics, business, and finance, along with its applications. Mathematical topics covered include set theory, functions, series, limits, univariate and multivariate calculus, unconstrained and constrained optimization, and matrix algebra. Applications include production functions, average and marginal cost functions, and profit maximization.

<table>
<thead>
<tr>
<th>Mode of Delivery</th>
<th>On campus.</th>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>None listed.</td>
</tr>
<tr>
<td>Incompatible Courses</td>
<td>STAT1006, EMET7001.</td>
</tr>
<tr>
<td>Course Convener:</td>
<td>Dr Damien Eldridge.</td>
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<td>Email:</td>
<td><a href="mailto:Damien.Eldridge@anu.edu.au">Damien.Eldridge@anu.edu.au</a></td>
</tr>
<tr>
<td>Office hours for student consultation:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tuesday (2:00 pm to 3:30 pm), Arndt Room 2029;</td>
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<tr>
<td></td>
<td>• Thursday (11:00 am to 12:30 pm), Arndt Room 2029;</td>
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<td></td>
<td>• Tutor Consultation Times TBA.</td>
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<tr>
<td>Research Interests</td>
<td>• Microeconomic Theory,</td>
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<td></td>
<td>• Applied Microeconomics,</td>
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<td></td>
<td>• Microeconometrics.</td>
</tr>
<tr>
<td>RSE Student Office</td>
<td>Nicole Millar</td>
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<tr>
<td>Contact</td>
<td></td>
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<td>Phone:</td>
<td>02 612 50384</td>
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<td>Email:</td>
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</tr>
<tr>
<td>RSE Students Webpage</td>
<td><a href="https://www.rse.anu.edu.au/students/">https://www.rse.anu.edu.au/students/</a></td>
</tr>
</tbody>
</table>

SEMESTER TWO, 2018
COURSE OVERVIEW

Learning Outcomes

By the end of the course students will:
1. Have a sound understanding of mathematical techniques discussed.
2. Formulate economic problems in mathematical terms and apply the tools provided in the module for analyzing them.
3. Demonstrate an understanding of many of the common functional forms used in economics.
4. Apply linear and matrix algebra techniques to simple economic and econometric problems.
5. Apply univariate and multivariate differential calculus techniques to simple economic and econometric problems.
6. Apply univariate integral calculus techniques to simple economic and econometric problems.
7. Apply optimization techniques to economic and econometric problems.

Assessment Summary

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Potential Value</th>
<th>Approximate Date</th>
<th>Date for Return of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Online Quiz One (One Hour)</td>
<td>5 % (Optional and Redeemable)</td>
<td>End of Week 3</td>
<td>Results and feedback provided upon conclusion of the period in which the exam may be undertaken.</td>
</tr>
<tr>
<td>2. Mid-Semester Exam (Fifteen Minutes Reading, Two Hours Writing)</td>
<td>20 % (Optional and Redeemable)</td>
<td>TBA (In Week 6)</td>
<td>Results announced in Week 7. Exam viewing times TBA.</td>
</tr>
<tr>
<td>3. Online Quiz Two (One Hour)</td>
<td>5 % (Optional and Redeemable)</td>
<td>End of Week 9</td>
<td>Results and feedback provided upon conclusion of the period in which the exam may be undertaken.</td>
</tr>
<tr>
<td>3. Final Exam (Fifteen Minutes Reading, Three Hours Writing)</td>
<td>70 %</td>
<td>TBA (In the official final exam period)</td>
<td>Exams may be viewed at some point after the final grades have been officially released.</td>
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</tbody>
</table>

Please note that the mid-semester exam, online quiz 1, and online quiz 2 are all both optional and redeemable. As such, there will be no special examinations for these assessment items under any circumstances. Instead the relevant assessment weighting will be moved to the final exam.

Research-Led Teaching
The material taught in this course is directly relevant to research and analysis of most topics in microeconomics, macroeconomics, econometrics, statistics, finance, and many business disciplines.
Feedback

Staff Feedback
Students will be given some general feedback after the online quizzes and detailed feedback after the mid-term exam. Students will also have the opportunity to obtain feedback on any topic related to this course during their scheduled tutorial sessions and the regular consultation sessions that are held by the teaching staff in this unit. I highly encourage students to avail themselves of these opportunities.

Student Feedback
ANU is committed to the demonstration of educational excellence and regularly seeks feedback from students. One of the key formal ways students have to provide feedback is through Student Experience of Learning Support (SELS) surveys. The feedback given in these surveys is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise excellent teaching, and opportunities for improvement. For more information on student surveys at ANU and reports on the feedback provided on ANU courses, go to http://unistats.anu.edu.au/surveys/selt/students/ and http://unistats.anu.edu.au/surveys/selt/results/learning/

Policies

ANU has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University’s academic standards, and implement them. You can find the University’s education policies and an explanatory glossary at: http://policies.anu.edu.au/

Students are expected to have read the Academic Misconduct Rules 2014 before the commencement of their course.

Other key policies include:
- Student Assessment (Coursework)
- Student Surveys and Evaluations

Workload Expectations

The amount of work required for successful completion of this subject may vary between students. As a rough guide, students should expect to devote at least 10 hours a week to this unit. This should include all of the following.

- 3 hours a week: lectures.
- 1 hour a week: tutorials.
- At least 6 hours a week: reading, research, writing, lecture and tutorial preparation.

Examination material or equipment

Other than writing-related equipment (such as pens, pencils, erasers, sharpeners, and rulers), only a non-programmable calculator may be used in either of the exams for this subject.
**Recommended Resources**

- **Textbook:**

- **Supplementary References:**

**COURSE SCHEDULE**

In the following outline for this course, the expression “a.b” means lecture b in week a. Note that this outline is just a rough guide to the topics that will be covered in this course and the lectures in which they will be covered. If it becomes necessary, the timing and subject matter will vary from that set out below.

<table>
<thead>
<tr>
<th>Lectures (Rough Guide)</th>
<th>Summary of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Introduction and Administration</td>
</tr>
<tr>
<td>1.2, 1.3</td>
<td>Topic 1: Sets, Numbers, Coordinates, and Distances</td>
</tr>
<tr>
<td>2.1, 2.2</td>
<td>Topic 2: Functions and Correspondences</td>
</tr>
<tr>
<td>2.3, 3.1, 3.2</td>
<td>Topic 3: Binary Relations, Equations, and Inequalities</td>
</tr>
<tr>
<td>3.3, 4.1, 4.2</td>
<td>Topic 4: Sequences, Series, and Limits (with a small number of applications to financial economics)</td>
</tr>
<tr>
<td>4.3, 5.1, 5.2, 5.3</td>
<td>Topic 5: Univariate Differential Calculus</td>
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<tr>
<td>6.1, 6.2</td>
<td>Replaced by the Mid-Semester Exam.</td>
</tr>
<tr>
<td>6.3</td>
<td>Review of the Mid-Semester Exam.</td>
</tr>
<tr>
<td>7.1, 7.2, 7.3</td>
<td>Topic 6: Univariate Integral Calculus</td>
</tr>
<tr>
<td>8.1, 8.2, 8.3, 9.1, 9.2, 9.3</td>
<td>Topic 7: Linear Algebra</td>
</tr>
<tr>
<td>10.1, 10.2, 10.3, 11.1</td>
<td>Topic 8: Multivariate Differential Calculus</td>
</tr>
<tr>
<td>11.2, 11.3, 12.1, 12.2, 12.3</td>
<td>Topic 9: Optimisation Theory</td>
</tr>
</tbody>
</table>
ASSESSMENT REQUIREMENTS

- As an academic integrity control, students may be selected for a fifteen-minute individual oral examination of their written assessment submissions.
- Any student identified, either during the current semester or in retrospect, as having used ghost writing services will be investigated under the University’s Academic Misconduct Rule.

Assessment Task 1
Assessment Task: Online Quiz One
Details of task: This will be a one-hour quiz that is administered online at the end of teaching week three of the semester. More details will be announced at a later date.
Estimated return dates: Results and general feedback will be available immediately after the quiz period has concluded.
Value: This online quiz is worth (at most) 5% of your raw mark for this course. However, this component is both optional and redeemable. It will only count towards your raw mark if it exceeds your mark on the final exam. If your mark for this online quiz does not exceed your mark on the final exam, then the five percentage points allocated to this quiz will be reallocated to the final exam.
Purpose: The purpose of this assessment item is to test both your understanding of the material covered in the relevant part of this course and your ability to apply that material to problems from economics, finance, and business studies.
Note: Since this assessment item is both optional and redeemable, no special arrangements will be made for students who do not complete this item, regardless of the reason for not doing so. The weight from this assessment will simply be transferred to the final exam for any such students.

Assessment Task 2
Assessment Task: Mid-Semester Exam
Details of task: This will be a formal exam consisting of fifteen minutes of reading time and two hours of writing time. It will consist of a number of problems that are related to the material covered in at least one of the following: (i) lectures in weeks one to four, (ii) tutorials in weeks two to five, and (iii) the associated readings. It will be held sometime during week six and will replace the first two hours of lectures for this course in that week.
Estimated return dates: Marks will be posted on the Wattle site for the unit by the end of week seven. Potential exam viewing times will be announced at that point.

Value: The mid-semester exam is worth (at most) 20 % of your raw mark for this course. However, this component is both optional and redeemable. It will only count towards your raw mark if it exceeds your mark on the final exam. If your mid-semester exam mark does not exceed your mark on the final exam, then the twenty percentage points allocated to the mid-semester exam will be reallocated to the final exam.

Purpose: The purpose of this assessment item is to test both your understanding of the material covered in the relevant part of this course and your ability to apply that material to problems from economics, finance, and business studies.

Note: Since this assessment item is both optional and redeemable, no special arrangements will be made for students who do not complete this item, regardless of the reason for not doing so. The weight from this assessment will simply be transferred to the final exam for any such students.

**Assessment Task 3**

**Assessment Task:** Online Quiz Two

**Details of task:** This will be a one-hour quiz that is administered online at the end of teaching week nine of the semester. More details will be announced at a later date.

**Estimated return dates:** Results and general feedback will be available immediately after the quiz period has concluded.

**Value:** This online quiz is worth (at most) 5 % of your raw mark for this course. However, this component is both optional and redeemable. It will only count towards your raw mark if it exceeds your mark on the final exam. If your mark for this online quiz does not exceed your mark on the final exam, then the five percentage points allocated to this quiz will be reallocated to the final exam.

**Purpose:** The purpose of this assessment item is to test both your understanding of the material covered in the relevant part of this course and your ability to apply that material to problems from economics, finance, and business studies.

**Note:** Since this assessment item is both optional and redeemable, no special arrangements will be made for students who do not complete this item, regardless of the reason for not doing so. The weight from this assessment will simply be transferred to the final exam for any such students.
Assessment Task 4

Assessment Task: Final Exam

Details of task: This will be a formal exam consisting of fifteen minutes of reading time and three hours of writing time. It will consist of a number of problems that are related to any of the material covered in this course. This includes material covered in lectures, material covered in tutorials, and material covered in the suggested reading. It will be held sometime during the official final exam period. The date, time, and location will be determined by the University administration.

Estimated return dates: The final exam script books will be available for viewing at some point following the release of the official results for this course.

Value: The final exam is worth (at least) 70 % of your raw mark for this course.

Purpose: The purpose of this assessment item is to test both your understanding of the material covered in this course and your ability to apply that material to problems from economics, finance, and business studies.

Extensions and penalties
No submission of assessment tasks without an extension after the due date will be permitted. If an assessment task is not submitted by the due date and an extension has not been granted or alternative arrangements have not been authorised, then a mark of 0 will be awarded.

Raw Unit Mark

Your raw final percentage mark for this unit will be determined according to the following formula:

- Raw Mark =
  - 0.7 x Final Exam % Mark
  - + 0.2 x Max ( Final Exam % Mark , Mid-Semester Exam % Mark )
  - + 0.05 x Max ( Final Exam % Mark , Online Quiz One % Mark )
  - + 0.05 x Max ( Final Exam % Mark , Online Quiz One % Mark ).

Scaling
Your final mark for the course will be based on the raw marks allocated for each of your assessment items. However, your final mark might not be the same number as produced by that formula, as marks might be scaled. Any scaling applied will weakly preserve the rank order of raw marks (i.e. if your raw mark exceeds that of another student, then your scaled mark will either match or exceed the scaled mark of that student), and might be either up or down.
Privacy Notice
The ANU has made a number of third party, online, databases available for students to use. Use of each online database is conditional on student end users first agreeing to the database licensor’s terms of service and/or privacy policy. Students should read these carefully.

In some cases student end users will be required to register an account with the database licensor and submit personal information, including their: first name; last name; ANU email address; and other information.

In cases where student end users are asked to submit ‘content’ to a database, such as an assignment or short answers, the database licensor may only use the student’s ‘content’ in accordance with the terms of service – including any (copyright) licence the student grants to the database licensor.

Any personal information or content a student submits may be stored by the licensor, potentially offshore, and will be used to process the database service in accordance with the licensors terms of service and/or privacy policy.

If any student chooses not to agree to the database licensor’s terms of service or privacy policy, the student will not be able to access and use the database. In these circumstances students should contact their lecturer to enquire about alternative arrangements that are available.

SUPPORT FOR STUDENTS
The University offers a number of support services for students. Information on these is available online from http://students.anu.edu.au/studentlife/ and http://www.anu.edu.au/students/health-safety-wellbeing.

Other Information
Building Access Hours
Both CBE and HW ARNDT are:
TEACHING PERIOD = Mon – Fri 07.45 to 21.15 and SAT, SUN and Public Holidays is not accessible by students.
Both CBE and HW ARNDT are:
NON TEACHING PERIOD = Mon – Fri 08.00 to 18.00 and SAT, SUN and Public Holidays is not accessible by students.

RSE has a Frequently Asked Questions page where you can find relevant policies and information on a broad range of topics, the onus is on the student to familiarise themselves with this page and the information available.
https://www.rse.anu.edu.au/students/students/frequently-asked-questions/
READING GUIDE

- Note that books relevant to this course can be found in both the Chifley Library (which houses most of the ANU Library’s economics collection) and the Hancock Library (which houses some of the ANU Library’s economics collection and most of the ANU Library’s mathematics collection).

- I strongly encourage you to familiarise yourself with, and make use of the resources contained in, both of these libraries.

Core References

- Textbook:
    - Any edition is fine.
    - I will request that this book be made available on short-loan from the ANU library system.

- Supplementary References (at a similar level to the textbook):
    - There is only one edition of this book, as far as I am aware.
    - I will request that this book be made available on short-loan from the ANU library system.
    - Any edition is fine.
    - This book is available in digital form from a link in the ANU Library catalogue.
    - Any edition is fine.
    - I will request that this book be made available on short-loan from the ANU library system.
    - There is only one edition of this book, as far as I am aware.
    - I will request that this book be made available on short-loan from the ANU library system.
• More Advanced References:
  - For those who want to pursue some of the material further.
    • Often, but not always, beyond the scope of this course.
    • These are intermediate-level undergraduate references on mathematical economics.
    • In general, when multiple editions of one of following references exist, then any edition of that reference will be fine.
  - Intriligator, MD (1971), *Mathematical optimization and economic theory*, Prentice-Hall, USA.

**Topic 1: Sets, Numbers, Coordinates, and Distance**

- Sydsaeter, Hammond, Strom, and Carvajal (2016): Chapters 1 and 2 (pp. 1–66).
- Asano (2013): Chapters 1 and 2 (pp. 1–56).
- Bradley (2013): Chapter 1 (pp. 1–35).
- Haeussler and Paul (1987): Chapter 0 (pp. 1–33).

**Topic 2: Functions and Correspondences**

- Asano (2013): Chapters 1 and 2 (pp. 1–56).
- Shannon (1995): Chapters 2 and 6 (pp. 28–82 and 231–284).
**Topic 3: Binary Relations, Equations, and Inequalities**

- Sydsaeter, Hammond, Strom, and Carvajal (2016): Chapters 2 and 3 (pp. 19–87).
- Asano (2013): Chapters 1 and 2 (pp. 1–56).
- Bradley (2013): Chapter 1 (pp. 18–21 only).
- Haeussler and Paul (1987): Chapters 1 and 2 (pp. 34–74).
- Shannon (1995): Chapters 1, 2, and 6 (pp. 1–27, 28–82, and 231–284).

**Topic 4: Sequences, Series, and Limits (with a small number of applications to financial economics)**

- Sydsaeter, Hammond, Strom, and Carvajal (2016): Chapters 2.8, 2.9, 2.10, 2.11, 6.5, 7.9, 7.11, and 10 (pp. 52–62, 182–188, 257–266, 270–273, and 375–406).
- Asano (2013): Chapter 3 (pp. 57–89).

**Topic 5: Univariate Differential Calculus**

- Sydsaeter, Hammond, Strom, and Carvajal (2016): Chapters 6, 7, and 8 (pp. 169–317).
- Asano (2013): Chapters 4 and 5 (pp. 90–146).
- Bradley (2013): Chapter 6 (pp. 259–360).

**Topic 6: Univariate Integral Calculus**

- Asano (2013): Chapter 7 (pp. 184–217).
- Bradley (2013): Chapter 8 (pp. 427–476).

**Topic 7: Linear Algebra**

**Topic 8: Multivariate Differential Calculus**

- Asano (2013): Chapter 6 (pp. 147–183).
- Bradley (2013): Chapter 7 (pp. 361–426).

**Topic 9: Optimisation Theory**

- Haeussler and Paul (1987): Chapters 12, 13, 17.7, 17.8, 17.9, and 17.10 (pp. 473–532 and 697–723).
- Shannon (1995): Chapters 8.6, 8.7, 10.4, 10.5, 10.6, and 10.7 (pp. 383–396 and 462–501).