B.E. International Program

Faculty of Economics, Thammasat University

Course Outline

EE 422 Mathematical Economics 2

Semester 1/2013 (August 13 – November 30, 2013)

Number of credits: 3 credits

Lecture Time: Tuesdays and Thursdays : 11.00 AM - 12:30 PM
Lecture Venue: 203, 2nd floor, Faculty of Economics
Thammasat University, Tha Prachan campus

Instructor: Assoc. Prof. Chaiyuth Punyasavatsut
Office : Room 7, 4th floor, 60th anniversary building
Tel : 02-6132466; 081-4001544
E-mail : chaiyuth@econ.tu.ac.th
Office hours : Tuesday 14.00-15.00 or by appointment

Prerequisite: *EE421 and having completed or currently taking EE312*

Course Description: The application of mathematical tools including integral calculus, differential equations, difference equations, phase diagram and dynamic optimization such as optimal control theory and dynamic programming for explaining dynamic economic phenomena as well as for locating time path and stability of variables in the context of both microeconomics and macroeconomics.

Textbooks

1. Sydsaeter, Knut et al. (2005). *Further Mathematics for Economic Analysis*, Prentice Hall. [SYD]
2. Simon, Carl P., and Blume, L. (1994). *Mathematics for Economists*. W.W. Norton & Company Inc, New York. [SB]
3. Chiang, A. and Wainwright, K. (2005). *Fundamental Methods of Mathematical Economics*, 4th international edition, McGraw-Hill. [CW]

Recommended Texts

4. Chiang, Alpha E. (1992). *Elements of Dynamic Optimization*. McGraw-Hill Inc. Singapore.
5. Dixit, A.K. (1990). *Optimization in Economic Theory*, Oxford University Press. 2nd ed.
6. Leonard, D. and Long, N.V. (1992). *Optimal Control Theory and Static Optimization in Economics*, Cambridge University Press.
7. Kamien, M.I. and Schwartz, N.L. (1981) *Dynamic Optimization: The Calculus of Variation and Optimal Control in Economics and Management*, North-Holland.

Course Evaluation

Homework	30%	
Mid-term exam	30%	(October 1, 2013 ; 11.00 AM – 12.30 PM)
Final exam	40%	(December 13, 2013 ; 9.00 AM – noon)

Course Content

1) **Preliminary Mathematics**

1.1 Convex Sets, Closed Sets, Bounded Sets and Compact Sets
1.2 Level Sets
1.3 Concave and Convex Functions
1.4 Quasiconcave and Quasiconvex Functions
1.5 Homogenous Functions and Euler's Theorems
1.6 Taylor's Formula
1.7 Transformations or mapping, differentiability and derivatives
1.8 Implicit function theorems
[Read: SYD, chapter 2 (skip 2.9 and 2.10); other equivalent texts]

2) **Static Constrained Optimization: A Review**

2.1 Extreme Points
2.2 Local Extreme Points
2.3 Equality Constraints: The Lagrange's Method
2.4 Local Second-order Conditions
2.5 Inequality Constraints: Nonlinear Programming and Kuhn-Tucker conditions
2.6 Constraint Qualifications
2.7 Nonnegativity Constraint
2.8 Maximum Value Functions and Envelop Theorem
[Read: SYD, Chapter 3; CW chapters 12-13]

3) Topics in Integration

3.1 Review of one-variable integration
3.2 Leibniz's formula
3.3 The Gamma function
3.4 Multiple integrals over product domains
[Read SYD, chapter 4, skip 4.5-4.8]

4) **Differential Equations 1: First-order Equations in one Variable**

4.1 Introduction
4.2 Find the Path
4.3 Separable Equations
4.4 First-order Linear Equations
4.5 Exact Equations and Integrating Factors
4.6 Transformation of Variables
4.7 Qualitative Theory and Stability
4.8 Existence and Uniqueness
[Read SYD chapter 5; CW chapter 15; also review basic integral calculus]

********** Midterm exam about here **********

5) **Differential Equations 2: Second-order Equations and Systems in the Plane**

5.1 Introduction
5.2 Linear Differential equations
5.3 Constant coefficients
5.4 Stability for linear equations
5.5 Simultaneous Equations in the plane
5.6 Equilibrium points for linear systems
5.7 Phase Plane analysis
5.8 Stability for nonlinear systems
5.9 Saddle points
[Read SYD chapter 6; C&W chapter 16]

6) **Optimal Control Theory: Basic Techniques**

6.1 Basic Problem
6.2 A simple Case
6.3 Regularity Conditions
6.4 The Standard Problem
6.5 The Maximum Principle
6.6 Adjoint Variables as Shadow Prices
6.7 Sufficient Conditions
6.8 Variable Final Time
6.9 Current Value Formulation
6.10 Infinite Horizon
6.11 Phase Diagrams
[Read: SYD Chapter 9; C&W chapter 20]

7) Difference Equations

7.1 First-order difference equations
7.2 Present discount values
7.3 Second-order difference equations
7.4 Constant coefficients
7.5 Higher-order equations
7.6 Systems of difference equations
7.7 Stability of Nonlinear difference equations

8) **Discrete Time Optimization: Dynamic Programming**

8.1 Dynamic Programming
8.2 The Euler Equation
8.3 Infinite Horizon
8.4 The Maximum Principle
8.5 Infinite Horizon Stationary Problem

[Read SYD chapter 12, skip 12.5-12.7; Sargent (1987) Dynamic Macroeconomic Theory; or class handouts]

********** Final exam **********

Important Dates

Class begins	August 13, 2013
Adding and Dropping Course	August 13 – 27, 2013
Midterm Exam	**October 1, 2013 ; 11.00 AM – 12.30 PM**
Course Withdrawal with "W"	October 16 – 21, 2013
Last day of classes	November 30, 2013
Final Exam	**December 13, 2013 ; 9.00 AM – noon**