# PRINCIPLES OF MATHEMATICAL ECONOMICS I
# ECONOMICS EC2141B 001
### Department of Economics
### Western University

**Instructor:** Mohammad Iftekher Hossain                                                    **January  2018**

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|---|---|
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| **Office Hours** | Thursday 12.15-2.15 |
| **Classroom meeting time(s) & location** | Tuesday 2.30-4.30, Thursday 2.30-3.30, UCC 67 |
| **Undergraduate inquiries** | 519-661-3507 SSC Room 4075 or econugrd@uwo.ca |

## Registration

You are responsible for ensuring you are registered in the correct courses.  If you are not registered in a course, the Department will not release any of your marks until your registration is corrected. You may check your timetable by using the Login on the Student Services website at https://student.uwo.ca.  If you notice a problem, please contact your home Faculty Academic Counsellor immediately.

## Prerequisite Note

The prerequisites for this course are: Economics 1021A/B and 1022A/B, or Economics 2001A/B, and the former Mathematics 030; or 0.5 course from: Mathematics 1225A/B, Calculus 1000A/B, Calculus 1500A/B, the former Calculus 1100A/B; plus 0.5 course from Calculus 1301A/B, 1501A/B, Mathematics 1229A/B, the former Linear Algebra 1600A/B *Prerequisite(s) for your course found at: http://westerncalendar.uwo.ca/2017/pg904.html*


You are responsible for ensuring that you have successfully completed all course prerequisites, and that you have not taken an anti-requisite course.  Lack of pre-requisites may not be used as a basis for appeal.  If you are found to be ineligible for a course, you may be removed from it at any time and you will receive no adjustment to your fees.  This decision cannot be appealed.

If you find that you do not have the course prerequisites, it is in your best interest to drop the course well before the end of the add/drop period.  Your prompt attention to this matter will not only help protect your academic record, but will ensure that spaces become available for students who require the course in question for graduation.

**Course Objectives**

This course introduces mathematical techniques through examples of their application to economic concepts. It covers mathematical techniques that are relevant to microeconomics, macroeconomics, and business economics.

At the beginning, the course explains why mathematics is useful to economists using some basic examples from demand and supply, elasticity of demand, national income accounting, consumer behavior etc. The course then discusses one variable calculus, exponential and logarithmic functions in economics, applications of linear algebra, differential calculus, and optimization techniques of functions of several variables used in microeconomics, macroeconomics, and business economics. The course covers unconstrained optimization and constrained optimization with equality and inequality constraints and from the perspective of consumers and producers. It also covers basic topics in integral calculus and some examples from linear difference equation.

After completing this course, students are expected to learn functions and economic models, draw graphs that correspond to linear, non-linear and composite functions, find the slopes of linear and non-linear functions, calculate growth rates, the properties of exponential growth, present value computations, optimal timing, how to solve a linear IS-LM or supply-demand system using linear algebra, univariate optimization, how to apply marginalist thinking at more than one margin, multivariate optimization and constrained optimization.

To sum up, focus of this course is the application of mathematics in economics. Students will learn how to use basic mathematical tools to analyze economic models, especially optimization models, both univariate and multivariate. <u>The course emphasizes more on applying mathematical techniques in economics which are common instead of focusing more on proofs and special cases.</u>

**Course Learning Outcomes**

After successful completion of the course students are expected to be able to

- formally represent economic relationships using mathematical forms.
- present several economic functions using graphs including rational functions, exponential functions, logarithmic functions, and level curves.
- represent economic models using matrix algebra and calculus.
- solving simultaneous linear equation systems in economics using matrix inversion and Cramer's rule.
- set up optimal timing problems and solve them using the appropriate techniques
- formulate optimization problems in microeconomics, macroeconomics, and business economics.
- formulate constrained optimization problems with equality constraints and inequality constraints.
- interpret the second-order sufficient conditions of optimization using Hessian and Bordered-Hessian.
- generate the comparative statics from optimization problems, using various techniques.
- understand the basic concepts of integral calculus, differential equation, and difference equation.

**Textbook**

Simon, Carl P. and Blume, Lawrence. 1994. Mathematics for Economists. Norton & Company

Recommended: Dowling, Edward T. 2001. Introduction to Mathematical Economics: Third Edition. McGraw-Hill

**Course Outline And Tentative Class Schedule**

|   | Topics | Recommended Text | Tentative Schedule |
|---|--------|------------------|--------------------|
| I | Introduction | Simon & Blume, Dowling | Week 1 |
| II | One Variable Calculus, Graphing Economic Functions, Maxima and Minima, Comparative Statics, Implicit functions and Inverse Functions, Sketching Cost Functions, Production Functions, and Profit Functions | Simon & Blume | Week 2-5 |
| III | Exponential and Logarithmic Functions, The Number e, Graphing Exponential and Logarithmic Functions, Computing Present Value, Discounting, Optimal Timing, and Annuities | Simon & Blume | Week 5-6 |
| IV | Linear Algebra Gaussian and Gauss-Jordan Elimination, Elementary Row Operations, Algebra of Square Matrix, Determinant of a Matrix, Linear Independence, Inverse Matrix, Cramer's Rule | Dowling, Simon & Blume | Week 6-8 |
| V | Calculus of Several Variables and Unconstrained Optimization, Marginal Concepts, Finding Profit-Maximizing Output for Competitive Firms and Monopolists, Use of Hessian Matrix to Check the Second-order Conditions for Unconstrained Optimizations | Simon & Blume | Week 8-10 |
| VI | Constrained Optimization with Equality Constraints and Inequality Constraints, Graphing Level Curves, Utility Maximization, Cost Minimization, Output Maximization, Cobb-Douglas and CES Production Function, Marginal Impact of the Constraint, Using Bordered-Hessian Matrix to Check the Second-Order Conditions for Constrained Optimizations | Simon & Blume | Week 10-12 |
| VII | Basic concepts of Integral Calculus, Differential Equation and Difference Equation, Cobweb Model | Dowling | Week 12-13 |

**Grading**

Grading will be based on the total points earned by the end of the semester. Assignments contribute 20 percent of points possible, a midterm exam contributes 30 percent of points possible, and a cumulative final exam contributes 50 percent of points possible. University and Departmental guidelines for grading will be strictly followed.

| Grade | Scale | Explanation |
|---|---|---|
| A+ | 90-100 | One could scarcely expect better from a student at this level |
| A | 80-89 | Superior work that is clearly above average |
| B | 70-79 | Good work, meeting all requirements, and eminently satisfactory |
| C | 60-69 | Competent work, meeting requirements |
| D | 50-59 | Fair work, minimally acceptable |
| F | <50 | Fail |

**Evaluation**

| Evaluation Type | Weight | Date, Time and Room |
|---|---|---|
| Four Assignments | 20% | Assignment 1 – Due Thursday, 01 February 2018 |
| | | Assignment 2 – Due Thursday, 15 February 2018 |
| | | Assignment 3 – Due Thursday, 15 March 2018 |
| | | Assignment 4 – Due Thursday, 29 March 2018 |
| Mid-Term | 30% | Date: 27 February 2017, Tuesday |
| | | Time: 6.30 pm – 8.30 pm |
| | | Exam duration: 90 minutes |
| | | Location: TBD |
| | | Method: Closed book examination |
| Final Examination | 50% | Set by the Registrar |
| | | Exam duration: 2.5 hours |
| | | Method: Closed book examination |

**Classroom Expectations**

Students are expected to attend lectures, listen attentively, participate in group activities, and take notes. Students should arrive on time. Please remember that to obtain satisfactory grade in this course, regular attendance is important as the evaluation will focus on the materials that will be discussed in the lectures and assignments. Please bring pages/notebooks and pens/ pencils so that in addition to draw funny pictures of the instructor, you can take important notes.

Students can use mobile phones and laptops only to get access to the lecture notes. Students cannot use Facebook, Twitter, or any site using Internet (this is the opportunity cost of attending the lectures). During lectures, students cannot use mobile phones or laptops to take pictures or record the lectures.

Please remember that the more you study and practice, the better your grade will be (but please be aware about diminishing returns and opportunity cost!).

> Remember that the University expects all students to take responsibility for their own academic Programs.  Also remember to check your registration to make sure you are enrolled in the correct courses.

1.  Guidelines and policies for the Faculty of Social Science and the Department of Economics are posted online in the current Western Academic Calendar at http://westerncalendar.uwo.ca.

2.  Students must familiarize themselves with the "Rules of Conduct for Examinations" http://westerncalendar.uwo.ca/2017/pg136.html.

3.  Cheating as an academic offence:  Students are responsible for understanding what it means to "cheat".  The Department of Economics treats cheating incidents very seriously and will investigate any suspect behavior.  Students found guilty will incur penalties that could include a failing grade or being barred from future registration in other economics courses or programs. The University may impose further penalties such as a notation on your official academic transcript, suspension or expulsion.

4.  Plagiarism:  Students must write their essays and assignments in their own words.  Whenever students take an idea or a passage from another author, they must acknowledge it by using quotation marks where appropriate and referencing with footnotes or citations.  Plagiarism is a major academic offence (see Scholastic Offence Policy in the current UWO Academic Calendar at http://westerncalendar.uwo.ca/2017/pg113.html).

    The University of Western Ontario uses software to check for plagiarism and students may be required to submit their written work in electronic form.  Those found guilty will have penalties imposed as noted in point 3.

5.  It is Department of Economics policy that NO assignments be dated, stamped or accepted by staff.  Students are responsible for submitting assignments in class or to the instructor during office hours.

6.  When appealing a mark, students should refer to the University's Procedures in the current UWO Academic Calendar (http://westerncalendar.uwo.ca/2017/pg112.html). Please note the relevant deadlines.

    The Department will not consider any appeal unless an attempt has been made to settle the matter first with your instructor.  If after this discussion you remain dissatisfied with a grade or other decision, you may proceed with a written appeal (e-mails are not acceptable) to the Undergraduate Director in Economics, stating the reasons for your appeal. A useful     form and checklist is provided at
    (http://economics.uwo.ca/undergraduate/program_counselling/responsibilities_policies.html#appeals).

7. Systematic adjustments of a class grade distribution (either up or down) can occur in Economics courses. The fact that grades have been adjusted is not grounds for an appeal.

8. Note the following add and drop deadlines:

   Last day to **add** a 2<sup>nd</sup> term half course:
   **Tuesday, January 16<sup>th</sup>, 2018**

   Last day to **drop** 2<sup>nd</sup> term half course without academic penalty:
   **Wednesday, March 7<sup>th</sup>, 2018**

9. Faculty of Social Science policy states that oversleeping or misreading an exam schedule is not an excuse for a make-up. This rule applies to all mid-term tests and final exams in the Department of Economics.


## POLICY REGARDING MAKEUP TESTS AND FINAL EXAMINATIONS

*Academic accommodation will not be granted automatically on request. You must demonstrate by documentation that there are compelling medical or compassionate grounds before academic accommodation will be considered.*

If you decide to write a test or an examination, you must be prepared to accept the mark you earn. Rewriting tests or examinations, or having the value of the test or examination reweighted on a retroactive basis, is not permitted. Book airline flights after you know the dates of your final examinations. Airline flights must not conflict with test or final exams.

If you are requesting a makeup test for a midterm or a final examination, unless medically incapable, notify your instructor by email or phone, preferably prior to the scheduled date of the test, but definitely within 24 hours of the date of the test or exam. Failure to follow this procedure may result in denial of a request for academic accommodation or result in a grade of zero. Set up an appointment as soon as possible to meet personally with your instructor. If the instructor is not available, you may send an email message, copying the Undergraduate Coordinator at econugrd@uwo.ca (Social Science Room 4075). Notifying your instructor of a missed test or exam does not automatically entitle you to a makeup test.

Students who seek a makeup test or examination must provide medical or other relevant verification that their absence from a regularly scheduled test or examination is beyond their control. Documentation must support your reasons. Medical documentation should be given to the Academic Counselling Office of your *home* Faculty as soon as possible (preferably within 24 hours of the test) if you know you may not be able to write your final examination on the scheduled day and time. Failure to follow this procedure, or to provide supporting documentation, may result in denial of a request for academic accommodation or result in a grade of zero. If your documentation is not acceptable, you will be given a zero for the missed test.

For personal illness, if you consult Student Health Services regarding your illness or personal problem, you should request a Student Medical Certificate from the physician. If you were seen

by an off-campus doctor, obtain a certificate from his/her office at the time of your visit. The off-campus medical certificate form must be used and can be found at: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf. Notes stating "For Medical Reasons" are not considered sufficient.

For any other circumstances, if you are not sure what documentation to provide, ask your Academic Counsellor. If your documentation is judged sufficient, the Academic Counsellor will issue a Recommendation for a Special Examination (a single form for midterms or a triple color form for final examinations). Once you have this form, contact your instructor as soon as possible to make arrangements. Even if approved from your home faculty Academic Counsellor, there is no guarantee that you will be allowed to write the makeup test and exam.

For final examinations, you need permission from your *home* Faculty Counsellor, your instructor, and the Department Undergraduate Director. Failure to follow this procedure may result in an examination grade of zero. You must ensure that the Special Examination form has been signed by the instructor and Department Undergraduate Director and that the form is returned to the Academic Counselling Office for approval without delay. Make-up final examinations, if permitted, will be written within one month of the end of the exam period.

## POLICIES REGARDING ACADEMIC ACCOMMODATION

Information about the Faculty of Social Science's policies regarding academic accommodation is found on its website at http://counselling.ssc.uwo.ca/procedures/havingproblems.asp or in Social Science Room 2105. Your "Academic Rights and Responsibilities" are also outlined in the current UWO Calendar at http://westerncalendar.uwo.ca/2017/pg111.html. Claiming that "you didn't know what to do" is not an acceptable excuse for not following the stated procedures.

## POLICY REGARDING CLASS ATTENDANCE

If your instructor views your class attendance as unsatisfactory, you can be prohibited from writing the final examination. If there is intent to make use of this University policy, you will be notified in writing.

## STATEMENT ON MENTAL HEALTH AND SUPPORT SERVICES

If you or someone you know is experiencing emotional/mental distress, there are several resources here at Western to assist you. Please visit http://www.uwo.ca/uwocom/mentalhealth/ for more information and a complete list of resources, as well as how to obtain help.