MATH 371: Physiology and Medicine
Fall 2020 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: Mathematical models of organs and organ systems: the heart and circulation, gas exchange in the lungs, electrical properties of excitable membranes, neuro-biological clocks, the renal countercurrent mechanism, muscle mechanics. The biology is introduced with each topic. Emphasis is on quantitative problem solving, model building, and numerical simulation.

Number of Credits: 3

Prerequisites: MATH 222 with a grade of C or better or 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 371-001	Professor J. MacLaurin

Office Hours for All Math Instructors: Fall 2020 Office Hours and Emails

Required Textbook:

Title	*Mathematical Physiology I*
Author	Keener and Sneyd
Edition	2nd
Publisher	Springer
ISBN #	978-0-387-75846-6

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 9, 2020**. It will be strictly enforced.

COURSE GOALS

Course Objectives

- Be able to solve, analyze, and interpret mathematical models of biological phenomena.
- Be able to develop an appropriate mathematical model given a description of a biological system.
- Be able to perform basic programing tasks in MATLAB, and use programing as a tool to obtain a deeper understanding of biological phenomena.

Course Outcomes

- Students have improved geometrical thinking and qualitative problem-solving skills.
- Students have a greater understanding of mathematical modeling as a means of unifying related concepts.
- Students are prepared for further study in mathematics and biology.

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	30%
Attendance	5%
Midterm Exam I	20%
Midterm Exam II	20%
Final Project	25%

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

A	90 - 100	C	70 - 74
B+	86 - 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 Policy: Homework is to be submitted online (usually once per week). The course will be administered using Canvas: you must regularly check your canvas page and email to see upcoming homework due dates. Late homework will not be accepted (and it must be submitted through canvas).

Project: The final project will include an oral presentation made during the final exam period (the Fall 2020 exam times have not yet been scheduled).

Exams: Homework is to be submitted online (usually once per week). The course will be administered using Canvas: you must regularly check your canvas page and email to see upcoming homework due dates. Late homework will not be accepted (and it must be submitted through canvas).

Midterm Exam I	October 12, 2020
Midterm Exam II	November 19, 2020
Final Exam Period	December 15 - 21, 2020

The final exam will test your knowledge of all the course material taught in the entire course. 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 strongly 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.

ADDITIONAL RESOURCES

Additional Textbooks: The textbook `A Primer on Mathematical Models in Biology' by Segel and Edelstein-Keshet. 2nd Edition will be of assistance. If you want additional information on the probability theory & stochastic processes aspect of the course, you can try `Stochastic Processes' by Gallager, but you should hopefully have most of what you need in the main textbook. Also "Modeling and Simulation in Medicine and the Life Sciences" Second Edition by Hoppensteadt and Peskin.

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). The most relevant course is `MATLAB Fundamentals'.

https://matlabacademy.mathworks.com/

You can also try these courses from MIT:

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

Also try the textbook "Matlab for Engineers" by Holly Moore (4th Edition).

The MATLAB Help Documentation is very extensive too.

Math Tutoring Center: Located in Cullimore, Room 214 (See: Fall 2020 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.

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

Accommodation of Disabilities: Disability Support Services (DSS) 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 Chantonette Lyles, Associate Director of Disability Support Services at 973-596-5417 or via email at lyles@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Disability Support 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 Disability Support Services (DSS) website at:

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

Important Dates (See: Fall 2020 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2020	T	First Day of Classes
September 5, 2020	S	Saturday Classes Begin
September 7, 2020	M	Labor Day
September 8, 2020	T	Monday Classes Meet
September 8, 2020	T	Last Day to Add/Drop Classes
November 9, 2020	M	Last Day to Withdraw
November 25, 2020	W	Friday Classes Meet
November 26-29, 2020	R - Su	Thanksgiving Recess - University Closed
December 10, 2020	R	Last Day of Classes
December 11 & 14, 2020	F & M	Reading Days
December 15 - 21, 2020	T - M	Final Exam Period

Course Outline

Week	Date	Reading	Topic
1	9/3	Online MATLAB Course	Course Overview
2	9/8	1.1 – 1.3 and 1.6. Segel 2.1 – 2.4	Biochemical Kinetics and Compartmental Modeling.
	9/10		
3	9/14	3.1-3.5 in Segel.	Linear ODEs. Review
	9/17		
4	9/21	2.9	Stochastic Processes
	9/24		Stochastic modeling of biochemical processes
5	9/28	1.4	Enzymatic Reactions
	10/1	2.1 , 2.4 – 2.8	Cellular Homeostasis
6	10/5		
	10/8		Review
7	10/12		**MIDTERM EXAM I**
	10/15	3.1-3.7	Membrane Ion Channels
8	10/19		
	10/22	Chapter 5. Segel Chapter 7.	Excitability, Phase Plane Analysis

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9	10/29		
	11/2	Chapter 9	Neuroendocrine Cells
10	11/5		
	11/9	Chapter 10	Regulation of Cell Function
11	11/12		
	11/16		Review
12	11/19		**MIDTERM EXAM II**
13			**FINAL PROJECT**
14			**FINAL PROJECT**
15			**FINAL PROJECT**