Instructor Information

Instructor: Jim Swift  Adel Math Bldg. 110  523-6878  Jim.Swift@NAU.edu

Office Hours: MTWF 10-11, W 4-5. If these times are inconvenient, you can make an appointment, or drop by my office any time.

Websites: http://oak.ucc.nau.edu/jws8/ is my web site. Follow the “Instructor Information” link. On that page, there is a link to the web site for this class, as well as a link to official U.S. time, http://www.time.gov, that our class will observe.

Course Description


Prerequisite: A grade of C or better in MAT 239 (Differential Equations), and MAT 431(Real Analysis), or the equivalent.

Content/Outline: This course is about the qualitative theory of Ordinary Differential Equations (ODEs). Although an undergraduate course gives a “bag of tricks” for finding analytic solutions, there is usually no closed-form solution of nonlinear ODEs. Instead of tricks, this course focuses on linear ODEs, which can be solved exactly, and the qualitative theory of nonlinear ODEs. Chapter 1 covers linear systems of ODEs, and then we use this to get local information near an equilibrium point in Chapter 2. Then we will do selected topics from Chapters 3 and 4, which are about global features of solutions to ODEs.

Student Learning Outcomes: Students will learn how to solve systems of linear first order differential equations of the form $\frac{dx}{dt} = Ax$, where $A$ is a constant matrix. This involves quite a bit of “applied linear algebra.” Non-constant matrices $A(t)$ make the ODE tricky, and the student will get some experience with these. The student will learn many qualitative techniques for analyzing solutions to nonlinear ODEs of the form $\frac{dx}{dt} = f(x)$. In particular, the student will learn to linearize about equilibrium points $x^*$, which satisfy $f(x^*) = 0$. The student will learn qualitative techniques to study periodic solutions of ODEs, which satisfy $x(t+T) = x(t)$ for all $t$ and some positive constant $T$. The student will learn a bit about bifurcation theory, which concerns differential equations $\frac{dx}{dt} = f(x,\mu)$ depending on the parameter $\mu$.

Course Structure The class will use lecture-discussion format.
Assessment of Student Learning Outcomes

**Homework:** (35% of the final grade) You know by now that it is necessary to practice math to learn it. You are *allowed* and *encouraged* to work together on homework.

**Midterms:** (2 × 20% = 40% of the final grade) There will be 2 midterms. Some component of the exams will be take-home.

**Final Exam:** (25% of the final grade) The Final Exam is scheduled for Wednesday, December 14 from 10:00 to 12:00.

**Course Policies**

**Calculators and Computers:** Most of the work in this class does not require calculators. There will be some use of computers, but no programming will be required. For example, some problems will require you to modify a Mathematica notebook that I will supply to you.

**Late Homework:** I will handle requests on a case-by-case basis, but please contact me before the due date.

**Missed Class Days:** It is important and required that you come to class every day. I will give excused absences for institutional excuses, illness, or other reasons that I approve. If you are experiencing flu-like symptoms, you should not attend class. Please notify me of an absence by e-mail or voice mail *before* class if possible. Furthermore, if you are late and I take roll before you arrive, then you will be counted absent.

**Makeup Exams:** A similar policy to “Missed Class Days” holds. I will give a makeup exam for illness or other emergencies. Please notify me that you will miss an exam by e-mail or voice mail *before* the exam if possible. I may give an exam the day before Thanksgiving; if so you may take the exam early on the Tuesday before Thanksgiving.

**Academic Honesty:** Do not look at other people’s exams during in-class tests. You may not use cell phones or other electronic communication devices during the exams. Groundrules for take-home exams will be clearly explained. You may seek help from me and other students for the homework, but please do your own work.

**University and Departmental Policies:** Our class web site has links to the Departmental and University Policies at www.cefns.nau.edu/Academic/Math/MasterSyllabi/DepartmentPolicies.pdf and www2.nau.edu/academicadmin/UCCPolicy/plcystmt.html.

**Amendments:** Any changes to this syllabus will be announced in class, and an updated version will be posted on my website.