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Fall 2024

MATH 573-001: Intro Math Analysis

D. Shirokoff

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MATH 473/573: Intermediate Differential Equations
Fall 2024 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 473-001 / 573-001	Professor D. Shirokoff

Office Hours for All Math Instructors: Fall 2024 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 **W** is **Monday, November 11, 2024**. 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	35%
Midterm Exams	15%
Project	20%
Final Cumulative Exam	30%

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

A	90 - 100	**C**	70 - 74
B+	85 - 89	**D**	60 - 69
B	80 - 84	**F**	0 - 59
C+	75 - 79		

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.

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 22, 2024
Final Exam Period	December 15 - December 21, 2024

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 2024 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 need an accommodation due to a disability, please contact the Office of Accessibility Resources and Services at oars@njit.edu, or visit Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is 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: Fall 2024 Academic Calendar, Registrar)

Date	Day	Event
September 2, 2024	Monday	Labor Day
September 3, 2024	Tuesday	First Day of Classes
September 9, 2024	Monday	Last Day to Add/Drop Classes

November 11, 2024	Monday	Last Day to Withdraw
November 26, 2024	Tuesday	Thursday Classes Meet
November 27, 2024	Wednesday	Friday Classes Meet
November 28 to December 1, 2024	Thursday and Sunday	Thanksgiving Recess - Closed
December 11, 2024	Wednesday	Last Day of Classes
December 12, 2024	Thursday	Reading Day 1
December 13, 2024	Friday	Reading Day 2
December 15 to December 21, 2024	Sunday to Saturday	Final Exam Period

Course Outline

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