Fordham University

Mathematical Modeling

Math 1700-R01 (15260)

Mon, Thu 4-5:15pm

John Mulcahy Hall 406

This course shows how discrete mathematical models can be built and used to solve problems in many fields including biology, epidemiology, and finance. Topics include linear and non-linear models, stability of fixed points and cycles, parameterized families, and the dynamics of linear systems and Markov processes. Along the way, students will be introduced to vectors, matrix operations, eigenvalues, and complex numbers.

Contact Information

Instructor:	John Adamski, PhD
Email	jadamski1@fordham.edu
Office	JMH 409
Website:	johnadamski.com
Office Hours:	Wed 11am-1pm and 2:30-4:30pm in the Math Help Room, JMH 410

Textbook

We will be using the text *Introduction to Mathematical Modeling Using Discrete Dynamical Systems* by Frederick R. Marotto. The author has generously provided a free PDF for use in this course. It can be found on the Content page of our course Blackboard.

Additional reading materials will be distributed through Blackboard as the semester progresses.

Homework

Beginning the second week of the semester, homework assignments based on the week's material will be distributed during Thursday's class and due at the beginning of class the following Thursday. It is important that you keep up with this pace and do not fall behind. Incomplete work will be accepted and partial credit will be given, but late assignmets will not be accepted. Some homework problems will be easy, and some will be challenging. Some homework problems will refer to additional readings (included in the assignment). You are expected to solve all of the given problems to the best of your ability and show all of your work. Correct answers with no work shown will not receive full credit. You should take time to make your work neat and legible. Keep in mind that someone other than yourself will be reading what you write, so write in a way that others can follow. I will grade and return all submitted assignmets the following week, along with my own detailed solutions.

Exams

There are two in-class Midterm Exams and a cumulative Final Exam, which are tentatively scheduled as follows.

Midterm Exam #1:	Thursday 10/7
Midterm Exam #2:	Thursday 11/11
Final Exam:	TBD

Make-up exams will only be permitted for excused absences. In order to qualify for a make-up exam, the student must contact me within 24 hours of the absence by email and be prepared to follow the college's policy on excused absences.

Grades

Your course grade will be calculated using the following rubric.

30%	Homework (lowest grade dropped)
20%	Midterm Exam #1
20%	Midterm Exam #2
30%	Final Exam

Attendance

Students are expected to attend all lectures. It is your responsibility to know what happens in class. The best way to fulfill this obligation is to come to every class meeting. I will take attendance because I have a duty to maintain accurate records relating to our course.

Absence is not an excuse for coming to class unprepared. Students may be dropped after 3 absences.

Academic Integrity

From the university's website:

> A university, by its nature, strives to foster and recognize originality of thought, which can be recognized only when people produce work that is theirs alone, properly acknowledging information and ideas that are obtained from the work of others. It is therefore important that students must maintain the highest standards with regard to honesty, effort, and performance.
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> As a Jesuit, Catholic university, Fordham is committed to ensuring that all members of the academic community strive not only for excellence in scholarship but also for integrity of character. In the pursuit of knowledge and personal development, it is imperative that students present their own ideas and insights for evaluation, critique, and eventual reformulation. As part of this process, each student must acknowledge the intellectual contributions of others.

By being enrolled at Fordham University, students are bound to comply with the Univeristy Code of Conduct, which includes, but it not limited to the Standards of Academic Integrity. For more information, see Undergraduate Academic Integrity Policy.

Disabilities

Under the Americans with Disabilities Act, all members of the campus community are entitled to equal access to the programs and activities of Fordham University. If you have (or think that you might have) a disability that may impact your participation in the activities, coursework, or assessment of this course, you may be entitled to accommodations through the Office of Disability Services. You can contact them at 718-817-0655, disabilityservices@fordham.edu, or by visiting the lower level of O'Hare Hall (Rose Hill campus) or Lowenstein 408 (Lincoln Center campus).

Whether or not you have documentation for accommodations, your success in this class is important to me. If there are aspects of this course that are not accessible to you, please let me know as soon as possible so that we can work together to develop strategies to meet both your needs and the requirements of the course.

Course Schedule

Day	Date	Agenda
1	9/2	Welcome, 1.1 Modeling Reality, 1.2 Discrete Dynamical Systems
2	9/8	2.1 Some Linear Models
3	9/9	2.2 Linear Equations and their Solutions
4	9/13	2.3 Homogeneous Equations and their Applications
5	9/16	2.4 Solutions of Non-Homogenous Equations
6	9/20	2.5 Applications of Non-Homogeneous Equations
7	9/23	2.6 Dynamics of Linear Equations
8	9/27	2.7 Emperical Models and Linear Regression
9	9/30	3.1 Some Non-Linear Models
10	10/4	3.2 Autonomous Equations and their Dynamics
11	10/7	**Midterm Exam #1 (chapters 1-2)**
12	10/14	3.3 Cobwebbing, Derivatives, and Dynamics
13	10/18	3.4 Some Mathematical Applications
14	10/21	3.5 Periodic Points and Cycles
15	10/25	3.6 Parameterized Families
16	10/28	3.7 Bifurcation and Period-Doubling
17	11/1	3.8 Chaos
18	11/4	4.1 Some Linear Systems Models
19	11/8	4.2 Linear Systems and their Dynamics
20	11/11	**Midterm Exam #2 (chapter 3)**
21	11/15	4.3 Some Vector and Matrix Arithmetic
22	11/18	4.4 Stability and Eigenvalues
23	11/22	4.5 Repeated Real Eigenvalues
24	11/29	4.6 Complex Numbers and their Arithmetic
25	12/2	4.7 Complex Eigenvalues
26	12/6	4.8 Non-Homogeneous Systems
27	12/9	Additional Topics
Optional	TBD	Review
Final	TBD	**Final Exam (cumulative)**