Forman Christian College University

By Love Serve One Another

Department of Economics
Course Outline
<u>ECON 315: ADVANCE MATHEMATICAL ECONOMISTS (3 Cr. Hrs.)</u>

Azma Batool
Assistant Professor, Room No. E-218

Second ^{Floor}, Elahi Block, Forman Christian College (A Chartered University), Lahore.
Email: azmabatool@fccollege.edu.pk

Contact Hours: **Tuesday, Thursday: 3:30 pm to 4: 45 pm**

Class-Room: **E-204**

Office Hrs.:   **Tuesday & Thursday 12.30 pm –2:30 pm**

Course Philosophy

This course along with Econ-103 should provide you with the basic ability to handle economic theory in mathematical language. Such ability is essential for further studies in economics - particularly for graduate economic theory courses and courses in Econometrics - and for understanding articles in economic journals.

We shall assume a background equivalent to material covered in Econ-103 and develop further mathematical theory needed for important applications in micro and macro economics. This advanced course in mathematical economics focuses on a complete discussion of topics on the frontier of economic research. It is designed for students who intent on learning several advanced mathematical tools that have become necessary for a proper understanding of advanced Micro and Macroeconomic modeling. Accordingly, it presents a thorough easily understood introduction to differential and integral calculus, linear programming, and difference equations with applications to the economic problems.

The course begins with the discussion of dynamic optimization followed by integral calculus and differential equations, difference equations and optimal control theory. Linear programming shall also be discussed along with the applications to economics. The course should be useful for the students who are already trained in basic mathematics for economics; both micro and macro, but still need advanced training to handle relatively higher-level economic modeling.

 This list is only a *suggested* one since actual coverage will depend on the background of the students in the class and the speed with which we can all move together

Course Objective

- Demonstrate better understanding of economic concepts using advanced mathematical techniques required for higher level courses in economic theory and econometrics

- Enable students to gain effective problem-solving skills and apply economic theory to real life problems
- Help students perform quantitative research skills to critically analyses economic ideas

Learning Outcomes
1. The students must be able to understand and comprehend advanced optimization techniques and interpretation of second order conditions using Hessian. The concept of homogeneous, homothetic and Euler's theorem will be discussed with the help of Cob-Douglas functional form.
2. The student should also be familiar with the integral calculus; the rules of integration, properties of indefinite and definite integrals, improper integrals, and their applications to economic problems such as consumer and producer surplus.
3. Students are also expected to solve the differential equations as well as difference equations and should be able to understand economic models involving the use of such equations by the end of the course.
4. The students are also expected to know the use of linear programming techniques in economics.
5. Course participants should also be familiar with the basics of optimal control theory and its application to certain macroeconomic models such as Ramsey model etc.

Expectations from Students
- Students are expected to attend classes regularly. Attendance shall not be marked in case of late comers.
- The students must attend at least 80% of the classes to qualify for the final exam.
- No late assignments shall be accepted, and no exam or quiz shall be retaken under any circumstances in case a student misses it.
- **Students must turn their cell phones off at the beginning of each class.**
- Students are expected to behave and maintain discipline in class. Collusion between students during exams shall not be tolerated. Copying cases shall get a zero score in the exam or quiz under consideration. Instructor is expected to conduct regular office hours for the students. Students are always welcome to walk in the office during those hours if they need extra help.

One word of advice.
A quantitative course like this one needs your constant attention. It is very important that you keep up with the discussion in class. This is not a course in which you can neglect it for a while and then catch up later. If you miss one class, you may gradually fall behind and not be able to catch up.

Course contents, Learning material and Activities schedule:

Week	Contents.	Learning Material & Activities
1.1	Introduction, optimization with one constraint and	Alpha C. Chiang

	comparative static analysis	
1.2	Homogenous and Homothetic function, linearly homogenous function, and Euler's theorem	Alpha C. Chiang
2.1	Cob Douglas function and application of linear homogeneity	Alpha C. Chiang
2.2	Practice questions	Alpha C. Chiang
3.1	Linear Programming: Introduction, Graphical approach to simple LP problems	Taha
3.2	Linear Programming: Simplex method Algorithm	Taha
4.1	general LP problem, introduction to duality theorem, general economic interpretation, complementary slackness	Taha
4.2	More Practice questions -linear programming	Taha
5.1	Dynamics Analysis and Integrals, Indefinite integral, Rules of Integration	Alpha, C. Chiang Hand outs
5.2	Definite Integrals. Definite Integrals and Area, Indefinite Integrals	Alpha, C. Chiang Hand outs
6.1	Application 1: Integrals and Marginal function from total function	Alpha, C. Chiang Hand outs
6.2	Application 2: Domar Model of Growth	Alpha, C. Chiang Hand outs
7.1	Discrete Time, First order difference equation, Discrete Time, Differences and Difference equation. Solving First order Difference equation	Gondalfo and Chiang
7.2	The Dynamic Stability of Equilibrium	Gondalfo and Chiang
8.1	The Cobweb Model	Gondalfo and Chiang
8.2	Higher Order Difference Equation, And complementary solution, Time Path Convergence	Gondalfo and Chiang
9.1	Samuelson Multiplier-Acceleration Model	Gondalfo and Chiang
9.2	Inflation and Unemployment in Discrete Time	Gondalfo and Chiang
10.1	First order differential equations with constant coefficient and constant term: homogenous and non-	Gondalfo and Chiang

	homogeneous solution	
10.2	Application 1: The Cobweb Theorem- A revisit	Gondalfo and Chiang
11.1	Application 2: Solow Growth Model	Gondalfo and Chiang
11.2	A qualitative- Graphical Approach: Phase Diagram	Gondalfo and Chiang
12.1	Second Order Linear differential equation with constant coefficient and constant term	Gondalfo and Chiang
12.2	Analysis of complex –Root case, The time Path, Dynamic stability of equilibrium	Gondalfo and Chiang
13.1	Application: Philips Stabilization Model	Gondalfo and Chiang
13.2	Some more practice with differential equation modeling	Gondalfo and Chiang
14.1	The nature of optimal control, simple macroeconomic model, the Hamiltonian and the necessary conditions for maximization in optimal control theory,	Gondalfo and Chiang
14.2	fixed terminal point, horizontal terminal line, lifetime utility maximization,	Gondalfo and Chiang
15	Review and Final-Term	GOOD LUCK

Study Materials

B1: Alpha C. Chiang and Kevin Wainwright, *Fundamental Methods of Mathematical Economics*, McGraw-Hill Higher Education, 4th Ed., 2005. ISBN: 0071238239.

B2: Giancarlo Gondalfo, *Economic Dynamics,* 2nd Ed, 1998.ISBN:3-540-62760.

B3: Hamdy A. Taha - Operations Research An Introduction, Eighth Edition (2006).pdf

Handouts

Some of the excellent web resources for this course are:
http://www.mathwarehouse.com/
http://mathforum.org/
http://www.purplemath.com/

Out-of-class Study
You will be given weekly problem sets/assignments which are an essential part of the course in addition to in-class activities (i.e., quizzes and practice problems). The problem sets/assignments will be marked so you must submit your work on the prescribed dates. We will discuss the answers in class, and you will be expected to participate in the discussion. Since the problems on the exams will be similar in character to the assigned problems, your serious effort on the problem sets/assignments is a necessary condition for good performance on the exams.

Learning Strategy
While students may have preferred individual learning strategies, it is important to note that most learning will be achieved outside of class time. Lectures can only provide a structure to assist your study, and practice time is limited. An "ideal" strategy (on which the provision of the course materials is based) might include:
Reading of the relevant chapter(s) of the text and any readings before the lecture. This will give you a general idea of the topic area.
Attendance at lectures. Here the context of the topic in the course and the important elements of the topic are identified. The relevance of the topic should be explained.

Course Assessment and Grade Determination

The entire course is worth of 100%, breakup for which is as under:
Problem sets/assignments: 10%
Announced Quizzes: 10%
Class Participation   10%
Midterm exam: 30%
Final term exam: 40%
The mid-term and final-term exams will consist of short questions and long questions, and there will be no multiple-choice type questions.

Letter Grade	GPA	%Age	Letter Grade	GPA	%Age
A	4.0	93% - 100%	A-	3.7	90% - 92%
B+	3.3	87% - 89%	B	3.0	83% - 86%
B-	2.7	80% - 82%	C+	2.3	77% - 79%
C	2.0	73% - 76%	C-	1.7	70% - 72%
D+	1.3	67% - 69%	D	1.0	60% - 66%
F	0.0	Bellow 60%	NS	No show	

Student's Conduct and Other Issues

Turn off your cell phone(s) before entering the classroom either for lecture or for exam.
Questions and comments are encouraged; your questions will not only help yourself, but others as well. So be quick to ask questions and participate in class discussion actively.

I want everyone to feel welcome in the class; therefore, no disparaging remarks will be tolerated regarding ethnic background, sex, sexual preference, age, religion, disability, socioeconomic background, educational background, etc. In addition, you should follow all university guidelines established in your student handbook. Any student can be removed from the class where behavior is deemed inappropriate or disruptive.

You are expected to be at each class. In case of absence, you are responsible for the announcements made and material given during that missed classis. **Minimum class attendance to participate in final examination is 80%.**

All of us occasionally have problems getting places on time. However, regularly coming to class late leaving early is disruptive and shows a lack of respect for the rest of us. If you think you will be late on a regular basis, drop the course and take it at a different time.

I will regularly assign homework problems from the text or other sources. I will also give occasional quizzes in class for you to check your progress. The problem sets/assignments will be submitted on due date, no late submission. There will be no makeup quiz or examinations, therefore, do not miss any exam or quiz.

Students can learn more from each other; therefore, you are encouraged to work together on problem sets/assignments outside the class if problem sets/assignments do not look like identical copies.

Plagiarism and cheating are a most serious breach of academic integrity (see your students manual for detail). Any student found responsible for dishonest practice (for example, copying, use of unauthorized material in exam, etc.) in relation to any piece of work submitted for assessment shall be subject to the FCC's dishonest practice regulations which may result in various penalties, including forfeiture of marks for the piece of work submitted, an F grade for the paper, or in extreme cases exclusion from the University. I also expect that you will fully respect the Core Values, follow the university dress policy (dress code), and always enter in the class with visible ID Card.

I hope that you will put your entire efforts to learn this course, attend classes, read the textbook(s)/other assigned reading material, and do the homework/problem sets/assignments in stipulated time.