Instructor

Boaz Ilan
Office: Science & Engineering 334, (209) 228-4178
bilan@ucmerced.edu

Lecture Time & Location

MWF, 11:30 am – 12:20 pm, COB 263

Discussion Section Time & Location

Thursday, 10:30 am – 11:20 am, KL 396

Office hours

Thursday, 3 pm – 4 pm, or by appointment.

Course Description

The overarching goal of this course is to introduce advanced topics in the theory of ordinary differential equations (ODEs). Emphases will be put on conceptual understanding and critical thinking. Simplified problems from physics and other disciplines will be used to motivate certain topics. This course serves as a preliminary for studying MATH 222: Partial Differential Equations I.

Course Topics

- Initial value problems (IVPs)
  - Existence theory for linear IVPs.
  - Elements of Floquet theory.
  - Stability, bifurcation theory, and limit cycles for nonlinear IVPs.
  - Existence theory for nonlinear IVPs.
- Boundary value problems (BVPs)
  - Existence theories.
  - Green's functions.
  - Spectral properties.

Course Goals and Objectives

My goals are that by the end of this course you will learn some of the fundamental concepts of ODE theory.

Graduates of MATH 221 should be able to fulfill the following **Learning Outcomes**:

1. Prove and determine the existence of solutions of ODEs.
2. Determine the stability, bifurcation curves, and limit cycles of IVPs.
3. Apply existence theory,Green's functions, and spectral properties to solve and analyze BVPs.

Relationship to Program Learning outcomes:
MATH 221 primarily addresses the first Program Learning Outcomes for the M.S. and Ph.D. programs.

- PLO #1: Solve advanced mathematical problems using analytical methods.

In particular, by the end of this course you should have learned how to use analytical techniques to solve the ODEs.

Prerequisites

Courses in Multi-Variable Calculus, Linear Algebra, Ordinary differential equations with Boundary Value Problems.

Course webpage:

UC Merced's CatCourses will be used.

Primary Textbook

- *A Second Course in Elementary Differential Equations* , P. E. Waltman (copy available at the University of California library).

Additional Reading

- *Elementary differential equations and boundary value problems*, W. E. Boyce and R. C. DiPirma (copy available at the University of California library).
- *The Spectral Theory of Periodic Differential Equations*, M. S. P. Eastham (copy available at the University of California library).
- *Nonlinear Dynamics and Chaos*, S. H. Strogatz (copy available at the University of California library).
- *Green's functions and boundary value problems*, I. Stakgold (copy available at the University of California library).

Homework

Homework problems will be assigned throughout the semester. However, you will not turn in solutions for these homework problems to be graded. Even though homework solutions are not graded, it is your responsibility to attempt, work through and complete these homework problems to succeed in this course. Exam questions will be based on these homework problems.

You are encouraged to work on homework problems in groups. However, *you must comprehend the material and be able to solve the problems on your own.* You homework should make use of appropriate literature resources, such as books (available through the UC Merced library) and journal articles (available online via the California Digital Library).

Exams

There will be three exams during this course. The exams are with closed books. The exams will take place at the Lecture time and place on the following dates:

· Exam 1: **Wednesday, September 28**.
· Exam 2: **Wednesday, October 26**.
· Exam 3: **Friday, December 9**.

You must show up for these exams. There will be no early or make-up exams.

Grade Determination

The final grades in the course will be based entirely on the performance on the three exams.

Dropping the Course

Please see the UC Merced General Catalog for more details.

Special accommodations

Student Affairs determines accommodations based on documented disabilities. If you qualify, please submit a letter from Disability Services to the instructor; every effort will be made to accommodate your needs.

I will also make every effort to accommodate students whose religious beliefs/obligations lead to scheduling conflicts with exams, assignments, or attendance. Please speak with me during the first two weeks of this course regarding any potential accommodations.

Academic integrity

Academic integrity is the foundation of an academic community and without it none of the educational or research goals of the university can be achieved. All members of the university community are responsible for its academic integrity. Existing policies forbid cheating on examinations, plagiarism and other forms of academic dishonesty. The current policies for UC Merced are described in the Academic Honesty Policy. See http://studentlife.ucmerced.edu/ $\rightarrow$ "Student Judicial Affairs"