

Time and Location: UNH 2727, TR 9:25-10:40 am

Instructor: Dr. Erika T. Camacho erika.camacho@lmu.edu
310-338-2375 University Hall 2768

Office Hours: M 2:00-4:00 pm, TR 10:50-11:50 am, W 9:30 - 11:30 am, and by appointment.

Textbook: *A Concrete Approach to Mathematical Modelling* by Michael Mesterton-Gibbons

Prerequisite: Senior standing or consent of instructor.

Announcements: There will frequently be announcements at the beginning of class and via email. Please be on time to lecture and check your email regularly.

Modeling covers a very vast range of mathematical fields and techniques. It requires intuition and plenty of background knowledge of the system at hand. It is a creative art that demands a critical eye and multiple revisions. It is like creating a sculpture where obtaining the final product is a result of adding, shaping/reshaping, stepping back, analyzing, taking away, shaping/reshaping, stepping back, analyzing, adding some more, shaping/reshaping, stepping back, and so on, continuing this process until the product is acceptable to the artist. With each step back she/he critically analyzes and evaluates her/his work. Only after doing this will she/he be able to decide the best possible way to proceed. In this course we will learn to be critical thinkers and readers of mathematics and to develop some creative modeling skills. It would be impossible to cover all the mathematics that have been used to model but we will definitely cover some of the most utilized.

Problem Set Assignments: Problem sets will be assigned weekly at the beginning of class and will be due within a week. These assignments will be used to familiarize you with some of the mathematical techniques used in modeling. **NO LATE HOMEWORK WILL BE ACCEPTED.** You are expected to hand in *neat* solutions to all of the assigned problems with all pages *stapled* together in order to receive *full credit*.

Article Discussion: Approximately every two or three weeks we as a class will synthesize and discuss an article. The article will be given to the class 1-2 weeks prior to the discussion day. Each student is responsible for *carefully* reading the article and summarizing it in 1-2 *typed* pages. The article summary should include all the items below:

- Title of the article and author's name
- Main question under consideration by the author
- 1-2 sentences describing the type of model (e.g., deterministic in continuous or discrete time)
- 1-2 paragraphs summarizing/describing the model formulation
- 1-2 paragraphs describing the analysis
- 1-3 sentences summarizing the results
- 1-2 paragraphs evaluating the model (i.e., what are its strengths and shortcomings)
- 1-2 paragraphs suggesting modifications and possible extensions
- A list of questions or key points that you would like to put up for discussion.

You can also turn in for extra credit your scratch sheet or computer code where you worked out some of the mathematics in the article. Students should use their summaries as a guide during the discussion. Summaries will be due in my office by 11:30 AM one day prior to the discussion date. **NO LATE SUMMARIES WILL BE ACCEPTED.** When you hand it to me I will immediately make a copy for you to take and use as a reference. You will be graded for your contributions during the discussion and for your summary. Together they will equally contribute to your article discussion grade. I recommend that you work out some of the mathematics in the article.

Computer Labs: Numerics is an important part of mathematical models. The computer labs will be used to introduce the students to Maple and Matlab computer packages and thereby equip them with the necessary tools to get insight into various mathematical models. You will be given a lab to work on and will be graded for it. Even though we will usually have an entire class period to work on the computer lab you might need to work on your own time in order to complete the lab. In such a case you will have until Tuesday to turn in your computer lab. NO EXCEPTIONS!! At the beginning of the semester you will be working in pairs but as you gain more experience you would be asked to work on your own. Each student must turn in a well-documented computer lab assignment/ code with the name of his/ her computer partner. Each student should write his/ her own explanations/ documentation. The computer labs will play a very important role in the numerics of your research project.

Research Meetings: Each group will select and commit to a 15-20 minute meeting slot every other week. During these meetings we will talk about your research and I will give you guidance on possible ways to proceed. This will allow me to see where you are in your research and to evaluate your progress. (If you need extra time you are encouraged to stop by anytime during my office hours to discuss your research.) Before our meeting you must turn in the following documents:

- copies of all the articles you have used to draw information from, create hypotheses, and/ or assumptions
- a 1-2 typed paragraph summary for each article that highlights its importance as it pertains to your research
- a 1-3 page typed research update of what you did since our last meeting (all calculations and equations must be typed)
- a printout of any new numerics or calculations (if this is more than 10 pages then you need to bring it on a disk or flash drive so I can copy it and grade it)

Your grade for these meetings will be based on all the items above but in particular on your typed research update, the article/paper summaries, well documented computer calculations and numerics, and any other relevant information/documentation. In order to receive *full credit* you must turn in all items 24 hours prior to our meeting. NO EXCEPTIONS!

Mini-Project: In order for you to get comfortable in dealing with a mathematical model and asking and answering appropriate questions you will be assigned a mini-project. You will have a week to work on it before turning it in for a grade. The project may be hand-written but must be complete and include an appendix with all calculations and graphs with legends, titles, labels and captions.

Research Project: The research project will be done in four phases: a 1st project update, a 2nd project update, a 3rd project update, and a final project (which consists of a typed manuscript and a presentation). Each of these phases will bring you closer to having a complete research project. The goal of this research project is to have, by the end of the semester, quality work that can be presented to the class and LMU faculty. Even though you will be working in groups each of you will be working independently in a different aspect of your group research project and therefore all updates, summaries, reports, and presentations will be individual assignments. Please read the *Research Project Description* for more information.

Course organization: The format of the course is as follows: a weekly lecture and a bi-weekly computer lab session (or article discussion session). Sometimes we will have lecture and computer lab on the same day.

Study habits: Having self-initiative and willingness to develop good computer and self-learning skills are key requirements of this course. It is essential that you READ THE BOOK and THE ARTICLES and use pencil and paper to work through the material as you read. You may have to re-read things many times in order to understand them. Take the time to learn and practice all the commands in all the computer labs. This will come in handy in your research. It is important that you continuously work on your research even when you are not asked to turn in something. Any extra time you put into your research will definitely be

well-invested. This course will move quickly and you will be expected to read things on your own and be resourceful.

Academic Integrity: Students are expected to abide by the LMU Honor Code as stated in the current Undergraduate Student Bulletin. For more detail information please can refer to pages 57-59 in the new bulletin. Failure to do so will result in a failing grade in the entire course.

You are, however, *highly encouraged* to work and study with your classmates because this can help you learn the material. You can collaborate on problem sets and figure them out jointly but EACH PERSON MUST TURN IN THEIR OWN SOLUTION AND IT MUST BE IN THEIR OWN WORDS. You must include the names of the people that work with you on the top of the first page of your homework. Having the same idea on how to solve a problem is not cheating, but implementing it, line by line, in exactly the same way is not allowed.

Important Deadlines and Grading policy: Course grades will be determined as follows:

Problem Sets:	7%	Weekly
Article Discussions:		
Class Discussions	5%	Sept. 14, Sept. 21, Oct. 12, Oct. 19
Article summary (By 11:30 AM)	5%	Sept. 13, Sept. 20, Oct. 11, Oct. 18
Computer Labs:	10%	Bi-Weekly
Research Meetings:		Bi-Weekly
Typed research update	5%	
Well documented numerics & computations	5%	
Copies of articles & summaries	3%	
Mini Project:	10%	September 26
Research Project:		
1st Project Update	5%	September 12
2nd Project Update	10%	October 12
3rd Project Update	10%	November 2
Final Project:		
Typed Manuscript	15%	*December 5
Poster Presentation	10%	*December 14

*Draft of manuscript will be due Nov. 28 and draft of power point presentation will be due Dec.7

Grades: A : 94-100% A- : 90-93.9% B+ : 87-89.9% B : 84-86.9% B- : 80-83.9%
 C+ : 77-79.9% C : 74-76.9% C- : 70-73.9% D : 60-69.9% F : below 60%

Math 495 Research Project Description: The research project will be done in four phases: a 1st project update, a 2nd project update, a 3rd project update, and a final project. Each of these phases will bring you closer to having a complete research project. The goal of this research project is to have, by the end of the semester, quality work that can be presented to the class and LMU faculty.

The **1st project update** should be a 1-2 page typed document introducing the problem you intend to do, giving the background to the problem, stating the questions you plan to address in your model, giving some ideas on how you plan to accomplish this, and formulating the mathematical model and equations. The last two things might be a little difficult but use your knowledge from previous math and science courses and information from texts, journals, and the web to come up with a logical set of equations and plan of attack. You must clearly describe in words what the equations are saying in reference to your problem. Putting this update together will require doing research, reading, and possibly emailing or talking with me, other professors, and experts on the area.

The **2nd project update** will be a typed report with the following sections: an introduction, derivation and discussion of the mathematical model, analysis and discussion of preliminary results, and further re-

search and directions to take. The introduction should include background, motivation, purpose, objectives and/or questions under consideration. The mathematical model section should include a thorough derivation of the model (equations), and data under analysis (if any). The analysis and discussion section should include explanations of any computations and graphs obtained up to this point and should connect the mathematics back to the objectives. All graphs and tables must have titles, legends, labels, and captions. In the discussion you should mention why you selected such a model, the benefits and drawbacks of your particular approach, what insights you have gained so far if any, what you have learned about modeling and about the particular problem, and what are some things that went wrong and why (if any). The graphs and mathematical results should be used to support your arguments in your discussion. The last section should include some ideas and steps to take next and reasoning behind these ideas/steps.

The **3rd project update** will be an extension of the 1st update and therefore it will contain additional analysis and discussion of any new results. It should also be typed. The structure will be similar except any detailed computation or calculation will be put in an appendix.

The **final project** will consist of a typed report similar to project update II but written as an article (or manuscript). You must also submit and give a poster presentation of your work. The report should contain a conclusion, a complete list of works cited in its bibliography, graphs and tables with labels, titles and captions throughout its body, and a detailed appendix as a separate component at the end. The poster presentation will be in power point. More details will be given later.

Policies and dates on this syllabus may be changed during the semester.