GR06-002

UNIVERSITY OF KENTUCKY
APPLICATION FOR CHANGE IN EXISTING COURSE: MAJOR & MINOR

1. Submitted by College of Agriculture Date 03/07/2006

   Department/Division offering course Agricultural Economics

2. Changes proposed:
   (a) Present prefix & number 662 Proposed prefix & number 662

   (b) Present Title Quantitative Methods in Renewable Resource Management

   New Title Quantitative Methods in Renewable and Nonrenewable Resource Management

   (c) If course title is changed and exceeds 24 characters (Including spaces), include a sensible title (not to exceed 24 characters) for use on transcripts: Quant Meth Res Mgmt

   (d) Present credits: 3 Proposed credits: 3

   (e) Current lecture: laboratory ratio 1:1 Proposed: 1:1

   (f) Effective Date of Change: (Semester & Year) Spring 2007

3. To be Cross-listed as: _____ _____
   Prefix and Number Signature: Department Chair

4. Proposed change in Bulletin description:
   (a) Present description (including prerequisite(s):

   Design and analysis of optimization models useful in agricultural economics. Includes survey of applications in mathematical programming. CPM-PERT, Markov processes, and Game theory. Case examples are used to demonstrate applicability and problem formulation in management of industrial and public forests. Prereq: MA 113 and MA 162 or equivalent, and AEC 445G or equivalent. (Same as FOR 662).

   (b) New description:

   Application of dynamic optimization methods to renewable and nonrenewable resource management. Includes problem formulation, mathematical problem solving, Matlab programming, simulations and optimal policies analysis. Case examples are used to demonstrate applicability and problem formulation in finance and general and partial equilibrium. Prereq: MA 113 and MA162 or equivalent, and AEC 661 or equivalent.

   (c) Prerequisite(s) for course as changed: Prereq: MA 113 and MA 162 or equivalent, and AEC 661 or equivalent.

5. What has prompted this proposal?

   New developments in dynamic optimization models and the use of quantitative methods.

6. If there are to be significant changes in the content or teaching objectives of this course, indicate changes:

   Students will be trained to program in Matlab and to use the newest techniques in quantitative methods and dynamic optimization.

7. What other departments could be affected by the proposed change?

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8. Is this course applicable to the requirements for at least one degree or certificate at the University of Kentucky? ☒ Yes ☐ No

9. Will changing this course change the degree requirements in one or more programs?* ☐ Yes ☒ No
   If yes, please attach an explanation of the change.*

10. Is this course currently included in the University Studies Program? ☒ Yes ☐ No
    If yes, please attach correspondence indicating concurrence of the University Studies Committee.

11. If the course is a 100-200 level course, please submit evidence (e.g., correspondence) that the Community College System has been consulted.

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12. If the course is 400G or 500 level, include syllabi or course statement showing differentiation for undergraduate and graduate students in assignments, grading criteria, and grading scales. ☐ Check here if 400G-500.

12. Is this a minor change? ☐ Yes ☒ No
(NOTE: See the description on this form of what constitutes a minor change. Minor changes are sent directly from the Dean of the College to the Chair of the Senate Council. If the latter deems the change not to be minor, it will be sent to the appropriate Council for normal processing.)

13. Within the Department, who should be consulted for further information on the proposed course change?

Name: Helen Pushkarskaya Phone Extension: 257-8842

Signatures of Approval:

Department Chair	Date: 3-7-06
Dean of the College	Date: 11/30/06
	Date of Notice to the Faculty: 11/2/06
Graduate Council (Jeannine Blackwell) Digitally signed by Jeannine Blackwell DN: cn=Jeannine Blackwell, c=US, o=University of Kentucky, ou=Graduate School, email=jeannine.blackwell@uky.edu Date: 2007.02.23 13:23:35 -05'00'	Date
**Academic Council for the Medical Center	Date
**Senate Council	Date of Notice to University Senate

**If applicable, as provided by the Rules of the University Senate.

ACTION OTHER THAN APPROVAL

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The Minor Change route for courses is provided as a mechanism to make changes in existing courses and is limited to one or more of the following:

a. change in number within the same hundred series;
b. editorial change in description which does not imply change in content or emphasis;
c. editorial change in title which does not imply change in content or emphasis;
d. change in prerequisite which does not imply change in content or emphasis;
e. cross-listing of courses under conditions set forth in item 3.0;
f. correction of typographical errors. [University Senate Rules, Section III - 3.1]

Agricultural Economics 662

Quantitative Methods in Renewable and Nonrenewable Resource Management

Instructor:

Dr. Helen Pushkarskaya
Office Hours by Appointment
Office phone number: 247-8842
e-mail: helen.pushkarskaya@uky.edu

Lectures: Monday & Wednesday 1:00-1:50 PM in CEBA 246

Laboratory: Friday 1:00-1:50 PM in CEBA 246

Course Description: Application of dynamic optimization methods to renewable and nonrenewable resource management. Includes problem formulation, mathematical background, Matlab programming, simulations and optimal policies analysis. Case examples are used to demonstrate applicability and problem formulation in finance and general and partial equilibrium.

Prerequisites: MA 113 and MA 162 or equivalent, and AEC 661 or equivalent.

Course overview: The first part of the course covers basic aspects of numerical analysis, including solving nonlinear equations and optimization problems, numerical integration and differentiation, and solving functional equations (including differential equations). The second part of the course focuses on solving dynamic models of renewable and nonrenewable resource management, including dynamic programming problems, rational expectations and arbitrage-based asset pricing problems.

Learning Outcomes:

After completion of this class, the student will be able to:

1. model intertemporal dynamics in economics problems including but not limited to renewable and nonrenewable resources management,
2. design and analyze intertemporal policies,
3. use a wide variety of numerical methods to solve problems in economics that don't have closed form solutions solution, and
4. program in Matlab.

Textbooks:

Applied Computational Economics and Finance, by Mario J. Miranda and Paul W. Fackler, forthcoming, MIT Press, Cambridge MA, 2002.

Numerical Methods in Economics, by Kenneth L. Judd, MIT Press, Cambridge, MA, 1998.

Software:

MATLAB 6.1 (or higher). Accessible on the CEBA 246 computer laboratory computers and Agr. Econ Grad Students lab.

Coursework

Lectures (Mondays & Tuesdays): Lectures are designed to emphasize key concepts and to synthesize course materials, not to provide an exhaustive treatment of all topics comprising the course. Class participation is expected.

Laboratories (Fridays): Laboratory sessions are designed to instruct students on the use of computers to solve class assignments and to reinforce learning of topics covered in lecture and in readings. Attendance is expected.

Readings: Students are expected to master the material contained in Chapters 1-9 and the mathematical appendix of the Miranda & Fackler textbook, even if the material is not discussed in lectures.

Assignments: Students are expected to master the concepts and techniques covered in the regularly assigned problem sets. Problem sets will be due on Monday before the class. Late submissions will not be accepted.

Research proposal: Students are expected to prepare a proposal of a research project that uses the dynamic optimization method by the end of the semester.

Evaluation

Course Grading: Course grades will be assigned based on the following weights: class participation 10%, problem sets 30%, midterm examination 30%, and research proposal 30%.

Examinations: A written midterm examination will cover key concepts discussed in lecture and assigned readings. It is scheduled for Monday, March 7.

Grading Scale: Grades will be assigned as follows:

A = 90% B = 80% C = 70% E = < 70%

Academic Misconduct
Academic misconduct of any kind will not be tolerated. Faculty Rule 3335-5-54 will be followed in cases of suspected academic misconduct: "Each instructor shall report to the Committee on Academic Misconduct all instances of what he or she believes may be academic misconduct."

Students with Disabilities
Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs.

Outline

Week 1.

W. 01/11
Introduction
Some Apparently Simple Questions
An Alternative Analytic Framework (Chapter 1)

F. 01/13
Matlab getting started and mathematics demos
http://www.mathworks.com/academia/student_center/tutorials/
http://www.mathworks.com/access/helpdesk/help/pdf_doc/matlab/getstart.pdf (GSM-Ch. 1, 2)
Week 2

W. 01/18
Mathematical Background (Appendix A)
F. 01/20
Basic programming, Data and graphs demos (GSM – Ch. 3, 4)

Week 3

01/23-01/27 (Chapter 2)
Linear Equations and Computer Basics
L-U Factorization
Gaussian Elimination
Rounding Error and Pivoting
Ill Conditioning
Special Linear Equations
Iterative Methods *

Week 4

01/30-02/03 (Chapter 3)
Nonlinear Equations and Complementarity Problems
Bisection Method
Function Iteration
Newton's Method
Quasi-Newton Methods
Problems With Newton Methods
Choosing a Solution Method
Complementarity Problems

Week 5

02/06-02/10 (Chapter 4)
Finite-Dimensional Optimization
Univariate Optimization
Newton-Raphson Method
Quasi-Newton Methods
Line Search Methods Methods
Special Cases
Constrained Optimization

Week 6

02/13-02/17 (Chapter 5)
Numerical Integration and Differentiation
Newton-Cotes Methods
Gaussian Quadrature

Monte Carlo Integration
Quasi-Monte Carlo Integration
Numerical Differentiation
Initial Value Problems *

Week 7

02/20-02/24 (Chapter 6)
Function Approximation
Interpolation Principles
Polynomial Interpolation
Piecewise Polynomial Spline Interpolation
Piecewise Linear Spline Basis Functions *
Multidimensional Interpolation
Choosing an Approximation Method
The Collocation Method
Boundary Value Problems *

Week 8

02/27-03/3
Review, Catch up.

Week 9

03/6 Midterm

03/8 Optimization problems – applications -- overview

03/10 Class Projects – planning ahead

Spring Break

Week 10

03/20-03/24 (Chapter 7)

Discrete Time, Discrete State Dynamic Models: Theory
Discrete Dynamic Programming
Economic Examples
Solution Algorithms

Week 11

03/27-03/31 (Chapter 7)
Discrete Time, Discrete State Dynamic Models: Methods
Dynamic Simulation Analysis
Numerical Methods

Numerical Examples

Week 12

04/03-04/07 (Chapter 8)
Discrete Time, Continuous Space Dynamic Models: Theory
Continuous Space Dynamic Programming
Euler Conditions
Continuous State, Discrete Choice Models
Continuous State, Continuous Choice Models
Dynamic Games
Rational Expectations Models

Week 13

04/10-04/14 (Chapter 9)
Discrete Time, Continuous Space Dynamic Models: Methods
Linear Quadratic Control
Bellman Equation Collocation Methods
Implementation of Collocation Methods
Postoptimality Analysis
Discrete Choice Examples
Continuous Choice Examples
Dynamic Game Examples
Rational Expectations Examples

Week 14

04/19-04/21 (Chapter 10&11)
Continuous Time Models: Theory and Methods -- overview *

* We will cover these topics only if time allows.

Problem sets and due dates.

Set	Assignment	Due Date
1	Chapter 3, problems 7, 8, and 10	Monday, February 6
2	Chapter 5, problems 1, 3, 4, and 5	Monday, February 20
3	Chapter 6, problems 1, 2, 3 and 5	Monday, March 6
4	Chapter 8, problems 1, 2, 4, and 5	Monday, April 3
5	Chapter 9, problems 2, 3, 4, and 5	Monday, April 17