MATH 451-H04 : Methods of Applied Mathematics II
(Capstone II)
Spring 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: Small teams of students conduct research projects under the guidance of faculty members who perform applied research. Effective From: Spring 2009.

Number of Credits: 3

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

Course-Section and Instructors:

Course-Section	Instructor
Math 451-H04	Professor C. Diekman

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

Required Textbook: None. Textbook chapters and journal papers will be provided on Canvas.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 4, 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:

Attendance and In-Class Participation	10%
Homework	25%

Midterm Project Report and Presentation	30%
Final Project Report and Presentation	35%

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

A	90-100	**C**	60-69
B+	85-89	**D**	50-59
B	75-84	**F**	0-49
C+	70-74		

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.

ADDITIONAL RESOURCES

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

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

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

Date	Day	Event
January 18, 2022	Tuesday	First Day of Classes
January 22, 2022	Saturday	Saturday Classes Begin
January 24, 2022	Monday	Last Day to Add/Drop Classes
March 14, 2022	Monday	Spring Recess Begins
March 19, 2022	Saturday	Spring Recess Ends

April 4, 2022	Monday	Last Day to Withdraw
April 15, 2022	Friday	Good Friday - No Classes
April 17, 2022	Sunday	Easter Sunday - No Classes
May 3, 2022	Tuesday	Friday Classes Meet
May 3, 2022	Tuesday	Last Day of Classes
May 4 - May 5, 2022	Wednesday and Thursday	Reading Days
May 6 - May 12, 2022	Friday to Thursday	Final Exam Period

Course Outline

Data assimilation methods seek to optimally combine dynamical models with data measurements in order to understand and predict the behavior of complex nonlinear systems. The projects in this course will explore the use of data assimilation in neurophysiological systems.

Introduction to the theory and practice of data assimilation: sequential (Unscented Kalman Filter, Ensemble Kalman Filter) and variational (3D-Var, 4D-Var) data assimilation algorithms

Introduction to computational neuroscience: models of neuronal dynamics including the Fitzhugh-Nagumo and Hodgkin-Huxley models

Midterm Projects: Students will design and implement data assimilation algorithms to perform dynamical state and parameter estimation using simulated neuroscience data.

Final Projects: Students will design and implement data assimilation algorithms to perform dynamical state and parameter estimation using neuroscience data provided by experimental collaborators.