MATH 451H: Methods of Applied Mathematics II (Capstone II)
Spring 2025 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 is a project-based capstone course where students will apply their accumulated knowledge to real-world applications by conducting experimental research projects, under the guidance of faculty members, complemented with mathematical modeling, data analysis, and computational techniques. Students will learn to integrate their theoretical understanding with practical applications in a chosen field from engineering and physics.

Number of Credits: 3

Prerequisites: Math 450H with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 451-H02	Professor S. Afkhami

Office Hours for All Math Instructors: Spring 2025 Office Hours and Emails

Course Materials:

- References and literature will be provided by the instructor
- Research articles and course notes will be uploaded on Canvas

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 7, 2025**. 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 and Presentations	50%

Final Report and Presentation	50%

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.

Religious Observance: NJIT is committed to supporting students observing religious holidays. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, ideally by the end of the second week of classes and no later than two weeks before the anticipated absence.

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: Spring 2025 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 2025 Academic Calendar, Registrar)

Date	Day	Event
January 21, 2025	Tuesday	First Day of Classes
January 27, 2025	Monday	Last Day to Add/Drop Classes
March 16, 2025	Sunday	Spring Recess Begins
March 22, 2025	Saturday	Spring Recess Ends
April 3, 2025	Thursday	Wellness day
April 7, 2025	Monday	Last Day to Withdraw
April 18, 2025	Friday	Good Friday - No Classes

April 20, 2025	Sunday	Easter Sunday - No Classes Scheduled
May 6, 2025	Tuesday	Thursday Classes Meet
May 7, 2025	Wednesday	Friday Classes Meet
May 7, 2025	Wednesday	Last Day of Classes
May 8, 2025	Thursday	Reading Day 1
May 9, 2025	Friday	Reading Day 2
May 10 - May 16, 2025	Friday to Thursday	Final Exam Period

PROJECTS

Study And Modeling Of Ferrofluids Under Magnetic Fields:

A ferrofluid is a magnetic liquid that becomes magnetized in the presence of a magnetic field. There is much hope for future biomedical applications of ferrofluids. For example, using ferrofluids that can carry medications to specific locations in the body through the use of applied magnetic fields. In this research project, we will study the motion of ferrofluid drops through a viscous medium. We will build a mathematical model to predict the results of the experimental observations. We will then analyze the results and provide recommendations for optimal design for a biomedical application: restorative treatment of retinal detachment.

Outline:

1. Derivation of a mathematical model for the motion of ferrofluid drops through immiscible viscous media under a magnetic field.

2. Development of a numerical framework for the solution of the mathematical model.

3. Carrying out experiments to study parameters controlling field-induced motion of ferrofluids through immiscible viscous media.

4. Carrying out a detailed comparison of the experimental results with the theoretical/numerical results.

5. Preparation of final report and final presentation

Generative AI

Student use of artificial intelligence (AI) tools is permitted in this course but you must indicate where and how you have used these tools. Additionally, if and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments. Note that students are ultimately ***responsible*** *for developing skills in the course content area and therefore assignments that have errors and*

incorrect results will be graded accordingly regardless of whether or not AI tools are used. If you use AI in your coursework, you are encouraged to attempt to understand generated materials.

Updated by Professor S. Afkhami - 2025
Department of Mathematical Sciences Course Syllabus, Spring 2025