MATH 450H: Methods of Applied Mathematics I (Capstone I)
Fall 2022 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: Combines mathematical modeling with physical and computational experiments conducted in the Undergraduate Mathematics Computing Laboratory. Effective From: Spring 2009.

Number of Credits: 3

Prerequisites: MATH 331 with a grade of C or better, MATH 337 with a grade of C or better, and MATH 340 with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 450-H01	Professor L. Kondic

Office Hours for All Math Instructors: Fall 2022 Office Hours and Emails

Required Textbook:

There is no mandatory text for this section. The following books and materials are available in the library or will be provided by the instructor.

- Lin and Segel: Mathematics Applied to Deterministic Problems in the Natural Sciences; ISBN: 0898712297;
- Farlow: Partial Differential Equations for Scientists and Engineers; ISBN 048667620X;
- D.J. Acheson, Elementary Fluid Dynamics, Oxford Applied Mathematics and Computing Science Series, 1990, ISBN-13: 978-0198596790;
- K. W. Morton and D. F. Mayers, Numerical Solutions for Partial Differential Equations: An Introduction, Cambridge, 2005, ISBN-13: 978-0521607933j;
- Selected research articles.

University-wide Withdrawal Date: The last day to withdraw with a **M** is **Monday, November 14, 2022**. 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:

Projects	30%
Quizzes	20%
Midterm Exam	20%
Final Exam	30%

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.

Exams: There will be one exam during the semester and a cumulative final exam during the final exam week:

Midterm Exam	TBA
Final Exam Period	December 16 – 22, 2022

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.

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

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Fall 2022 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 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.

Important Dates (See: Fall 2022 Academic Calendar, Registrar)

Date	Day	Event
September 5, 2022	Monday	Labor Day
September 6, 2022	Tuesday	First Day of Classes
September 12, 2022	Monday	Last Day to Add/Drop Classes
November 14, 2022	Monday	Last Day to Withdraw
November 22, 2022	Tuesday	Thursday Classes Meet
November 23, 2022	Wednesday	Friday Classes Meet
November 24 to November 25, 2022	Thursday and Friday	Thanksgiving Recess - Closed
November 26, 2022	Saturday	Saturday Classes Meet
December 14, 2022	Wednesday	Last Day of Classes
December 15, 2022	Thursday	Reading Day
December 16 to December 22, 2022	Friday to Thursday	Final Exam Period

Course Outline

Introduction
Modeling in applied mathematics
Problem formulation and non-dimensionalization
Introduction to perturbation theory
Examples: linear and nonlinear pendulum, projectile problem
Continuum Fields
Introduction to continuum fields with examples: fluid mechanics, elasticity theory
Laplace’s equation and related examples

Application of asymptotic methods to continuum fields
Overview of nonlinear partial differential equations (PDE's): analytical methods
Overview of nonlinear partial differential equations (PDE's): numerical methods
Case Study: Asymptotic Methods in Fluid Mechanics
Systematic asymptotic reduction of Navier – Stokes equation using order-of-magnitude estimates and small-parameter expansion
Numerical methods for nonlinear parabolic equations
Stability theory in fluid mechanics
Applications of stability theory: examples involving thin films
Self-similarity in fluid mechanics