CALIFORNIA STATE UNIVERSITY FULLERTON

Department of Mathematics

Fall 2023

MATH 370 MATHEMATICAL MODELING

MW 10:00-11:50 (19493)
MH 501

Instructor

Dr. Charles H. Lee
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Office Hours MH 182E

MW 09:00-10:00
W 16:00-17:00

Text Book

A First Course in Mathematical Modeling

By Giordano, et. al. —5th Ed.
Brooks/Cole 2014

Exam Dates

Exam 1	*Wed Sep. 20*
Exam 2	*Wed Nov. 01*
Final Exam	*Mon Dec. 11*

Grade Scale

93%-100%	**A**
90%-92.9%	**A-**
87%-89.9%	**B+**
83%-86.9%	**B**
80%-82.9%	**B-**
77%-79.9%	**C+**
70%-76.9%	**C**
60%-69.9%	**D**
0%-59.9%	**F**

Grade Distribution

HW	**10%**
Quizzes & CA	**15%**
Midterm 1	**15%**
Midterm 2	**15%**
Class Project	**20%**
Final Exam	**25%**
Total Points	**100%**

Course Description: *This course is an introductory course on mathematical models in science and engineering. The course covers dimensional analysis, discrete and continuous dynamical systems, and numerous other topics. Emphases will be on deriving equations and using mathematical tools to make predictions.*

Prerequisites: *MATH 250A; MATH 207 or MATH 250B; MATH 107 and MATH 207, or CPSC 120A and CPSC 120L, or MATH 320, or CPSC 121; all with a "C" (2.0) or better.*

Quizzes: *Short quizzes and computer assignments are given almost everyday.*

Homework: *Homework is an incredibly important component of the course, so be sure to allow sufficient time to work through homework problems. Start early! You are encouraged to work together on Homework assignments, but be sure that the work turned in is your own. This means written by you, not copied from another student, or any other source. You are encouraged to discuss the method of solution with your classmates, but then use that information to write a complete solution individually. Answers without justification will receive no credit. Points will be taken off if homework is not written up neatly.*

Exams: *Each exam consists of two components. The analytical part is to be completed first with NO notes, books, or computer programs. Once the analytical part is submitted, the computational portion can be done with open notes, books, and computer codes.*

Make-up work: *No late or make-up work will be accepted, except verifiable emergencies .*

Software: *It's recommended that you install MATLAB on your computer for this course.*

Withdrawal deadlines*:*

Tue Sep 05 (Drop without a "w")
Mon Sep 18 (Drop with a "w")
Mon Nov 13 (Documentation required)

Emails: *Important information, announcements, and updates will be sent via e-mail, so please check your CSUF e-mail account at least once per business day. You can certainly e-mail me questions as well. I will respond to e-mails within 2 business days. Sometimes, however, communicating Mathematics via e-mail is difficult, so my response might be to come talk to me in Office Hours.*

Academic Integrity: *Students who violate university standards of academic integrity are subject to disciplinary sanctions, including failure in the course and suspension from the university. Since dishonesty in any form harms the individual, other students and the university, policies on academic integrity are strictly enforced. Academic dishonesty violations include, but are not limited to, copying from another student's homework, term paper, or exam, possessing or using unauthorized materials during the exam, or allowing another student to copy your work. If you are caught touching a phone during a quiz or an exam, you will receive an "F" for the course automatically, regardless whether the phone is on.*

Special Needs: *The university requires students with disabilities to register with the Office of Disability Support Services (DSS), located in UH-101 and at (714) 278-3112, in order to receive prescribed accommodations appropriate to their disability. Students requesting accommodations should inform the instructor during the first week of classes about any disability or special needs that may require specific arrangements/accommodations related to attending class sessions, completing course assignments, writing papers or quizzes/tests/examinations.*

Course Schedule

Math 370 — Mathematical Modeling — CSUF — Prof. Charles H. Lee

Week of		Monday	Wednesday
21-Aug-23	23-Aug-23	Mathematical Modeling—Overview Units & Dimensions	Dimensional Analysis (Sec 9.1)
28-Aug-23	30-Aug-23	Dimensional Analysis (Sec 9.1) Raleigh Method	Buckingham-Pi Theorem (Sec 9.2) Buckingham-Pi Theo. Applications (Sec 9.4)
04-Sep-23	06-Sep-23	**Labor Day**	Similitude – Geometric Similarity (Sec 2.3)
11-Sep-23	13-Sep-23	In-class Assignment	Similitude – Dynamic Similarity (Sec 9.5) Reivew
18-Sep-23	20-Sep-23	MATLAB—Introduction	**Exam 1**
25-Sep-23	27-Sep-23	MATLAB—Graphics **Class Project—Introduction**	Modeling Change with Diff Eqs (Sec 1.1)
02-Oct-23	04-Oct-23	Approximating Change with Diff Eqns (Sec 1.2) Sol's to Discrete Dynamical Systems (Sec 1.3)	Systems of Difference Equations (Sec 1.4)
09-Oct-23	11-Oct-23	Least Square Data Fitting (Sec 3.3) **Class Project—Developing Models**	Choosing a Best Model (Sec 3.4) Harvesting in the Chesapeake Bay and One-Term Models (Sec 4.1)
16-Oct-23	18-Oct-23	High-Order Polynomial Models (Sec 4.2) **Class Project—Propose Case Studies**	Smoothing: Low-Order Polynomial Models (Sec 4.3)
23-Oct-23	25-Oct-23	**Class Project—Validating Models**	Discrete Probabilistic Modeling (Sec 6.1) Linear Regression (Sec 6.3)
30-Oct-23	01-Nov-23	Continuous Model—Malthusian & Model Fit (Sec 11.1)	**Exam 2**
06-Nov-23	08-Nov-23	Cont. Model—Logistic & Model Fit (Sec 11.1) Drug Prescription Model (Sec 11.2)	Autonomous Differential Model (Sec 11.4)
13-Nov-23	15-Nov-23	Numerical Solution to Diff Model (Sec 11.5)	Modeling with Systems of Diff Eqs (Sec 12.1) A Competitive Hunter Model (Sec 12.2)
20-Nov-23	22-Nov-23	**Happy Thanksgiving**	**Happy Thanksgiving**
27-Nov-23	29-Nov-23	A Predator-Prey Model (Sec 12.3) **Class Project—Finalization**	**Class Project—Presentation**
04-Dec-23	06-Dec-23	**Class Project—Presentation**	**Class Project—Presentation**
11-Dec-23		**Comprehensive Final Exam 11:00-12:50**	

Course Objectives/Learning Outcomes

The following learning goals are achieved through the course work, including homework, classroom activities, quizzes, exams and projects, which require the student to demonstrate understanding of the mathematical concepts presented in the course and to apply these concepts to the solutions of real world applied problems.

- To use dimensional analysis to analyze and build mathematical models, including scaling laws.
- To use data analysis to find scaling laws that predict the functional relationship between variables.
- To build models of dynamical systems and predict/interpret their behavior by finding fixed points, determining stability and analyzing flow fields (phase planes).
- To derive mathematical models using techniques from optimization and calculus of variations.
- To, in general, build, test, and evaluate mathematical models.