

Economics 4775/7775

**Dynamic Optimization and Its Applications to the Natural Sciences and Economics
Spring 2018**

Instructors: Dr. X. H. Wang, 125 Professional Building, 882-4954, wangx@missouri.edu.

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Dr. Wang's Office Hours: 1pm – 3pm Tuesdays, or by appointment

Course Description:

The first part of this class will start with a brief review of static optimization, then provide a quick introduction to ordinary differential equations, difference equations, and their applications in economics. Topics include first-order differential (difference) equations, higher-order differential (difference) equations, and systems of differential (difference) equations.

Then the course will use these tools to study dynamic optimization. We will first develop the calculus of variations by doing a series of applications. Next we will develop optimal control theory, which is, basically, just a generalized form of the simpler calculus of variations. We will then develop stochastic generalizations of optimal control theory and the basics of robust control and give applications. The level of rigor of the mathematical presentation will be geared to the mathematical level of the students in the class.

Applications will include ecology, economics, finance, climate science, and others depending upon the interests of the class.

Prerequisite is Economics 4370/7370 (Quantitative Economics) or equivalent, or instructor's consent.

Grading: Class participation and homework sets (50%), midterm test (25%), take-home final exam (25%). Problem-solving will be emphasized. Plus/minus grades will be used.

Major Topics (All materials will be provided)

Economic Dynamics

Differential Equations

Systems of Differential Equations

Difference Equations

Calculus of Variations (with Applications)

Optimal Control (with Applications)

Applications to Economics, Climate Science, Ecology, and Other Areas of Natural Science

Student References:

Chiang & Wainwright, **Fundamental Methods of Mathematical Economics**, 2005.

Simon & Blume, **Mathematics for Economists**, 1994.

Boileau, Martin, **Econ 7020: A child's guide to optimal control theory**
<http://www.colorado.edu/Economics/courses/boileau/7020/Cgoptcon.PDF>.

Evans, Lawrence C., **An Introduction to Mathematical Optimal Control Theory**
<http://math.berkeley.edu/~evans/control.course.pdf> (for very advanced students--not used in this class).

Kamien, Morton I. and Nancy L. Schwartz, **Dynamic Optimization: The Calculus of Variations and Optimal Control in Economics and Management**, North-Holland, Amsterdam, 1991.

Malliariis, A. G. and W. A. Brock, **Stochastic Methods in Economics and Finance**, 1982.

Dockner, E., S. Jorgensen, N. Van Long and G. Sorger, **Differential Games in Economics and Management Science**, 2000.

ACADEMIC INTEGRITY POLICY

Academic honesty is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor.

Academic Dishonesty includes but is not necessarily limited to the following:

- A. Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty.
- B. Plagiarism which includes but is not necessarily limited to submitting examinations, themes, reports, drawings, laboratory notes, or other material as one's own work when such work has been prepared by another person or copied from another person.
- C. Unauthorized possession of examinations or reserve library materials, or laboratory materials or experiments, or any other similar actions.
- D. Unauthorized changing of grades or markings on an examination or in an instructor's grade book or such change of any grade report.

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ADA STATEMENT (FROM OFFICE OF THE PROVOST)

If you anticipate barriers related to the format or requirements of this course, if you have emergency medical information to share with me, or if you need to make arrangements in case the building must be evacuated, please let me know as soon as possible.

If disability related accommodations are necessary (for example, a note taker, extended time on exams, captioning), please register with the *Disability Center* (<http://disabilitycenter.missouri.edu>), S5 Memorial Union, 573- 882-4696, and then notify me of your eligibility for reasonable accommodations. For other MU resources for persons with disabilities, click on "Disability Resources" on the MU homepage.

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Audio/Video Recording

University of Missouri System Executive Order No. 38 lays out principles regarding the sanctity of classroom discussions at the university. The policy is described fully in Section 200.015 of the Collected Rules and Regulations. In this class, students may not make audio or video recordings of course activity, except students permitted to record as an accommodation under Section 240.040 of the Collected Rules. All other students who record and/or distribute audio or video recordings of class activity are subject to discipline in accordance with provisions of Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

Those students who are permitted to record are not permitted to redistribute audio or video recordings of statements or comments from the course to individuals who are not students in the course without the express permission of the faculty member and of any students who are recorded. Students found to have violated this policy are subject to discipline in accordance with provisions of Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

INTELLECTUAL PLURALISM STATEMENT (FROM OFFICE OF THE PROVOST)

The University community welcomes intellectual diversity and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair or Divisional leader or Director of the [Office of Students Rights and Responsibilities](http://osrr.missouri.edu/) (<http://osrr.missouri.edu/>). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.