

The Australian National University

College of Business and Economics

MATHEMATICAL TECHNIQUES IN ECONOMICS 1 (ECON8013)

MATHEMATICS FOR ECONOMISTS A (ECON 2125)

Syllabus (Course Outline) - Semester 1, 2009

INTRODUCTION:

This course aims to introduce students to a wide range of mathematical concepts that are in frequent use by economists. Students who complete this course successfully will be able to read most undergraduate level technical economics books. Roughly speaking, we will study advanced calculus, linear algebra, set theory, optimization and a little bit of mathematical analysis - all essential tools that are standard in modern economic analysis.

Students wishing to pursue post graduate level programs in economics, finance, business or other social sciences are strongly advised to take this class and its sequence, ECON2127 Mathematics for Economists B (also called Mathematical Techniques in Economics II – ECON8014), which is usually offered in semester 2.

This course is open to undergraduate students who enroll in ‘Mathematics for Economists A (ECON 2125)’, and to graduate students and fourth-year Applied Economics Honours students in the School of Economics who enroll in ‘Mathematical Techniques in Economics I (ECON 8013)’.

Lecturer: Dr. Jose Rodrigues-Neto (jose.neto_at_anu.edu.au). My office is located at H.W. Arndt Building - Room 1024. When sending me an email, please, put on the title of the email “MATH student”. If you have a question regarding the tutorials, please, address it directly to the tutor.

Tutor: Ms. Pamela Katic (pamela.katic_at_anu.edu.au). Her office is located at the Crawford School PhD Annex II. Phone number: 6125 1300.

School Administrator: Maria Tatarow (maria.tatarow_at_anu.edu.au). Her office is on HW Arndt Building - Room 1014, and her Phone is 6125 3590.

WebCT (Internet access):

The material for this course will be available on the webCT (<http://webct.anu.edu.au>).

To access webCT you need to type your student ID and PAC numbers. Then, go to the link of ECON 8013 or ECON2125. The material on the webCT includes course outline (syllabus), problem sets and class notices.

You should check the webCT site of our course at least twice a week. The class notes are not meant to substitute the textbook. You really need to read them both.

LECTURES AND TUTORIALS

In every week, there are two lectures of 2 hours each, and a tutorial of 1 hour. The lecture times are:

- Tuesdays, from 2:00 pm to 4:00 pm, at COP G030 (Building 24); AND
- Fridays, from 2:00 pm to 4:00 pm, at Manning Clark Centre, Theatre 4 (Building 26a).

Tutorials will commence in the second week of class. The tutorials will discuss exercises and review some concepts. Students are strongly advised to prepare in advance for classes and tutorials. Students who merely follow through the steps of answers provided in tutorials will often be unable to answer new questions. Mathematics is like gymnastics: **if just watch other people working out, you will not get stronger.** Those who consistently work through **lots** of exercises for themselves without prior knowledge of the answers will, generally, obtain a superior understanding and, consequently, tend to perform much better in the exams.

Tutorials will be held each week, commencing in Week 2. To enroll in a tutorial you need to use Electronic Teaching Administration (ETA) on <http://eta.fec.anu.edu.au> and follow the commands on the Student Login page. The sooner you do this, the more likely you are to get in the tutorial of your choice. Please, attend the tutorial you are assigned to.

CONSULTATION HOURS

Ms. Pamela Katic will be the tutor. She will be available for an hour each week for consultation. Once the tutorials are organized, she will inform you of her availability. She can be contacted by email (pamela.katic_at_anu.edu.au). Her office is located at the Crawford School PhD Annex II and her phone number is 6125 1300 (ext. 51300).

I (Jose) will also be available for consultation in my office at Friday, from 4:00 pm to 5:15 pm. Students will be seen on a first-come-first-serve basis. There is no need to email in advance. Just turn up **during** the office hours.

ASSESSMENT

The method of assessment is as follows:

- Mid-Term exam: 35 per cent; and
- Final Exam: 65 per cent.

The **Mid-Term** is **NOT redemptive**. Make sure you are well prepared. The date of the Mid-Term is Friday March 27, during our regular class (from 2:00 pm to 4:00 pm at the usual place). The last day to drop the course without having a Fail grade on your ANU academic record is March 31.

The **Final Exam** will be after classes finish in the end of the semester. Please, check time table in the future.

I do not control students' presence. However, this is a hard course and if you miss one or more classes it is very likely that your grade will drop significantly. Learning mathematics is like climbing: you do not reach a higher level without reaching ALL previous levels first.

READING AND STUDYING

Preliminary reading of all topics may help you. After every lecture, please, read the corresponding sections **again**. If necessary, read again and again until you understand clearly. You can also consult different books, if there is need to do so. Studying math only in the week of the exam is a sure path to failure. Learning math takes time, effort and persistency. Plan in advance the time and place you will study.

Please, **before** classes start, read chapters 1 to 5 (Part I) of our text book (Simon & Blume), as well as Appendices A1, A2 and A4.

TENTATIVE LIST OF TOPICS (EMPHASIS ON THE WORD "TENTATIVE")

Topic 1: Basic Concepts – Brief Revision

- Sets and subsets.
- Numbers.
- Ordered pairs, Cartesian products and properties of point sets.
- Functions, graphs, increasing functions, inequalities.
- Straight Line, tangents, slope, vectors in Euclidean spaces.
- Relations, truth tables.
- Logic, necessary and sufficient conditions, mathematical induction.
- Boolean algebra.

Topic 2: Univariate Calculus: (Text, Chs. 3, 4 and 5).

- Continuity of a function of one variable.
- The derivative and the differential.
- Conditions for differentiability.
- Rules for differentiation.
- Higher-order derivatives.
- Convex and concave functions.
- Necessary conditions for unconstrained maxima and minima.
- Second-order conditions.
- Comparative statics in optimization models.

- Integral calculus.
- Taylor series formula.

Topic 3: Linear Algebra: (Text, Chs. 6-11).

- Solving systems of linear equations.
- Linear systems of n -variables.
- Matrices.
- Vector spaces, sub-spaces.
- Linear independence.
- Linear transformations.
- Vectors and linear independence.
- Inverse and determinant of an $n \times n$ matrix.
- Cramer's Rule.
- Eigenvalues and eigenvectors.
- Quadratic forms.

Topic 4: Calculus for Functions of n -Variables: (Text, Chs. 12-15).

- Partial differentiation.
- Higher order partial derivatives.
- The first-order total differential.
- Chain rule for several variables.
- The Implicit Function Theorem and comparative statics.
- Level curves and level sets.
- Curvature properties: concavity and convexity.
- Quasiconcavity and quasiconvexity.
- Homogeneous and homothetic functions.

Topic 5: Optimization: (Text, Ch. 16-22).

- First and second order conditions.
- Comparative statics.
- The Envelope Theorem (unconstrained case).

Topic 6: Mathematical Analysis: (Text, Ch. 29-30).

- Sequences.
- Topology.

Again, note that this is just a **TENTATIVE** list. Topics 5 and 6 will only be part of the course if there is enough time. The order in which topics will be covered may not be the order in which they appear in this list.

MAIN TEXTBOOK (you need to have this book **before** classes start)

Carl P. Simon and Lawrence Blume, *Mathematics for Economists*, First Edition, 1994, W.W. Norton and Company. (Chifley, HB135.B59).

We will cover most of the book in our course. Feel free to read it all. It will help you a lot in the future.

HIGHLY RECOMMENDED REFERENCES (you do **not** need to have these books)

Knut Sydsaeter; Peter Hammond, *Essential Mathematics for Economic Analysis*, 3rd edition, ISBN 978-0-273-71324-1.

Knut Sydsaeter; Peter Hammond; Atle Seierstad; Arne Strom, *Further Mathematics for Economic Analysis*, 2nd edition, ISBN 978-0-273-71328-9.

OTHER REFERENCES (you do **not** need to have these books)

Chiang, A.C., *Fundamental Methods of Mathematical Economics*, 3rd edition, McGraw Hill (Chifley HB74.M3.C485).

Dixit, A.K., *Optimization in Economic Theory*, 2nd edition, Oxford University Press, 1990 (Chifley HB135.D58).

Dowling, E.T., *Schaum's Outline of Theory and Problems of Mathematics for Economists*, McGraw-Hill, 1992, (Hancock QA37.2.D68).

Silberberg, E., *The Structure of Economics - A Mathematical Analysis*, McGraw-Hill, 1990, (Chifley HB135.S54).

Sydsaeter, K. and P.J. Hammond, *Mathematics for Economic Analysis*, Prentice-Hall, 1995 (Chifley, HB135.S888).

Those with weak backgrounds who want some additional explanation or worked examples are recommended to consult the texts by Sydsaeter and Hammond or Dowling. More advanced material is covered in Silberberg.

A few places where you can buy the books online (there are other online retailers – google your preferred one):

- <http://www.coop-bookshop.com.au/bookshop>
- <http://www.footprint.com.au/>
- <http://www.johnwiley.com.au/highered/engine.jsp>
- <http://www.amazon.com>
- <http://www.barnesandnoble.com/>

ANU College of Business & Economics – General Information for Enrolled

Students

The following College offices provide assistance with program and course selection, enrolment, change of program, variation to enrolment, status and other general matters.

College Office

The College Office is located on the 1st floor of the Copland Building (room 1120), contact details are:

phone (61) 02 6125 3807; Email info.cbe@anu.edu.au or via the web: <http://www.cbe.anu.edu.au/>.

Students enrolled in the Master of Business Administration, the Master of Management and the

Graduate Certificate in Management should visit the Student Office located in the Sir Roland Wilson

Building (No.120) room 2.07. Contact details are: phone (61) 02 6125 9830; Email:

ngsm@anu.edu.au

Main Administrative Dates 2009

The main administrative dates regarding teaching sessions, course census dates, examination period, graduation and enrolment variations (ie add and drop courses) are available from the ANU SEAP Guide 2009 - http://www.anu.edu.au/sas/SEAP_guide/

Associate Dean (Education)

Associate Professor Alex Clarke is the Deputy Dean/Associate Dean (Education) in the ANU College of

Business & Economics.

ANU Student Support

Academic Skills and Learning Centre

The Academic Skills and Learning Centre, in the Pauline Griffin Building, offers services to students regarding a range of academic issues including essay writing, note-taking, referencing, reading, examination preparation, and plagiarism. More information about the services and on-line materials

can be found on their website: <http://www.anu.edu.au/academicskills/>.

ANU College - <http://www.anucollege.com.au/>

ANU College offers the following introductory and extended programs:

- maths bridging courses; and
- English language support for students from non-English-speaking backgrounds.

Information Literacy Program - <http://ilp.anu.edu.au/index.html>

Workshops are available to undergraduate and graduate students to develop skills in handling information and communication technologies.

ANU College of Business & Economics - Information for Enrolled Students - Policies, Procedures and Rules

Primary Reference - ANU SEAP Guide 2009 http://www.anu.edu.au/sas/SEAP_guide/

The Student Enrolment and Administrative Procedures Guide (SEAP) supplements the ANU

Undergraduate Handbook information available on Study@ANU (<http://info.anu.edu.au/studyat/>), the

ANU Rules (<http://www.anu.edu.au/cabs/rules/>), and the Graduate Research website

(<http://www.anu.edu.au/graduate/>).

Information for Enrolled Students http://cbe.anu.edu.au/Current_Students/general_info/

Students are expected to be familiar with the ANU College of Business & Economics and universitywide

policies and procedures in regard to:

- Code of Practice for Student Academic Honesty
- Assessment Arrangements for Students from Language Backgrounds Other Than

English

- Academic Progress Rules and Procedures
- Special examinations/consideration
- Supplementary examinations
- Review of assessment procedures

Special Examinations

NOTE: You must contact the College Office for guidance on the procedure for special examinations. Do not approach your lecturer for this information.

Students who are unable to attend an examination for reasons outlined in the policies above, may

apply to sit a special examination by lodging an application with the College Student Administration

Office no later than 72 hours after the scheduled examination. It is important to emphasise that travel arrangements are not normally an acceptable grounds for special examinations

(Section 2, College 'Special Examination Policy':

<http://ecocomm.anu.edu.au/student/policy/specexam.asp>).

Please note: Section 7.7 of the 'Student Enrolment and Procedures Guide 2009' states:

Students must make themselves available for the duration of the examination

period in order to attend any special examination that may be required.

If you know in advance of circumstances whereby you will be unable to sit the examination, you should lodge an application for consideration as soon as possible.

The dates on which Special Examinations will be held will be published on the School website when

the final timetable is published.

Applications for special examinations must be correctly completed with all original supporting documentation attached. Where an application is made on the grounds of sickness, Section B of the

application must be completed by a medical practitioner and a detailed medical certificate stating the effect on your capacity to sit the examination is required.

Please Note: The medical certificate must carry the stamp from the medical practice, and will not always be sufficient evidence.

Special examinations are not automatically granted. Once approved, successful candidates are required to contact the relevant School General Office to obtain details of the special exam. If you do

not sit the examination, or your application for a special examination is declined, then you will fail the

course as incomplete.

It is not grounds for a further special examination if students are not contactable and miss the scheduled examination date.

Special Consideration

If illness or other disruptive events have affected your preparation for, or performance during an

examination, you can bring this to the attention of the examiners by making a request for special consideration using the Application for Special Consideration form.

Requests for special consideration must be lodged with the relevant School General Office before the

scheduled date of the examination. However, if it relates to a problem that arose during the examination, it should be submitted immediately after the examination (see the invigilator).

Requests for special consideration must be accompanied by documentation of the illness and/or a letter setting out the reasons for the difficulties in studying for or sitting an examination. The examiners will take this into account in awarding the final grade.

Special Arrangements

If you have a disability or disorder (permanent or temporary) which makes undertaking a formal sitdown

examination difficult, then you are responsible for requesting special arrangements to be made for your examination. In the past these arrangements have included the use of special equipment, additional time, writing breaks, a scribe (someone to write for you), etc.

Please contact the Examination Office early in the semester and at least 10 days prior to the examination period.

Failure to make appropriate arrangements for an examination may result in a subsequent application

for a special examination/consideration being declined.

Disabilities

If you have any queries about special arrangements with respect to disabilities, please refer to the Disabilities Officer. The ANU Disability Services Centre's website is

<http://www.anu.edu.au/disabilities/>.

Supplementary Examinations

Under University policy Examinations Rules 2007,

<http://www.anu.edu.au/cabs/rules/ExamsRules.pdf> you may be provided with a supplementary exam.

If you have qualified for a supplementary examination, your grade will be recorded as a PX on your

Notification of Results. You must notify the School Office, in writing (email is satisfactory), within 7 days of the official publication date of examination results to indicate your

acceptance or otherwise to sit the supplementary examination.

If you pass the supplementary examination you will receive the grade of PS (pass supplemental) and

a mark of 50. If you are unsuccessful, or you decide not to sit the supplementary examination, your

grade will be recorded as N (fail) and your original mark will stand.

Supplementary examinations will be held early in the next semester on dates to be advised. For information regarding the timing and venues for Supplementary examinations please refer to the school websites in week 2 of the current semester:

ABIS: <http://www.cbe.anu.edu.au/schools/abis/>

ECONOMICS: <http://www.cbe.anu.edu.au/schools/eco/>

FAS: <http://www.cbe.anu.edu.au/schools/fas/>

MMIB: <http://www.cbe.anu.edu.au/schools/mmib/>

Travel plans should be made accordingly as failure to do so is not an acceptable reason to miss a supplementary examination.

Results and Examinations

ANU Grading Codes - in accordance with the University Assessment Grades/Codes, the CBE applies the following scale when awarding grades:

Final Pass Grades

HD - High Distinction 80 –100

D – Distinction 70 – 79

CR – Credit 60 - 69

P – Pass 50 – 59

PS – Pass at supplementary examination 50

Final Fail Grades

N – Fail 00 – 49

NCN – Not Completed/Fail

WN – Withdrawn with failure

Interim Codes (used when a result for a course has not yet been finalised)

DA – Deferred assessment

PX – Awarded supplementary assessment

RP – Result pending

WA – Withheld for administrative reasons

Scaling

Scaling can increase or decrease a mark but does not change the order of marks relative to the other

students in the course.

If it is decided that scaling is appropriate, then the final mark awarded in a course may differ from the

aggregation of the raw marks of each assessment component.

Results Notification

To access results students should check their ISIS accounts on the advertised date for release of

examination results. After publication students enquiring about results must provide an ANU student

card as proof of identification. For privacy reasons students should not make enquiries regarding the

results of other students.

Examination Timetable – Final Examination Period

Details of the final examination timetable are available on the ANU Timetabling website

(<http://timetable.anu.edu.au/default.asp>). The onus is upon students to acquire their own scheduling details.

Examination Timetable – Mid-Semester Examinations

When a mid-semester exam is scheduled, timetable information will be posted by the relevant School.

Misconduct

In relation to an examination, misconduct on the part of a student includes:

- cheating;
- plagiarism (including the reproducing in, or submitting for assessment for, any examination, by way of copying, paraphrasing or summarising, without acknowledgement and with the intention to deceive, any work of another person as the student's own work, with or without the knowledge or consent of that other person);
- submitting for an examination any work previously submitted for examination (except with the approval of the prescribed authority);

- failing to comply with the University's instructions to students at, or in relation to, an examination;
- acting, or assisting another person to act dishonestly, in or in connection with an examination;
- taking a prohibited document into an examination venue.

The administrative procedures regarding misconduct are incorporated in the ANU Discipline Rules –

detailed here <http://www.anu.edu.au/cabs/rules/DisciplineRules.pdf>

Plagiarism

The College regards plagiarism as any appropriation of the ideas or expressions of another without relevant and appropriate acknowledgment. This includes un-attributed appropriation of text or content and may extend to improper referencing. Plagiarism will not be tolerated in any course and all

discovered instances would be pursued to the full extent allowable under the rules.

Where students have doubts as to how to deal with or acknowledge source materials in course assignments they should consult the lecturer or tutor.

The penalties and administrative procedures regarding plagiarism are incorporated in the ANU Policy

on Academic Honesty – see here for details

http://info.anu.edu.au/Policies/_DVC/Policies/Code_Practice_Student_Academic_Honesty.asp?tab=1).

On-line material discussing plagiarism and referencing styles is available from the Academic Skills and

Learning Centre Web page (<http://www.anu.edu.au/academicskills/>).