ECONOMICS 741: ADVANCED MATHEMATICAL ECONOMICS
Fall 2021
TR 12:30pm – 1:45pm
2210 MHRA Building

INSTRUCTOR: Professor Dora Gicheva
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Office Hours: Thursday 10am – 12pm or by appointment (virtual by request)

COURSE DESCRIPTION: This course is designed to provide the mathematical foundations necessary for the study of advanced economic theory. The material for the course includes sets and functions, constrained and unconstrained optimization, and intertemporal optimization.

PREREQUISITE: ECO 642 or equivalent

COURSE MATERIALS: Mathematics for Economists by Carl Simon and Lawrence Blume and Dynamic Economics: Quantitative Methods and Applications by Jerome Adda and Russell Cooper. An electronic version of the latter is available through the UNCG library: https://ebookcentral-proquest-com.libproxy.uncg.edu/lib/uncg/detail.action?docID=3338811

I will also use Microeconomic Theory by Mas-Colell, Whinston and Green. There will be additional readings from other textbooks and journal articles. I will make such readings available to you.

I will usually post brief lecture notes on the UNCG Canvas website prior to lecture. You should print them out and go over them before class. Bringing them to class will make it easier for you to take notes.

The required software for this class is MATLAB®. There are several ways to access and use MATLAB:
1. You can purchase a copy of MATLAB to use on your personal computer. The price of the basic student version is $49. We will use the following add-ons:
   - Optimization Toolbox
   - Symbolic Math Toolbox
   http://www.mathworks.com/academia/student_version/
   There is a discount if you purchase add-ons at the same time as the MATLAB software.
2. You can use MATLAB in the computer labs on campus.
3. You can access MATLAB remotely through UNCG MyCloud (https://mycloud.uncg.edu/vpn/index.html). Log on using your UNCG username and password.

COURSE OBJECTIVES: By the end of this course students should have the mathematical background necessary to complete a graduate-level sequence in microeconomic theory. Students will learn about the following:

- Properties of sets; open and closed sets
- Functions of several variables; differentiation of multivariate functions
- Implicit functions
- Definite matrices
- Constrained and unconstrained optimization; Kuhn-Tucker conditions
- Homogeneity and homotheticity
- Concave and quasiconcave functions
- Eigenvalues and eigenvectors
- Preference relations and utility functions
- Bellman equations
- Intertemporal optimization with uncertainty
- Search models

GRADES: Grades will be based on the following components:

Homework	20%
Exams	35% each
Presentations	10%

Homework: I will usually assign problem sets weekly, although I will occasionally skip a week and assign a longer problem set the following week. Most problem sets will have a programming component, which should be completed using MATLAB®. You should turn in a printout of your (well-documented and clearly written) program, as well as a <u>concise</u> printout of the output.

You can work on the homework assignments in groups but you have to write up your own solutions. All homework is due at the beginning of class; no late homework will be accepted.

Exams: There will be two in-class exams. The second exam will be given on the last day of class (November 30) and is <u>not cumulative</u>. The two exams will contribute equal weights toward your semester grade. I will provide more information about the exams in class.

Presentations: Presentations will take place during the final exam period. I will provide more details in class.

1. Notation and definitions
    a. Sets, numbers and proofs (SB Appendix 1)
2. Review of matrix and vector algebra (SB 8 – 11)
3. Limits and open sets (SB 12, MWG M.F)
4. Functions of several variables (SB 13)
5. Calculus of several variables (SB 14, MWG M.A)
6. Implicit functions and their derivatives (SB 15, MWG M.E)
7. Positive and negative (semi-)definite matrices (SB 16, MWG M.D)
8. Unconstrained optimization (SB 17, MWG M.J)
9. Constrained optimization (SB 18, 19; MWG M.K, M.L)

First Exam

10. Homogeneous and homothetic functions (SB 20, MWG M.B)
11. Concave and quasi-concave functions (SB 21, MWG M.C)
12. Preference Relations (MWG 1.B, 3.A – 3.C)
13. Utility Maximization (MWG 3D)
14. Dynamic programming: general formulation (AC p.24-31 and 147-150; MWG M.N)
15. Optimal stopping (AC p.22-24, 175-179, 205-209)
16. Search models (AC p.257-262)

Second Exam: November 30

SB – Simon and Blume;
MWG – Mas-Colell, Whinston and Green;
AC – Adda and Cooper

ACADEMIC INTEGRITY POLICY: By submitting an assignment, each student is acknowledging their understanding and commitment to the Academic Integrity Policy on all major work for the course. Refer to the following URL: https://osrr.uncg.edu/academic-integrity/.

ACCOMMODATIONS: UNCG seeks to comply fully with the Americans with Disabilities Act (ADA). Students requesting accommodations based on a disability must connect with the Office of Accessibility Resources and Services (OARS) in 215 Elliott University Center, (336)334-5440, oars.uncg.edu.

Students may request accommodations for religious holidays under applicable laws. See https://catalog.uncg.edu/academic-regulations-policies/university-policies for more information.

Students should remind the instructor in advance when accommodation affects course activities, e.g., before taking exams, to ensure that the instructor has updated systems accordingly.

HEALTH AND WELLNESS: Your health impacts your learning. Throughout your time in college, you may experience a range of health issues that can cause barriers to your learning. These might include physical ailments, illnesses, strained relationships, anxiety, high levels of stress, alcohol/drug problems, feeling down, or loss of motivation. Student Health Services and The Counseling Center can help with these or other issues you may be experiencing. You can learn about the free, confidential mental health services available on campus by calling 336-334-5874, visiting the website at https://shs.uncg.edu/ or visiting the Anna M. Gove Student Health Center at 107 Gray Drive. Help is always available.

FACULTY AND STUDENT GUIDELINES can be found at https://bryan.uncg.edu/wp-content/uploads/2017/08/Faculty-and-Student-Guidelines-2018-2019.pdf. Please read them carefully in order to understand the roles and responsibilities of both students and faculty.

COMMUNICATION AND COURSE TECHNICAL GUIDELINES:
Technical support: Students with technical issues with the course and email should contact 6TECH for support either by email or phone or chat (https://its.uncg.edu/Help/6TECH/). Please also make your instructor aware of the issue, and if there will be any delays in resolving the issue.

BEHAVIORS THAT LIMIT THE SPREAD OF COVID-19
As we return for fall 2021, the campus community must recognize and address continuing concerns about physical and emotional safety, especially as we will have many more students, faculty, and staff on campus than in the last academic year. As such, all students, faculty, and staff are required to uphold UNCG's culture of care by actively engaging in behaviors that limit the spread of COVID-19. Such actions include, but are not limited to, the following:

- Following face-covering guidelines
- Engaging in proper hand-washing hygiene when possible
- Self-monitoring for symptoms of COVID-19
- Staying home if you are ill

● Complying with directions from health care providers or public health officials to quarantine or isolate if ill or exposed to someone who is ill.

Instructors will have seating charts for their classes. These are important for facilitating contact tracing should there be a confirmed case of COVID-19. Students must sit in their assigned seats at every class meeting and must not move furniture. Students should not eat or drink during class time.

To make it easier for students to hear their instructor and/or read lips and if conditions permit, instructors who are fully vaccinated and who can maintain at least six feet of distance from students may remove their masks while actively teaching if they choose, but will wear a mask at all other times while in the classroom, including during the periods before and after class

A limited number of disposable masks will be available in classrooms for students who have forgotten theirs. Face coverings will also be available for purchase in the UNCG Campus Bookstore. Students who do not follow masking requirements will be asked to put on a face covering or leave the classroom to retrieve one and only return when they follow the basic requirements to uphold standards of safety and care for the UNCG community. Once students have a face covering, they are permitted to re-enter a class already in progress. Repeated issues may result in conduct action. The course policies regarding attendance and academics remain in effect for partial or full absence from class due to lack of adherence with face covering and other requirements.

For instances where the Office of Accessibility Resources and Services (OARS) has granted accommodations regarding wearing face coverings, students should contact their instructors to develop appropriate alternatives to class participation and/or activities as needed. Instructors or the student may also contact OARS (336.334.5440) who, in consultation with Student Health Services, will review requests for accommodations.