MATH 573: Intermediate Differential Equations
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: Topics in the qualitative behavior of solutions of ordinary differential equations with applications to engineering problems. Includes phase plane analysis, stability, dynamical systems, and chaos. Effective From: Fall 2010.

Number of Credits: 3

Prerequisites: Math 222 and Math 337 with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 573-001	Professor M. Booty

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

Required Textbook:

Title	*Nonlinear Dynamics and Chaos*
Author	Steven Strogatz
Edition	2nd
Publisher	Westview Press
ISBN #	978-0-8133-4910-7
Website	http://www.westviewpress.com
Required Software:	MATLAB

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

be strictly enforced.

COURSE GOALS

Course Objectives

- Gain a deeper understanding of the relevance and the ubiquitous importance of dynamical systems.
- Learn the meaning of new concepts and theory in the qualitative analysis of differential equations.
- Learn how to apply the knowledge of ordinary differential equations and dynamical systems to problems in applied mathematics, science and engineering.

Course Outcomes

- Students gain deeper knowledge of the theory and applications of differential equations and dynamical systems, and their broad applicability.
- Students are prepared for further study in more advanced mathematics, science and engineering courses.
- Students can apply their knowledge to solve problems in applied mathematics, fluid dynamics, electrodynamics, and other areas of science and engineering.

Course Assessment: The assessment of objectives is achieved through homework assignments and quizzes, and the in-class midterm and final examinations.

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:

Homework and Quizzes	40%
Midterm Exams	25%
Final Cumulative Exam	35%

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

A	87 - 100	**C**	62 - 67
B+	81 - 86	**D**	55 - 61
B	75 - 80	**F**	0 - 54
C+	68 - 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.

Quiz and Homework Policy: Homework problem sets will be emailed at the end of each week, and will be based on the material covered that week. Late homework will not be accepted. A short quiz based on the homework problems will be given about every other week, and will be announced at least one day in advance.

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	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

Date	Lec	Sections	Topic	Assign.
9/6	1	Chap. 1	Introduction, Overview, Review	Selected Problems
9/9	2	Chap. 1, 2.0-2.2	Overview, Review, Stability	Selected Problems
9/13	3	2.3 – 2.8	Population Dynamics, Potentials and Numerics	Selected Problems
9/16	4	3.0 – 3.4	Saddle-Node, Transcritical & Pitchfork Bifurcations	Selected Problems
9/20	5	3.4, 3.6, Chap. 4	Imperfect Bifurcations, Flow on a Circle	Selected Problems
9/23	6	5.0 – 5.2	2D Linear Systems	Selected Problems
9/27	7	5.0 – 5.2, 6.0 –6.2	2D Linear Systems, Phase Portraits	Selected Problems
9/30	8	6.3 – 6.5	Fixed Points, Linearization and Lotka-Volterra Eqs.	Selected Problems
10/4	9	6.5	Conservative and Hamiltonian Systems	Selected Problems
10/7	10	6.5	Conservative and Hamiltonian Systems	Selected Problems
10/11	11	6.6, 6.7	Reversible Systems, Pendulum	Selected Problems
10/14	12	6.7	Structural Stability, Peixoto's Theorem	Selected Problems
10/18	13	7.0 – 7.2	Limit Cycles, Lyapunov Functions	Selected Problems
10/21	14	7.3	Poincaré -Bendixson Theorem <Midterm Review>	Selected Problems
10/25	15	----------	**MIDTERM EXAM**	-------
10/28	16	8.0 – 8.1	2D Bifurcations <PROJECT ASSIGN (due 12/9)>	Selected Problems
11/1	17	8.2-8.3	Hopf Bifurcation and Applications	Selected Problems
11/4	18	8.6	Coupled Oscillators, Quasiperiodicity	Selected Problems
11/8	19	8.7	Poincaré Maps	Selected Problems
11/11	20	9.0 – 9.4	Lorenz and related Equations	Selected Problems
11/15	21	10.0 – 10.2	Cobweb, Logistic Map	Selected Problems
11/18	22	10.3 – 10.4	Logistic Map, Sharkovski's Theorem	Selected Problems
11/23	23	10.5 – 10.6	Lyapunov Exponents, Universality	Selected Problems
11/29	24	11.0 – 11.2	Fractals and Fractal Dimensions	Selected Problems
12/2	25	11.3 – 11.4	Fractals and Fractal Dimensions	Selected Problem
12/6	26	12.0 - 12.1	Strange Attractors and Smale Horseshoe	Selected Problems
12/9	27	12.2 - 12.3	Henon and related Maps <PROJECT DUE>	Selected Problems
12/13	28	----------	Review for **Final Exam**	-------

Updated by Professor M. Booty - 7/28/2022
Department of Mathematical Sciences Course Syllabus, Fall 2022