

**MATH 4540/7540: MATHEMATICAL MODELING
FALL 2017
COURSE SYLLABUS**

INSTRUCTOR Samuel Walsh (walshsa@missouri.edu)
TEXTBOOK *An Invitation to Applied Mathematics:
Differential Equations, Modeling, and Computation*
by CARMEN CHICONE, ISBN 9780128041536

LECTURE MWF 3:00PM–3:50PM in Strickland 209
OFFICE HOURS WR 4:00–5:00 PM in 307 Math Sci. Bldg.
WEBSITE <http://faculty.missouri.edu/~walshsa/index.html>

Overview. This course serves as an introduction to mathematical modeling and applied mathematics, more generally. The main objective will be to learn how to take a phenomena arising in physics, chemistry, biology, even the social sciences, then study it (intelligently) using mathematics. This can be a very tricky endeavor: it necessitates both a sound understanding of the field where the problem originated, and a capacity for sometimes quite sophisticated mathematical analysis.

It also typically requires using numerical analysis, that is, using a computer to solve problems that are not tractable by hand. This means that as part of the course you will be frequently asked to program. Specifically, you will need to be proficient enough in at least one language (Mathematica, Matlab, Maple, C/C++, Fortran, Python, R, and Excel are good choices) so that you are able to implement numerical algorithms, as well as generating graphics such as plots. I can offer some help with a few of these, but you are mostly responsible for teaching yourself.

The planned topics to be covered are:

- Introduction to the basic ideas of applied mathematics and mathematical modeling
- Review of DE theory and computation
- Reaction, diffusion, and convection
- Transport equations: electrical signals on neurons
- The mechanics of fluids and elastic solids
- Water waves

Depending on student interest, and the general flow of the class, we may add or subtract items. Please let me know if there is something in particular that you'd like to see covered.

Homework. Homework assignments will be assigned roughly every other week in class. Completed homework must be submitted at the beginning of class the following week. In total, they will account for 40% of your final grade.

The assignments for this course will require a lot of writing — you should not submit work that consists of nothing but a string of equations absent context or exposition. You should approach each assignment as if you were writing a journal article or technical report: use complete, grammatically correct sentences, and explain your thinking so that the reader understands and believes in your conclusions. It is my strong preference that you typeset your homework (using LaTeX, for example), but this is not mandatory.

You are encouraged to work together on homework. You will find that interdisciplinary collaboration is particularly valuable for a course like this. Ultimately, though, each student must submit his/her own assignment. For code, this means that while you and your group members may use the same general approach or algorithm, you should not copy-paste someone else's code.

Project. In addition to the homework, there will be a semester long project that you can do individually or in small groups. The topic is up to you: I will provide a list of potential projects from which you can choose, but you are free (and encouraged) to propose your own. We will meet to discuss your progress periodically throughout the term. You will submit the completed document on the last day of class, **Wednesday, December 6th**. The project accounts for 40% of your final grade.

Final. At the end of the semester, there will be a take-home final exam that must be done individually. It will be handed out on the last day of class and due no later than **Tuesday, December 12th**. The final will account for the remaining 20% of your grade.

Disabilities. If you need accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office. To request academic accommodations (for example, a note taker), students must also register with Disability Services (<http://web.missouri.edu/~accesscm>), AO38 Brady Commons, 882-4696 or 882-8054 TTY. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. Another resource, MU's Adaptive Computing Technology Center (<http://iatservices.missouri.edu/adaptive>), 884-2828, is available to provide computing assistance to students with disabilities. For more information about the rights of people with disabilities, please see ada.missouri.edu or call 884-7278.

Academic Honesty. Academic honesty is fundamental to the activities and principles of a University. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. When in doubt about plagiarism or collaboration, consult the course instructor. The academic community regards academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion. If at any time you have questions about this policy, please ask.

Executive Order N° 38, Academic Inquiry, Course Discussion and Privacy.

University of Missouri System Executive Order N° 38 lays out principles regarding the sanctity of classroom discussions at the university. The policy is described fully in section 200.015 of the Collected Rules and Regulations. In this class, students may not make audio or video recordings of course activity, except students permitted to record as an accommodation under section 240.040 of the Collected Rules. All other students who record and/or distribute audio or video recordings of class activity are subject to discipline in accordance with provisions of section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

Those students who are permitted to record are not permitted to redistribute audio or video recordings of statements or comments from the course to individuals who are not students in the course without the express permission of the faculty member and of any students who are recorded. Students found to have violated this policy are subject to discipline in accordance with provisions of section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.

Complaints. If you have communication (or other problems) with your instructor, you can report them to Professor Stephen Montgomery-Smith either by phone at (573) 882-4540, or by e-mail (muasmathdgs@missouri.edu).