Instructors:

The head instructor for this course is Bruce Carpenter. However, virtually all of the student's interactions will be with a graduate student TA named Tayyab Nawaz (as of Fall 2013). It is also possible for the student to be assigned an undergraduate TA, Lavin Devnani. The grad TA is responsible for grading homework assignments and he also holds "office hours" via an online chat system that features audio chatting and screen-sharing, which allows him to see and control your computer screen. He is very knowledgeable about the course material and whenever he doesn't know the answer to a question he is diligent about finding out and getting back to you. His spoken English is not perfect, so if it is difficult to communicate with him via audio, just tell him that you prefer to type your questions rather than use the microphone.

Prerequisites:

The only listed prerequisite is Calculus III. A solid grasp on the basic concepts of Calculus is definitely helpful in NetMath 286. Students will be expected to take partial derivatives and perform integration, and more importantly, will need to have a qualitative understanding of these basic concepts. Near the end of the course there is also some overlap with topics covered in Linear Algebra such as eigenvectors and eigenvalues, but Linear Algebra is not a prerequisite and is certainly not necessary to succeed in Differential Equations.

When to Take It:

The course is a self-paced online offering that can be started at any time. The course must be completed within 16 weeks of the start date. The registration process goes through UIUC's office of Online and Continuing Education (OCE) and it may take about 2 weeks from the time you register until you can actually begin your lessons, so plan accordingly. This course is listed as a prerequisite for ECE 210, which in turn is a prerequisite for virtually every subsequent ECE course, so the sooner you take Math 286 the better.

Class Content:

The course content is delivered completely online using a Mathematica-based platform called Making Math. The Making Math subscription costs $79 (as of Fall 2013)---think of it as analogous to buying a course textbook. The course content is composed of 9 units as follows.

**Unit 0:** Getting Started
- This is a quick intro to the Making Math / Mathematica system. Not graded.

**Unit 1:** The Exponential Differential Equation

**Unit 2:** The Forced Oscillator Differential Equation

**Unit 3:** Laplace Transform and Fourier Analysis

**Unit 4:** Modern Differential Equation Issues
- Euler's method of approximating solutions to differential equations
- Flow plots for analyzing differential equations
- The predator-prey model

**Midterm Exam 1:** Covers Units 1 thru 4

**Unit 5:** First Order Differential Equations
- Phase lines for analyzing differential equations
- Autonomous differential equations
- Bifurcation plots of differential equations
- Sensitive dependence on starter data

**Unit 6:** Systems and Flows
- Systems of differential equations
- Trajectories and vector fields

**Unit 7:** Eigenvectors and Eigenvalues for Linear Systems

**Unit 8:** Linearizations
- Using linearizations to approximate nonlinear differential equation systems
- Lyapunov's rules
- The pendulum oscillator
Each unit is composed of a lesson, a tutorial, and a lengthy homework assignment, all delivered via Making Math. The Making Math platform is difficult to describe, but you can think of it as an online interactive textbook. Below is a screenshot from the first lesson to give you an idea.

All of the content is authored by Bill Davis, an Ohio State mathematics professor, and Jerry Uhl, a late UIUC mathematics professor. They do an excellent job of mixing in interesting applications of the material and some comic relief.

The exams are the only part of the course that is conducted in-person. The student is responsible for finding a proctor and scheduling a time to take exams. If you are on campus, it is easy to schedule proctored exams through the UIUC Office of the Dean of Students (ODOS) Testing Center located at 601 E. John St. If you are off campus you just have to submit a proctorship approval form to the NetMath program and schedule your exams far enough in advance for the test booklets to be mailed to your proctor.

*Note: NetMath 286 and Math286 cover about the same material, but it may vary depending on the professor for Math286.

Work:

As mentioned above, there are 9 units, each composed of a lesson, a tutorial, and a homework assignment. Most of the units have 2 weeks allotted to them, but a few of the shorter units are expected to be completed in just 1 week. Since the course is self-paced you can certainly complete the units faster if you wish. You may also be able to work at a slower pace, but it is best to check with the TA to make sure you will not be penalized for missing "due dates," and keep in mind that there is a 16-week limit for the entire course.

The homework is the only part of each unit that is submitted for a grade, but expect to spend a lot of time completing these assignments. For most assignments you will be given the opportunity to hand in your homework a second time after your first try has been graded and returned to
you. Although the lesson and tutorial at the beginning of each unit are not submitted for a grade, plan to dedicate significant time to these as well. The lesson and tutorial are where you actually learn the material before attempting the homework, and time spent on the lesson and tutorial is much like time spent in the classroom of a traditional course.

The number of hours required to complete each unit varies greatly. Longer units (such as Unit 2) may require ~25 hours of work to complete, whereas shorter units (such as Unit 9) may require only ~6 hours. On average over a 16-week semester, the work comes out to about 8.5 hours per week. The course can also be completed over the summer on an accelerated timeline.

**Life After:**

Math 286 is a prerequisite for ECE 210 Analog Signal Processing, which is directly or indirectly a prerequisite for much of the rest of the ECE curriculum. After taking it you will notice that the concepts pop up everywhere, even in courses that do not list Math 286 as a prerequisite.

Beyond the ECE department, Math 286 will allow you to take upper level physics courses in mechanics (e.g. PHYS 325), electromagnetics (e.g. PHYS 435), and quantum mechanics (e.g. PHYS 486). It is also a prerequisite for Math 442 Intro Partial Differential Equations.