MATH 373: Introduction to Mathematical Biology
Spring 2023 Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

Course Description: This course provides an introduction to the use of mathematical techniques applied to problems in biology. Discrete and continuous models of biological phenomena will be discussed. Biological topics discussed range from the subcellular molecular systems and cellular behavior to physiological problems, population biology and developmental biology. Techniques of phase plane analysis for differential equations are introduced in the course. No prior background in biology is necessary. Effective From: Spring 2022.

Number of Credits: 3

Prerequisites: Math 211 with a grade of C or better or Math 213 with a grade of C or better or 213H with a grade of C or better and Math 337 with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 373-002	Professor J. MacLaurin

Office Hours for All Math Instructors: Spring 2023 Office Hours and Emails

Required Textbook:

Title	*A Primer on Mathematical Models in Mathematical Biology*
Author	Edelstein-Keshet and Segel
Edition	2nd
Publisher	Springer
ISBN #	978-1-611972-49-8

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 3, 2023**. It will be strictly enforced.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Homework	25%
Quiz and Attendance	20%
Midterm Exam I	20%
Midterm Exam II	15%
Final Project	20%

Your final letter grade will be based on the following tentative curve.

A	90 - 100	**C**	70 - 74
B+	85 - 89	**D**	60 - 69
B	80 - 84	**F**	0 - 59
C+	75 - 79		

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy. This policy will be strictly enforced.

Homework: Homework is due in class - typically one week after it is assigned. Late homework will either be penalized or not accepted. The two lowest homework scores will be dropped.

Quiz Policy: There will be a quiz roughly every second Friday. Most of the quizzes will be written (in class), and some will be online. Lowest quiz score will be dropped.

Project: The final project will include an oral presentation made during the final exam period (May 5 - May 11, 2023). The oral presentation will not be directly assessed - however a coherent presentation certainly won't harm the grading of your final project.

Exams: There will be two midterm exams held in class during the semester and one comprehensive final exam.

Midterm Exam I	TBA
Midterm Exam II	TBA

Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

Makeup Exam Policy: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an

exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

Software: For this class, you will be required to write code and simulate models using computer programming. It is recommended that you use MATLAB (since I can assist you with MATLAB). However those adept with other languages, such as Python or XPP can use these if they prefer. MATLAB is a mathematical software program that is used throughout the science and engineering curricula. Students can download it to their computers from the IST software downloads page.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

Canvas: The course will be administered through Canvas. I will usually contact the entire class by sending a message through Canvas, so make sure to check this regularly. New assignments and quizzes will be uploaded to canvas. The assignments must be submitted to Canvas as well.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Spring 2023 Hours)

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for Instructor Office Hours and Emails. These office hours will be held virtually on Webex. Make sure that you come to my personal room (send me an email to let me know that you are there if I don't notice)

https://njit.webex.com/meet/maclaurinjit.edu

Additional Textbooks: If you require further assistance with dynamical systems theory, try the textbook "Nonlinear Dynamics and Chaos" by Strogatz. Extra information on stochastic processes may be found in "Stochastic Processes: Theory for Applications" by Gallager and "An Introduction to Stochastic Processes with Applications in Biology" by Linda Hamilton. Other textbooks on mathematical biology include "Mathematical Modelling in Biology" by Ingalls, "Mathematical Biology" by Jim Murray and "Methods and Models in Mathematical Biology" by Muller and Kuttler. These are very comprehensive references and good for your projects.

Some good online MATLAB Resources:

It is strongly recommended that you do some of the introductory courses on MATLAB offered by Mathworks (the company that designed MATLAB)

https://matlabacademy.mathworks.com/

You can also check out these courses from MIT:

https://ocw.mit.edu/resources/res-18-002-introduction-to-matlab-spring-2008/other-matlab-resources-at-mit/

Accommodation of Disabilities: The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Scott Janz, Associate Director of Disability Support Services at 973-596-5417 or via email at scott.p.janz@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and

Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

https://www.njit.edu/accessibility/

Important Dates (See: Spring 2023 Academic Calendar, Registrar)

Date	Day	Event
January 17, 2023	Tuesday	First Day of Classes
January 23, 2023	Monday	Last Day to Add/Drop Classes
March 13, 2023	Monday	Spring Recess Begins
March 18, 2023	Saturday	Spring Recess Ends
April 3, 2023	Monday	Last Day to Withdraw
April 7, 2023	Friday	Good Friday - No Classes
May 2, 2023	Tuesday	Friday Classes Meet
May 2, 2023	Tuesday	Last Day of Classes
May 3 - May 4, 2023	Wednesday and Thursday	Reading Days
May 5 - May 11, 2023	Friday to Thursday	Final Exam Period

Course Outline

Week	Dates	Reading	Topic
1	1/17	1.1-1.11	Course Overview
	1/20	2.1-2.6	Biochemical Kinetics and Law of Mass Action
2	1/24	3.1-3.5	Review: Linear ODEs
	1/27	5.1-5.3	Qualitative Behavior of 1d ODEs.
3	1/31		Bifurcations in 1d ODEs.
	2/3	Handout	Stochastic Processes and Microscopic Biochemical Kinetics

4	2/7	Handout	Stochastic Simulation and the Gillespie Algorithm
	2/10	Handout	Equilibrium Distributions for Stochastic Processes
5	2/14	7.1-7.4	Phase Plane Analysis
	2/17	7.1-7.4	Phase Plane Analysis
6	2/21	8.1-8.4	Quasi Steady State Approximation
	2/24	8.1-8.4	Enzyme Kinetics
7	2/28	9.1-9.8	Cooperativity
	3/3		Review
8	3/7		Review
	3/10		**MIDTERM EXAM I**
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9	3/21	7.5-7.8	Oscillations and Hopf Bifurcations.
	3/24	11.1-11.5	Neuronal Dynamics.
10	3/28		
	3/31	Handout	Epidemiology
11	4/4	Handout	
	4/7		Good Friday. No Class.
12	4/11		Review
	4/14		**MIDTERM EXAM II**
13	4/18		**FINAL PROJECT**

	4/21		**FINAL PROJECT**
14	4/25		**FINAL PROJECT**
	4/28		**FINAL PROJECT**
15	5/2		**FINAL PROJECT**

Updated by Professor J. MacLaurin - 1/4/2023
Department of Mathematical Sciences Course Syllabus, Spring 2023