MATH 451-H04: Methods of Applied Mathematics II (Capstone II)
Spring 2018 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 L. Kondic

Office Hours for All Math Instructors: Spring 2019 Office Hours and Emails

Course Materials:

- M. Wessling, Two dimensional stochastic modeling of membrane fouling, Separation and Purification Technology, 24, 375 (2001).
- I. Griffiths, A. Kumar, P. Stewart Designing asymmetric multilayered membrane filters with improved performance, J. Membrane Science, 511, 108 (2016).
- U. Beuscher, Modeling Sieving Filtration using Multiple Layers of Parallel Pores, Chem. Eng. Technology, 33, 1377 (2010);
- Sanaei, P., Richardson, G.W., Witelski, T. Cummings, L.J., Flow and fouling in a pleated membrane filter, J. Fluid Mech. 795, 36 (2016).
- Sanaei, P., Cummings, L.J., Flow and fouling in membrane filters: Effects of membrane morphology, J. Fluid Mech. 818, 744 (2017).

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 8, 2019**. 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	70%
Final Report and Presentation	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.

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 2019 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 Fenster Hall Room 260. 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:

- http://www5.njit.edu/studentsuccess/disability-support-services/

Important Dates (See: Spring 2019 Academic Calendar, Registrar)

Date	Day	Event
January 22, 2019	T	First Day of Classes
February 1, 2019	F	Last Day to Add/Drop Classes
March 17 - 24, 2019	Su - Su	Spring Recess - No Classes, NJIT Open
April 8, 2019	M	Last Day to Withdraw
April 19, 2019	F	Good Friday - No Classes, NJIT Closed
May 7, 2019	T	Friday Classes Meet/ Last Day of Classes
May 8 & 9, 2019	W & R	Reading Days
May 10 - 16, 2019	F - R	Final Exam Period

Course Outline

Stability of Converging and Diverging Thin Film Flows

LITERATURE

- D.J. Acheson, Elementary Fluid Dynamics, Oxford Applied Mathematics and Computing Science Series, 1990, ISBN-13: 978-0198596790 (available in the library or from the instructor);
- Selected research articles.

THEORETICAL COMPONENT

- Review of Navier-Stokes equations in viscous regime and simplifications for thin film flow;
- Dimensional analysis & identification of small parameters;
- Consistent asymptotic expansion and reduction of complexity;
- Review of linear stability analysis for gravity driven flow down an incline;
- Formulation of the thin film problem appropriate to the flow in angular geometries;
- Linear stability analysis for the flows with time-dependent base state;
- Comparison of the results of linear stability analysis to experimental and computational results.

COMPUTATIONAL COMPONENT

- Methods for solving highly nonlinear partial differential equations;
- Review of finite difference methods;
- Introduction to spectral methods for solving partial differential equations;
- Numerical solution of boundary value problems resulting from linear stability analysis;
- Obtaining numerical predictions for instability development in converging and diverging flows.

EXPERIMENTAL COMPONENT

- Setting up careful experiments of thin film flows in converging and diverging geometries;
- Developing of appropriate visualization techniques;
- Extracting relevant non - dimensional parameters and comparison with computational and theoretical results.