Spring 2024

# MATH 373-002: Intro to Mathematical Biology

C. Diekman

# MATH 373: Introduction to Mathematical Biology
## *Spring 2024 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 222 with a grade of C or better.

**Course-Section and Instructors:**

| Course-Section | Instructor |
|---|---|
| Math 373-002 | Professor C. Diekman |

**Office Hours for All Math Instructors:** Spring 2024 Office Hours and Emails

**Required Textbook:**

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|---|---|
| **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 1, 2024.** 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:

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|---|---|
| **Homework** | 25% |
| **Attendance and In-Class Participation** | 10% |
| **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+** | 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.

**Exams**: There will be two midterm exams during the semester and a final project.

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| Midterm Exam I | March 1, 2024 |
| Midterm Exam II | April 12, 2024 |

**Project:** The final project will include an oral presentation made during the final exam period (May 3 - May 9, 2024) and a written report.

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 will provide examples and can most easily assist you with MATLAB. However, those adept with other languages, such as Python, R, or Julia, can use those 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.

**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 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 2024 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.

**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 If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@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 2024 Academic Calendar, Registrar)

| Date | Day | Event |
|---|---|---|
| January 16, 2024 | Tuesday | First Day of Classes |
| January 22, 2024 | Monday | Last Day to Add/Drop Classes |
| March 10, 2024 | Sunday | Spring Recess Begins |
| March 16, 2024 | Saturday | Spring Recess Ends |
| March 29, 2024 | Friday | Good Friday - No Classes |
| April 1, 2024 | Monday | Last Day to Withdraw |
| April 30, 2024 | Tuesday | Friday Classes Meet |
| April 30, 2024 | Tuesday | Last Day of Classes |
| May 1, 2024 | Wednesday | Reading Day 1 |

| | | |
|---|---|---|
| May 2, 2024 | Thursday | Reading Day 2 |
| May 3 - May 9, 2024 | Friday to Thursday | Final Exam Period |

# Course Outline

| Week | Dates | Reading | Topic |
|---|---|---|---|
| 1 | 1/16 | 1.1-1.11 | Course Overview |
| | 1/19 | 2.1-2.6 | Biochemical Kinetics |
| 2 | 1/23 | | Biochemical Kinetics |
| | 1/26 | 3.1-3.5 | Review: Linear ODEs |
| 3 | 1/30 | 4.1-4.3 | Nondimensionalization and Scaling |
| | 2/2 | | Nondimensionalization and Scaling |
| 4 | 2/6 | 5.1-5.3 | Qualitative Behavior of 1D Nonlinear ODEs |
| | 2/9 | | Qualitative Behavior of 1D Nonlinear ODEs |
| 5 | 2/13 | 6.1-6.4 | Case Study: Spread of an Infection |
| | 2/16 | | Case Study: Spread of an Infection |
| 6 | 2/20 | 7.1-7.8 | Qualitative Behavior of 2D Nonlinear ODEs |
| | 2/23 | | Qualitative Behavior of 2D Nonlinear ODEs |
| 7 | 2/27 | | Review |
| | 3/1 | | **MIDTERM EXAM I** |
| 8 | 3/5 | 10.1-10.7 | Neuronal Dynamics |
| | 3/8 | | Neuronal Dynamics |

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|---|---|---|---|
| -- | -- | ---------- | **SPRING BREAK** |
| 9 | 3/19 | 11.1-11.6 | Excitable Systems |
| | 3/22 | 11.1-11.5 | Excitable Systems |
| 10 | 3/26 | 12.1-12.3 | Models for the Cell Division Cycle |
| -- | -- | ---------- | **GOOD FRIDAY (NO CLASS)** |
| 11 | 4/2 | | Various Math Bio Models from the Literature |
| | 4/5 | | Various Math Bio Models from the Literature |
| 12 | 4/9 | | Various Math Bio Models from the Literature |
| | 4/12 | | **MIDTERM EXAM II** |
| 13 | 4/16 | | **FINAL PROJECT** |
| | 4/19 | | **FINAL PROJECT** |
| 14 | 4/23 | | **FINAL PROJECT** |
| | 4/26 | | **FINAL PROJECT** |
| 15 | 4/30 | | **FINAL PROJECT** |