INTRODUCTION TO MATHEMATICAL ECONOMICS

INSTRUCTOR: Professor Frank S. T. Hsiao
OFFICE HOURS: TR 11:00-12:00, F 2:00-3:30

OFFICE: Economics Building 107
OFFICE PHONE: 492-7908

PREREQUISITES: Math 1050-1, 1060-1, 1070-1, 1080-1, 1100-1; or Math 1070-3 and 1080-3; or Econ 1078-3 and 1088-3; or Math 1300-5, or higher.

We assume that the students have completed the equivalent of the following textbook: Mizrahi, Abe, and M. Sullivan, Mathematics for Business and Social Sciences, An Applied Approach, 4th ed., John Wiley and Sons. This book is generally used in Math 1050-1 to Math 1100.


OBJECTIVES: The purpose of this course is to provide a comprehensive exposition of basic mathematical instruments that are commonly used in all fields in economics - microeconomics, macroeconomics, econometrics, international trade and finance, public finance, money and banking, resource and environmental economics, urban and regional economics, labor and human resources, and industrial organization. Methods of Static Analysis, Comparative Static Analysis, Optimization will be introduced. Major emphasis is on illustrating how these tools can be used to analyze theoretical and practical economic problems which arise in the behaviors of households, firms, and markets. To assure homogeneity of the student background, the prerequisites of this course will be enforced.

The last lecture of the week may be devoted to problem solving exercises and quizzes. Students are required to attend all lectures. They are expected to read the assigned reading materials on chapters prior to the lecture and complete their homework assignments on time.

HOMEWORK and QUIZ: Exercises from chapters will be announced in the classes. Each homework assignment will be graded on a 10-point scale. Credit will be given only to the homework that is handed-in before or on the due date and time. Occasionally, an exercise or quiz will be given in the class. The quiz will be graded on the basis of 10 points.

Self-help problems are solved at the end of the text. Homework will be assigned when a chapter or a section is completed. Students are responsible for checking their homework answers with the answers in the text and the Instructor's Manual reserved in the library. Generally, we devote the first 5-10 minutes of each class to answer the homework questions.
EXAMS: The two mid-term exams will mainly be based on the class notes, textbook examples, and homework questions. The final exam will be comprehensive. Some questions in the final will test your ability of applying what you have learned in the class. They may combine several homework questions or textbook examples, or their variation, in large comprehensive questions. Thus, in addition to reviewing the class notes, homework, and examples, you are encouraged to be imaginative and innovative. Two copies of a previous final exam will be reserved in the Norlin Library. Please acquaint yourselves with them.

SEMESTER GRADES: The semester grade will consist of 3 parts - Exam scores (40% for two mid-term exams, 40% for the final), Homework scores (15%), and quizzes (5%). Probable cutoff points are in the vicinity of 90% (A), 80% (B), 70% (C), 60% (D), and some curving may be used.

Please KEEP the returned quizzes and homework assignments until the end of the semester. Check the grades of your mid-term exams and homework with the instructor during the last week of the semester. This will ensure that your semester work is properly credited.

NOTES:
1. Please attend the classes regularly, I expect every student to participate in all classes. Please make every attempt to attend the last four weeks of classes, otherwise, a surprise may be in store for you in the final.

2. Please prepare for the tests long before the test dates.

3. If you are going to miss or have missed the final exam, hand in an explanatory statement and documentation to the instructor. No credits will be given to unexcused absences in examinations.

4. Please come (or call) to talk with the instructor about any problems related to this course.

5. If you come to ask questions, please be well prepared for the questions you want to ask. Don’t come to the office looking for questions all over the book or your notes, wasting valuable time.

The following Examination Rules will be strictly enforced.

1. Spread the chairs - you should not be too close to each other.

2. Put books in front under the blackboard, out of reach.

3. Use only the sheets of paper distributed to you in class. Do not use your own paper for tests and calculations.

4. Calculators may be used but not required.

5. Write the answers in the designated place only, clearly and legibly.

6. Hand in all of the test papers and materials you have used in the test. Write "scrap" at the upper right corner of the paper if it does not contain your answers.

7. Students are not allowed to leave the classroom during the test. Please go to the washroom before the test starts.
## COURSE OUTLINE

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<tr>
<th>Date</th>
<th>Chapter</th>
<th>Topic (Workbook Chapter)</th>
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<tbody>
<tr>
<td>1/15/02</td>
<td>Ch. 1</td>
<td>The Mathematical Framework of Economic Analysis</td>
</tr>
<tr>
<td>1/22/02</td>
<td>Ch. 2</td>
<td>An Introduction to Functions</td>
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<tr>
<td>1/29/02</td>
<td>Ch. 3</td>
<td>Exponential and Logarithmic Functions</td>
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<tr>
<td>2/5/02</td>
<td>Ch. 3</td>
<td>Exponential and Logarithmic Functions</td>
</tr>
<tr>
<td>2/12/02</td>
<td>Ch. 4</td>
<td>Systems of Equations and Matrix Algebra</td>
</tr>
<tr>
<td>2/19/02</td>
<td>Ch. 5</td>
<td>Further Topics in Matrix Algebra</td>
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<tr>
<td>2/21/02 (R)</td>
<td>Chapters 1-5 - 100 points (20%)</td>
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<tr>
<td>2/26/02</td>
<td>Ch. 6</td>
<td>An Introduction to Differential Calculus</td>
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<tr>
<td>3/5/02</td>
<td>Ch. 7</td>
<td>Univariate Calculus</td>
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<td>3/12/02</td>
<td>Ch. 8</td>
<td>Multivariate Calculus</td>
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<tr>
<td>3/19/02</td>
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<td>4/2/02</td>
<td>Ch. 9</td>
<td>Extreme Values of Univariate Functions</td>
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<td>4/4/02 (R)</td>
<td>Chapters 6-8 - 100 points (20%)</td>
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<tr>
<td>4/9/02</td>
<td>Ch. 10</td>
<td>Extreme Values of Multivariate Functions</td>
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<tr>
<td>4/16/02</td>
<td>Ch. 10</td>
<td>Extreme Values of Multivariate Functions</td>
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<tr>
<td>4/23/02</td>
<td>Ch. 11</td>
<td>Constrained Optimization</td>
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<td>4/30/02</td>
<td>Ch. 11</td>
<td>Constrained Optimization</td>
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<tr>
<td>5/6/02 (M)</td>
<td>Chapters 1-12 (comprehensive) - 100 points (40%)</td>
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Check your final exam schedule during the first week of the semester. If you are concerned about the possibility of taking three or more final exams on the same day, please make any desired schedule adjustment during the drop-add period.
References for ECON 4808

The following references are available in Norlin Library:

Allen, R.G.D., *Mathematical Analysis for Economists*, St. Martins Press, 1938. Paperback edition available. This is a classic work with which every economist, whether or not he is interested in Mathematical Economics, must be acquainted. A must for graduate students.


Weber, J. E., *Mathematical Analysis - Business and Economics*


There are many other textbooks on mathematics for economists. Most of them are survey type with more emphasis in techniques than economic applications. The following texts emphasize applications.

**Textbooks on Micro and Macroeconomics which use more Mathematics**


Demburg, T.F. and J.D. Demburg, (1969) *Macroeconomic Analysis, An Introduction to Comparative Statistics and Dynamics*, Addison-Wesley. For the first year graduate student.

**Textbooks on Calculus Recommended**

Apostol, T.M., (1962, 67) *Calculus, I, II*, Braisdel. (An introductory to intermediate text, good examples.)

Review for the Final

Please note: Not all topics in the book are covered in the class. Check the lecture notes for the materials we have covered. Review all the homework questions.

The final examination is comprehensive. Read the previous two reviews. Try to follow the step-by-step methods explained in the class.

Chapter 7. Univariate Calculus
Make sure you know the rules of differentiation, especially the quotient rule and the chain rule.

Definition and concept of elasticities in pp. 183-185.

The definition of concave and convex functions in pp. 194-198.

Chapter 8. Multivariate Calculus
Young’s Theorem in p. 218, derivatives of the Cobb-Douglas production function in pp. 218-220.

Total differentials and implicit differentiation in pp. 237-240, 242-244.
(Slopes of isoquants and indifferent curves, MRTS and MRS, Law of Diminishing Returns)

Chapter 9. Extreme Values of Univariate Functions
The first order condition, pp. 253-259.
The second order condition, pp. 260-263, 267-269.

Chapter 10. Extreme Values of Multivariate Functions
We only cover the case of two independent variables.
The first order condition, pp. 282-285.
The second order condition, pp. 296-296.
(use Hessian determinants, Leading Principle Minors)

Chapter 11. Constrained Optimization
The first order condition, pp. 312-315, 317-318, 320-321.
(the Lagrange function and multiplier)
The second order condition 327-330
(Bordered Hessian)