MA 331: Differential Equations for Life Sciences (Fall 2017)

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Office Location: Cox 406E (Rutter), Cox 506C (Banks)
Textbook: None. Notes will be provided.
Course Info: Tu/Th: 1:30-2:45 PM, SAS 1220
Office Hours: TBD

Course Description

This course provides students with an understanding of how mathematics and life sciences can stimulate and enrich each other. The course topics include first order differential equations, separable equations, second order systems, vector and matrix systems, eigenvectors/eigenvalues, graphical and qualitative methods. The methods are motivated with examples from the biological sciences (growth models, kinetics and compartmental models, epidemic models, predator-prey, etc). Computational modeling will be carried out using SimBiology, a MATLAB toolbox based graphical user interface, which automates and simplifies the process of modeling biological systems. The student is not required to purchase the toolbox.

Requisites and Restrictions

Prerequisites for this course is MA 231 or MA 241. There are no co-requesites. Credit cannot be given for both MA 341 and MA 331.

Course Communications

Modes of communication in use for this course include email and office hours. Office hours will be held on Tuesday and Wednesday from 11:00am to 12:30pm.

- I will do my best to respond to weekday e-mails and posts within 24 hours. Email messages or posts left after 4 pm Friday will be responded to by the following Monday.
- If you would like to speak with me in person and you can't make it to my posted office hours, please email me to schedule a time that is convenient. Include several time slots that would work for you in your email.
- Please be aware that ALL email communications for this course will be sent to your NCSU unity email. If you do not regularly use your ncsu.edu account, there are settings within Gmail that allow you to forward your e-mail to another account. For more information see:
  http://google.ncsu.edu/what-best-way-forward-my-nc-state-gmail-non-nc-state-e-mail-address

Attendance Policy

Regular attenence of lectures will improve performace in the class. Attendance will not be taken. Make-up work will not be allowed for unexcused absenses. Please inform the instructor in advance of any anticipated absenses and the instructor will be willing to work with the student to make up any work missed. For complete attendance and excused absence policies, please see http://policies.ncsu.edu/regulation/reg-02-20-03.

Homework Policies

Homework will be assigned and may be a mixture of mathematical questions and additional computational questions. Late homework will not be accepted. Extensions may be granted *in advance* on a case by case basis.

Project Policies

The project will involve using a mathematical equation to describe dynamics for data collected by the student. More details will be provided.

Exam Policies

Exams will be in-class tests to be completed without the use of textbooks, course material or other notes. A formula sheet will be provided. Calculators, including graphical calculators, may be used, although notes may not be stored on them. Tests missed with certified medical excuses or prior approval of the Instructor will be dealt with on a case by case basis.

If you miss a test without either a certified medical excuse or prior Instructor approval, you may take a makeup test at a designated time during the last week of semester. Only one makeup test will be given, and it will be fair but comprehensive and challenging. This means that even if the missed test covers only part of the course, the makeup test may contain material from any part of the course.

Final Exam Policies

The final exam will be held on Tuesday, 12/05/17 at 1-4 PM in the regular classroom. The final exam is comprehensive and will cover material from the entire course. There are **no** exemptions for missing the final examination, except when a student obtains permission for having at least 3 exams during a 24 hour period. Students must inform the instructor in advance if they will be absent from the final exam for this reason. The instructor is not able to move the final exam date without clearance from the University.

Final Grade Calculation

There are several components to this course: homework, two 1-hour tests, one project, and one 3-hour final exam (comprehensive). These components will be weighted as follows.

Homework:	**15%**
Project:	**20%**
50-minute tests:	**40%**

Each test is worth 20% of your grade.

Final Exam:	**25%**

This course uses standard NCSU letter grading (with NO ROUNDING):

$90 \leq$ A- < 93	$93 \leq$ A < 97	$97 \leq$ A+ ≤ 100
$80 \leq$ B- < 83	$83 \leq$ B < 87	$87 \leq$ B+ < 90
$70 \leq$ C- < 73	$73 \leq$ C < 77	$77 \leq$ C+ < 80
$60 \leq$ D- < 63	$63 \leq$ D < 67	$67 \leq$ D+ < 70
$0 \leq$ F < 60		

Unity ID and Password

Students need to be familiar with their *Unity ID* and *password* to login to access lecture recordings and other university-provided resources. Refer to online information at: http://oit.ncsu.edu/unityid or contact the NCSU HELP desk at (919) 515-HELP or HELP@ncsu.edu for assistance.

Academic Integrity
Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01
The NCSU Student Code of Conduct covers all work done in this course. Any suspected violations will be promptly reported.

Academic dishonesty will result in an automatic failing grade for the course. See http://policies.ncsu.edu/policy/pol-11-35-01for a detailed explanation of academic honesty.

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment".

Course Evaluations
A formal evaluation is conducted by the University at the end of the semester and the goal is to achieve 100% class participation in this survey. Online class evaluations will be available for students to complete during the last two weeks of class. Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question, and students will never know the ratings for any particular instructor.

Accommodations for Disabilities
Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office (http://www.ncsu.edu/dso), 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at http://policies.ncsu.edu/regulation/reg-02-20-01.

Non-Discrimination Policy
NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or http://www.ncsu.edu/equal_op/. Any person who

feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

Tentative Course Topics

Date	Topic
08/17	Introduction and review
08/22-08/24	Separable Equations and Integrating Factors
08/29-08/31	Mathematical Models of Population Growth and Biology
09/05-09/07	Slope Fields, Introduction to *SimBiology*
09/12-09/14	*SimBiology*, **Exam 1**
09/19-09/21	Intro to 2nd order differential equations, Constant Coefficients
09/26-09/28	Predator-Prey Models, Circadian Oscillators
10/03	Numerical Methods
10/10-10/12	Intro to Linear Algebra, Matrices and Vectors
10/17-10/19	Linear Systems in Normal Form, Real and Complex Eigenvalues
10/24-10/26	Applications: HIV, SIR, predator-prey models
10/31-11/02	Inverse Problem Techniques in Biology (Project Starts)
11/07-11/09	Inverse Problem Techniques in Biology, **Exam 2**
11/14-11/16	Phase Plane Analysis, Stability
11/21	Linearization of 2D systems
11/28-11/30	Periodic Solutions, Limit cycles, and periodically forced systems

Note: Depending on student interest, topics may be emphasized or de-emphasized. The instructor reserves the right to alter the syllabus. Any changes to the syllabus will be disseminated in class.