Mathematical Modeling Syllabus, Spring 2021

- INSTRUCTOR: Dr. Hundley

  OFFICE: Olin 222

  OFFICE HOURS: Online. A link to schedule a visit will be found both on Canvas and our class website. You can also send an email.

  OFFICE PHONE: 527-5151

  EMAIL: hundledr@whitman.edu

  CLASS WEBSITE: We have two websites, both will be updated as the course progesses. One website is on Canvas, and the other is open to the world on the regular web. Things like a daily log and links to course materials will be on the regular web (so you do not need extra passwords or accounts to access this). This site is below, which will also turn up using a Google search:

  `http://people.whitman.edu/~hundledr/courses/M350.html`

- **Text:** "Introduction to Empirical Modeling", in progress. The course notes will be distributed as we go, and are available on our class website or on Canvas.

  We will also be looking at excerpts from other texts as well, and these links will be available on Canvas.

  Since this semester will be online, this course will mostly be asynchronous, meaning that you can work through the material when you are able.

  A good idea: Reserve MWF at 10 in your schedule for working through the material in this course. It would be good to actually schedule time every day, but this gets you started. The **key to success** in online learning is to stay up to date with the material!

- **Technology:**

  - All lectures will be freely available on YouTube, and the links will be provided as we go. There are a lot of free resources online, and I will try to point them out; some are better than others. My videos will be short- no more than about 10 minutes per video- so if we were in class, we would probably go through the equivalent of 3-4 of these videos per class session.
  - You'll need a device from which you can watch these lectures- It can be a laptop, a desktop computer, a phone or a tablet. All of these are (or will be) linked from YouTube.
  - You'll either need a smartphone or a good friend that has a smartphone in order to scan your work and upload it to Canvas. There is a sample video on both class websites.

- **Software** I'll discuss this more as we go, but generally speaking, you'll be able to choose which programming language you want to use for most things. Normally I would use Matlab, but since we're online, I'll let you choose mainly between Matlab and Python. Matlab is a commercial piece of software, but if you're going into engineering, you might consider picking up a student copy for yourself (Mathworks is the company that makes Matlab). Otherwise, there is a free version of Matlab called Octave which you may use. In fact, if you want to try it out, there is an online version of Octave you can try.

  We'll have some time before we get into the software- our first set of topics will be systems of differential equations, so we'll look at algorithms in the middle of that.

- **Grading Criteria.**

  - HOMEWORK/LAB WORK:

    Homework and lab work is extremely important for the class, and will be assigned daily and collected weekly. You are expected to produce your own solutions to all homework problems! There may be occasions when we do "group work", and even in those cases, each student should turn in their own copy of the work.

    We'll discuss turning in solutions later (sometimes this can be done electronically). Collectively, homework will account for 25% of the overall grade.

  - EXAMS:

    We will have two midterms, one during week 5 one at week 11 and a final exam. They will all be weighted equally, and will take 75% of the overall grade.

  GRADING: Grading is done on a standard scale:

  90-100%=A, 80-89%=B, 70-79%=C, 60-69%=D, 59 and below=F

  I will use the plus/minus grading only sparingly in borderline cases.

- Help! I encourage you to come see me. If you can't make it during office hours, either email me if you have short questions, or make an appointment.

- Academic Honesty. Academic standards will be *strictly* adhered to as outlined in the College's policies. This means that cheating will not be tolerated, and that includes copying another student's work (homework or computer programs).

- If you have a learning disability, please let me know as soon as possible so that we can make alternative assessment methods. Please do not wait until the day of the exam!

- **General Discussion of Topics**

  Mathematical modeling is the process by which we translate some physical process into mathematical statements. There are several ways of doing this- Some modeling classes are mostly statistics, some are mostly differential equations (or partial differential

equations), and still others are physics-based. The coming of data analytic techniques are now bringing forth "data driven" modeling, and so we'll be discussing some of these techniques as well.

First, we'll look at systems of differential equations. This would be the primary mode of modeling in physics and biology, and we'll look at ways of analyzing the solutions-using techniques from linear algebra, and numerical techniques, and this should take us through about 4 weeks.

The remaining 2/3 of the course will be in developing data analytic techniques to look at data-driven modeling. We'll end the course by considering some different types of neural networks.