Cover Sheet: Request 12854

ABE 4XXX Modeling Coupled Natural-Human Systems

Info

Process	Course|New|Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Rachata Muneepeerakul rmuneepe@ufl.edu
Created	7/11/2018 12:37:03 PM
Updated	10/23/2018 9:10:01 AM
Description of request	To request a permanent number for the course

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	ENG - Agricultural and Biological Engineering 514907000	Rafael Munoz-Carpena		7/20/2018
No document changes					
College	Conditionall Approved	ENG - College of Engineering	Heidi Dublin	Conditionally Approved-- Course description in the form and syllabus are different. They must be the same. The one in the syllabus is too long. States there are no makeups for quizzes. Makeups are required for excused absences. The UF policy cannot be modified with “Additionally”	9/18/2018
No document changes					
Department	Approved	ENG - Agricultural and Biological Engineering 514907000	Kati Migliaccio		9/19/2018
MDLG CNHS 4XXX.docx MDLG CNHS 5XXX.docx					9/19/2018 9/19/2018
College	Approved	ENG - College of Engineering	Heidi Dublin	Approved by the HWCOE Curriculum Committee and Faculty Council	10/23/2018
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			10/23/2018
No document changes					
Statewide Course Numbering System					
No document changes					
Office of the Registrar					
No document changes					

Step	Status	Group	User	Comment	Updated
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Course|New for request 12854

Info

Request: ABE 4XXX Modeling Coupled Natural-Human Systems
Description of request: To request a permanent number for the course
Submitter: Rachata Muneepeerakul rmuneepe@ufl.edu
Created: 9/19/2018 10:55:55 AM
Form version: 2

Responses

Recommended Prefix ABE
Course Level 4
Number XXX
Category of Instruction Joint (Ugrad/Grad)
Lab Code None
Course Title Modeling Coupled Natural-Human Systems
Transcript Title MODELING NAT-HUM SYS
Degree Type Baccalaureate

Delivery Method(s) On-Campus
Co-Listing Yes
Co-Listing Explanation Students enrolled in the graduate session will be given additional, more advanced problems in both homework assignments and midterm exam.
Effective Term Earliest Available
Effective Year Earliest Available
Rotating Topic? No
Repeatable Credit? No

Amount of Credit 3

S/U Only? No
Contact Type Regularly Scheduled
Weekly Contact Hours 3
Course Description Approaches to modeling coupled natural-human systems are explored, drawing from both natural and social sciences. Topics include regime shift from dynamical systems and basic concepts from game theory and social-ecological system literature. These are combined in models that operationalize a conceptual framework. Students develop models—with guidance—for final projects.
Prerequisites Basic calculus & college-level probability courses
Co-requisites N/A
Rationale and Placement in Curriculum Many important engineering problems involves both biophysical and social factors. Effective analysis must draw from both natural and social sciences. This course prepares the students to tackle these problems by introducing them to concepts and tools from natural and social sciences and teaching them how to integrate these elements into models that can be used to study systems of their interest.
Course Objectives Upon completion of this course, students will be able to:
- Perform stability analysis and construct a bifurcation diagram for simple dynamical systems.
- Articulate the nature of regime shifts or tipping points in the context of coupled natural-human systems.
- Make connections between concepts such as resilience and robustness to their mathematical basis.
- Identify the applicability and limitations of different modeling approaches to coupled natural-human systems.
- Develop a simple model for a coupled natural-human system and analyze it, using tools learned in this course. This is what you are expected to do in your final project.

Course Textbook(s) and/or Other Assigned Reading No textbooks are required. Some example readings Include:

Anderies, J. M., M. A. Janssen, and E. Ostrom (2004), A framework to analyze the robustness of social-ecological systems from an institutional perspective, Ecology and Society, 9(1), 18.

Madani, K. (2010). Game theory and water resources. Journal of Hydrology, 381: 225-238.

Müller-Hansen, F., Schlüter, M., Mäs, M., Donges, J. F., Kolb, J. J., Thonicke, K., & Heitzig, J. (2017). Towards representing human behavior and decision making in Earth system models–an overview of techniques and approaches. Earth System Dynamics, 8(4), 977.

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Weekly Schedule of Topics Week TOPIC

1	Overview, introductions, logistics
2	Basic game theory: classic 2x2 games and their Nash equilibriums
3	Mixed-strategy Nash equilibrium
4	3x3 games; Basic evolutionary game theory—replicator equations
5	Analysis of 1-D replicator equations
6	1-D stability analysis Regime shifts; Examples of models with regime shifts
7	MATLAB introduction
8	2D stability analysis
9	2D stability analysis; MIDTERM
10	Putting them together: develop CNH models
11	Analysis of selected CNH models
12	Analysis of selected CNH models; PROJECT PROGRESS REPORTS
13	MATLAB sessions on selected systems.
14	MATLAB workshops for final projects
15	Review; FINAL PROJECT PRESENTATIONS

Links and Policies Grades and Grade Points
For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx
Attendance and Make-Up Work
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Online Course Evaluation Process
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Academic Honesty
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It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not

be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

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- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/

Counseling Services
Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching

- Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Grading Scheme Assessment and Evaluation:

Assignments: 45% | Midterm Exam: 25% | In-class Quizzes: 5% | Final Project: 25%

Your final score will be rounded to the nearest integer—for example, 86.5 will be rounded to 87—and your final grade will be determined accordingly to the scale below.

91-100 = A | 86-90 = A- | 81-85 = B+ | 76-80 = B | 71-75 = B- | 66-70 = C+ | 61-65 = C | 51-60 = D | 0-50 = E

Instructor(s) Rachata Muneepeerakul

ABE4XXX: Modeling Coupled Natural-Human Systems

Spring 20XX, 3 Credit hours

Time & Location: M 9:35-10:25AM & W 8:30-10:25AM, Frazier Rogers 283

Pre-requisites: Basic calculus and college-level probability courses

Instructor: Rachata Muneepeerakul, PhD
rmuneepe@ufl.edu; Phone: (352) 392-1864 Ext. 227
Frazier Rogers Hall 227
Office Hours: TBD and by appointments

Graduate Teaching Assistants (email, office hours and location): N/A

Course Description

Approaches to modeling coupled natural-human systems are explored, drawing from both natural and social sciences. Topics include regime shift from dynamical systems and basic concepts from game theory and social-ecological system literature. These are combined in models that operationalize a conceptual framework. Students develop models—with guidance—for final projects.

Learning Objectives:

Upon completion of this course, students will be able to:

- Perform stability analysis and construct a bifurcation diagram for simple dynamical systems.
- Articulate the nature of regime shifts or tipping points in the context of coupled natural-human systems.
- Make connections between concepts such as resilience and robustness to their mathematical basis.
- Identify the applicability and limitations of different modeling approaches to coupled natural-human systems.
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Tentative schedule:

Week	TOPIC*
1	Overview, introductions, logistics
2#	Basic game theory: classic 2x2 games and their Nash equilibriums
3	Mixed-strategy Nash equilibrium
4	3x3 games; Basic evolutionary game theory—replicator equations
5	Analysis of 1-D replicator equations
6	1-D stability analysis Regime shifts; Examples of models with regime shifts
7	MATLAB introduction
8	2D stability analysis
9	2D stability analysis; **MIDTERM**
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15	Review; **FINAL PROJECT PRESENTATIONS**

* The schedule is tentative. Actual schedule would depend on progress and interest in class.

Assignments

Tentative topics in assignments:

HW**	TOPIC**
1	Finding Nash equilibriums of 2x2 and 3x3 games Memo of one or more relevant papers
2	Stability analysis, regime shift, and bifurcation of a replicator equation Memo of one or more relevant papers
3	Stability analysis, regime shift, and bifurcation of a 2-D dynamical system Memo of one or more relevant papers
4	Analysis of a CNH model Memo of one or more relevant papers

** The number of assignments and their topics are tentative; the actual number and topics would depend on progress and interest of class. The assignments are usually due 1 to 1.5 weeks after the date they are assigned.

Sample Readings:

No textbooks are required. The materials for this course will be drawn from several sources. Below are some examples (we would likely not cover all of them):

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Gintis, H. (2000). *Game theory evolving: A problem-centered introduction to modeling strategic behavior*. Princeton University Press.

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ABE5XXX: Modeling Coupled Natural-Human Systems

Spring 20XX, 3 Credit hours

Time & Location: M 9:35-10:25AM & W 8:30-10:25AM, Frazier Rogers 283

Pre-requisites: Basic calculus and college-level probability courses

Instructor: Rachata Muneepeerakul, PhD
rmuneepe@ufl.edu; Phone: (352) 392-1864 Ext. 227
Frazier Rogers Hall 227
Office Hours: TBD and by appointments

Graduate Teaching Assistants (email, office hours and location): N/A

Course Description

Approaches to modeling coupled natural-human systems are explored, drawing from both natural and social sciences. Topics include regime shift from dynamical systems and basic concepts from game theory and social-ecological system literature. These are combined in models that operationalize a conceptual framework. Students develop models—with guidance—for final projects.

Notes on the graduate section: Students enrolled in the graduate section will be given additional, more advanced problems in both homework assignments and midterm exam.

Learning Objectives:

Upon completion of this course, students will be able to:

- Perform stability analysis, construct a bifurcation diagram, and determine critical parameter values for dynamical systems.
- Articulate the nature of regime shifts or tipping points in the context of coupled natural-human systems.
- Make connections between concepts such as resilience and robustness to their mathematical basis.
- Identify and assess the applicability and limitations of different modeling approaches to coupled natural-human systems.
- Develop a model for a coupled natural-human system and analyze it, using tools learned in this course. This is what you are expected to do in your final project.

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7	MATLAB introduction
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9	2D stability analysis; **MIDTERM**
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Tentative topics in assignments:

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