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WSU Registrar

Washington State University
MAJOR CURRICULAR CHANGE FORM - - COURSE
(Submit original signed form and ten copies to the Registrar's Office, zip 1035.)

Future Effective Date: 08/01/2012 ☑ New course ☐ Temporary course ☐ Drop service course
(effective date cannot be retroactive) ☐ There is a course fee associated with this course (see instructions)

☐ Variable credit _____ ☐ Repeat credit (cumulative maximum _____ hours)

☐ Increase credit (former credit _____) ☐ Lecture-lab ratio (former ratio _____)

☐ Number (former number _____) ☐ Prefix (former prefix _____)

☑ Crosslisting (between WSU departments) **(Must have both departmental signatures)** ☐ Cooperative listing (UI prefix and number _____)
taught by: WSU ☐ UI ☐ jointly taught ☐

☐ Conjoint listing (400/500) ☐ S, F grading

☐ Request to meet Writing in the Major [M] requirement **(Must have All-University Writing Committee Approval)**

☐ Request to meet GER in _____ **(Must have GenEd Committee Approval)** ☐ Fulfills GER lab (L) requirement

☐ Professional course **(Pharmacy & Vet Med only)** ☐ Graduate credit **(professional programs only)**

☐ Other (please list request) _____

BIOL/MATH	579	Mathematical Modeling in the Biological and Health Sciences
course prefix	course no.	title

3	3			
credit	lecture hrs per week	lab hrs per week	studio hrs per week	prerequisite

Description (**20 words or less**) An in-depth look at techniques, theory, and current literature in mathematical modeling in the biological and health sciences, including computational simulation.

Instructor: Elissa Schwartz Phone number: 335-5631 Email: ejs@wsu.edu

Contact: Justine Rupp Phone number: 335-3553 Email: ruppj@wsu.edu

Campus Zip Code: 4236

- Please attach rationale for your request, a current and complete syllabus, and explain how this impacts other units in Pullman and other branches (if applicable).
- Secure all required signatures and provide 10 copies to the Registrar's Office.

21 Nov 2011	11/28/11	
Chair/date	**Dean/date**	**General Education Com/date**
NOV. 23, 2011		
Chair (if crosslisted/interdisciplinary)*	**Dean (if crosslisted/interdisciplinary) ***	**Graduate Studies Com/date**
All-University Writing Com/date	**Academic Affairs Com/date**	**Senate/date**

***If the proposed change impacts or involves collaboration with other units, use the additional signature lines provided for each impacted unit and college.**

Mathematical Modeling in the Biological and Health Sciences
New Course Proposal

Rationale:

As the study of biology becomes more interdisciplinary, there is increasing interest in quantitative models of biological systems. WSU has a widespread and varied group of faculty across campus who are collaborating on research on biological systems using quantitative methods; they are also training graduate students in mathematical biology or related fields that use modeling. Thus we propose to offer a graduate-level course, Biol/Math 579, Mathematical Modeling in the Biological and Health Sciences.

This graduate course is the natural extension of WSU's curriculum in mathematical biology, which has seen increased enrollment in recent years. The goal of the course is to train life science students in modeling. Course content will cover a range of areas in biology, such as population dynamics, ecology, cell biology, and health sciences. Furthermore, the course complements Biol 565, Ecology and Evolution of Disease, by teaching the development and simulation of models used in disease ecology.

This course was taught twice before as graduate seminars (Mathematics 583, Spring 2010; Biology 589; Fall 2010). Each time the course was successful and the student feedback was positive. Enrollment and attendance exceeded expectations for a new course: 10 students, Math 583; 12 students, Biol 589. Students represented a broad spectrum of departments at WSU, including not only Biological Sciences and Math, but also Anthropology, Veterinary Medicine, Molecular Biosciences, Animal Sciences, and Biological Systems Engineering. In addition, one was a student from U. Idaho (BCB program) and another was from U. Washington (IPEM program). Thus the seminar appealed to students in many disciplines at WSU and beyond.

Rationale for cross-listing:

We propose this course be cross-listed with Biological Sciences and Mathematics. The course was taught twice previously, once in each of these departments, and the courses attracted a majority of students from these departments. Cross-listing will benefit students by exposing them to other students in the related discipline; furthermore it will familiarize biology students with quantitative methods and math students with biological literature and direct applications.

Impacts on other units in Pullman and other branches:

We anticipate that Biol/Math 579, Mathematical Modeling in the Biological and Health Sciences, will impact other units across campus that utilize modeling and quantitative techniques in biological and health (or related) research. A list of departments that may benefit includes but is not limited to Anthropology, Veterinary Medicine, Molecular Biosciences, Animal Sciences, and Biological Systems Engineering. Students from these departments participated in the course when it was taught as a seminar. Accommodations can be made for interested students at WSU branch campuses.

SYLLABUS

Mathematical Modeling in the Biological and Health Sciences
Biol/Math 579, 3 credits

Instructor: **Dr. Elissa Schwartz**
Office: Eastlick 289
Phone: 509-335-5631
Email: ejs@wsu.edu
Office hours: By appointment

Prerequisite: Graduate standing.

Course website (Angel): http://lms.wsu.edu. Any changes or announcements will appear on the course website. Students should check the website regularly for updates.

Course Description

Biol/Math 579 is a graduate course on mathematical modeling for students in life sciences. It offers an understanding of the theory and techniques of modeling, with an emphasis on current literature. Topics will focus on population dynamics of various biological systems, and will cover deterministic models, stochastic models, network models, and other quantitative modeling techniques including agent-based (individual-based) models.

Course Objectives

- Acquire understanding of mathematical tools and techniques used in various areas of biology.
- Develop familiarity with the methods of analysis of mathematical models and the implementation of computational methods.
- Critically evaluate research articles in the biological and health sciences literature that use mathematical modeling.

Readings
Text:

- A Course in Mathematical Biology: Quantitative Modeling with Mathematical and Computational Methods by de Vries, *et al.*

Supplemental texts (recommended but not required):

- A Biologist's Guide to Mathematical Modeling in Ecology and Evolution by Otto and Day
- Mathematical Models in Biology by Edelstein-Keshet

Additional readings:

- Journal articles in the current mathematical biology literature
- Software tutorials

Course Pedagogy
Forms of instruction include lecture, class discussion, computer labs, and class projects. Lectures will be based upon texts and followed by class discussion. Class discussion will also be encouraged on current readings from the literature, which represent applications of the lecture material. The computer lab module will take place in SLIC (Abelson 227) during weeks 8-10 and will consist of mathematical modeling exercises using Excel. Students will also have the option to use other platforms/software such as R or Berkeley Madonna (free downloads available), Matlab or Maple (using My.Math through the Math Department), or others if they choose. Class projects will be developed by the students in an area of biological modeling relevant to their research and/or interests. The projects will be either original or extensions of published studies, and they will include the aim of the model, model development, model parameterization, model analysis and/or simulation, results, and model interpretation.

Required assignments
- Computer lab exercises on model simulation (using Excel, R, Berkeley Madonna, Matlab, or other relevant programs).
- Research article presentations on papers from the biological modeling literature describing model construction, analysis, simulation, results, and interpretation.
- Final class project on an area of biological modeling, with progress reports due weeks 6, 8, 10, 12, and 13:
    - Progress report 1: Project proposal describing goal of model
    - Progress report 2: Model development
    - Progress report 3: Data/Model parameter estimation
    - Progress report 4: Model analysis and/or simulation
    - Progress report 5: Model interpretation/conclusions
- Final project presentation

Grading:

Computer lab exercises (2)	10%
Research article presentations (2)	40% (20% each)
Progress reports	25%
Final project/ presentation	25%
Total	100%

Course Assessment:
Letter grades will be assigned as follows:

92.5 - 100% = A
89.5 - 92.4% = A-
86.5 – 89.4% = B+
82.5 – 86.4% = B
79.5 – 82.4% = B-
76.5 – 79.4% = C+
72.5 – 76.4% = C

69.5 – 72.4% = C-
66.5 – 69.4% = D+
59.5 – 66.4% = D
< 59.4% = F

Course Outline and Schedule

Week	Topic/Activity	Assignments
Week 1	Introduction to mathematical modeling	Reading: chapter 1
Week 2	Mathematical modeling techniques: Modeling population growth and dynamics	Reading: chapter 2
Week 3	Mathematical modeling techniques: Non-linear models of population growth	Reading: chapter 3
Week 4	Model analysis: Deterministic and stochastic models	Reading: chapter 5
Week 5	Model analysis: Simulation	Reading: chapter 8
Week 6	Presentations and discussion of current literature in biological modeling	Reading: research articles. Progress report due: project proposal
Week 7	Interpretation and evaluation of model results, Model parameter estimation, Model selection	Reading: chapter 7
Week 8	Computer lab: predator-prey and competition models	Progress report due: model development
Week 9	Computer lab: infectious diseases, epidemiology, and SIR models	
Week 10	Computer lab: Within-host models and viral dynamics	Progress report due: model parameterization
Week 11	Presentations and discussion of current literature in biological modeling	Reading: research articles.
Week 12	Network models, branching process models, spatial models, age-structured models, individual/agent based modeling	Reading: chapter 4 Progress report due: model simulation
Week 13	Mathematical models in cell biology and physiology, health sciences, immunological networks, systems biology	Progress report due: model results
Week 14	Final project presentations	Computer exercises due
Week 15	Final project presentations	Final projects due

Attendance, Participation, and Late Work Policy: Students are expected to attend all scheduled class times and contribute to class discussions. A student who must miss a class should notify the instructor and provide a reason for the absence. Late assignments are subject to grade reduction.

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, please visit the Access center. All accommodations MUST be approved through the Access Center (Washington Building, Room 217). Please stop by or call 509-335-3417 to make an appointment with an Access Advisor.

WSU Safety Measures: Washington State University is committed to maintaining a safe environment for its faculty, staff, and students. Please visit http://safetyplan.wsu.edu and http://oem.wsu.edu/emergencies to access the Campus Safety Plan and emergency information. You should also become familiar with the WSU Alert Site (http://alert.wsu.edu) where information about emergencies and other issues affecting WSU will be found.

Academic Integrity: Academic integrity will be strongly enforced in this course. Any student caught cheating on any assignment will be given an F grade for the course and will be reported to the Office of the Dean of Students. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand these definitions:
http://www.conduct.wsu.edu/Content/Documents/conduct/09-10%conduct%20booklet.pdf