NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 613: Advanced Applied Mathematics I: Modeling
Fall 2018 Graduate 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: Concepts and strategies of mathematical modeling are developed by investigation of case studies in a selection of areas. Consistency of a model, nondimensionalization and scaling, regular and singular effects are discussed. Possible topics include continuum mechanics (heat and mass transfer, fluid dynamics, elasticity), vibrating strings, population dynamics, traffic flow, and the Sommerfeld problem.

Number of Credits: 3

Prerequisites: MATH 331 and MATH 337, or departmental approval.

Course-Section and Instructors

Course-Section	Instructor
Math 613-001	Professor V. Matveev

Office Hours for All Math Instructors: Fall 2018 Office Hours and Emails

Required Textbooks:

Title	*Mathematical Models in the Applied Sciences*
Author	A. C. Fowler
Edition	1st
Publisher	Cambridge University Press
ISBN #	978-0521467032

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, November 12, 2018**. 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:

Assignments	28%
Midterm Exam	32%
Final Exam	40%

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

A	85 - 100	**C+**	58 - 66
B+	76 - 84	**C**	50 - 57
B	67 - 75	**F**	0 - 49

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 Policy: Homework is assigned each week, and is expected to be handed in on time. Late submissions will be penalized.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam. Exams are held on the following days:

Midterm Exam	October 25, 2018
Final Exam Period	December 15 - 21, 2018

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: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

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

ADDITIONAL RESOURCES

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: Fall 2018 Academic Calendar, Registrar)

Date	Day	Event

September 4, 2018	T	First Day of Classes
September 10, 2018	M	Last Day to Add/Drop Classes
November 12, 2018	M	Last Day to Withdraw
November 20, 2018	T	Thursday Classes Meet
November 21, 2018	W	Friday Classes Meet
November 22 - 25, 2018	R - Su	Thanksgiving Recess
December 12, 2018	W	Last Day of Classes
December 13 & 14, 2018	R & F	Reading Days
December 15 - 21, 2018	Sa - F	Final Exam Period

Course Outline

Date	Topic
Sept. 4	Basics of modeling. Units, dimensions, dimensional analysis, and scaling.
Sept. 6	Nondimensionalization and the Buckingham's Π theorem
Sept. 11	Nondimensionalization: examples from various models.
Sept. 13	ODE models: chemical reactions and the principle of mass-action
Sept. 18	ODE models: SRI model for infectious disease propagation in a population
Sept. 20	Perturbation methods, asymptotic series
Sept. 27, Oct. 2	Introduction to continuum models: review of Divergence Theorem, continuity equation, vector calculus, Einstein notation for vector derivatives
Oct. 4, 9, 11	Random walks and the diffusion equation.
Oct. 16, 18, 23	Wave phenomena 1: Maxwell's Equations, electrostatics, EM wave in vacuum
Oct. 25	**MIDTERM EXAM**
Oct. 30, Nov 1	Wave phenomena 2: Traffic modeling, method of characteristics, and shocks.
Nov. 6	Stochastic processes: method of characteristics to solve for the generating function
Nov. 13, 15, 20	Continuum processes: Inviscid and viscous fluid flows
Nov. 27, 29, Dec. 4	Models in mathematical biology: Goldman-Hodgkin-Katz equation, Hodgkin-Huxley and Morris-Lecar models
Dec. 6	Models in mathematical biology: Reaction-diffusion equations and cell calcium dynamics