Fall 2019

MATH 573-001: Intermediate Differential Equations

D. Shirokoff

NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 573: Intermediate Differential Equations
Fall 2019 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: Methods and applications for systems of ordinary differential equations: existence and uniqueness for solutions of ODEs, linear systems, stability analysis, phase plane and geometrical methods, Sturm-Liouville eigenvalue problems.

Number of Credits: 3

Prerequisites: MATH 222, MATH 337, or departmental approval.

Course-Section and Instructors

Course-Section	Instructor
Math 573-001	Professor D. Shirokoff

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

Required Textbook:

Title	*Nonlinear Dynamics and Chaos with Applications to Physics, Biology, Chemistry and Engineering*
Author	S. Strogatz
Edition	2nd
Publisher	Westview Press
ISBN #	978-0813349107
Recommended Materials	Additional papers will be provided by the instructor.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 11, 2019**. It will be strictly enforced.

COURSE GOALS

- Geometric analysis and characterization of ODEs via phase plane analysis. Sketching phase planes.
- Understanding of how (physical) parameters change the qualitative behavior of solutions to ODEs
- Some physical understanding of instabilities, and how they arise from bifurcations.
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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, Quizzes, and Class Participation	35%
Midterm Exam	15%
Project/ Presentation	20%
Final 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.

Exams: There will be one midterm exam held in class during the semester.

Midterm Exam	Tuesday, October 22, 2019
Final Exam Period	December 14 - 20, 2019

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

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:

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

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

Date	Day	Event
September 3, 2019	T	First Day of Classes
September 13, 2019	F	Last Day to Add/Drop Classes
November 11, 2019	M	Last Day to Withdraw
November 26, 2019	T	Thursday Classes Meet
November 27, 2019	W	Friday Classes Meet
November 28-29, 2019	R-F	Thanksgiving Recess
December 11, 2019	W	Last Day of Classes
December 12, 13 2019	R & F	Reading Days
December 14-20, 2019	F - R	Final Exam Period

Course Outline

Lecture	Topic	Assignment
1	Introduction, overview, review of analytical and numerical methods of solving ordinary differential equations (ODEs)	See course website
2	Geometric methods for the qualitative analysis of ODEs. Fixed-points and stability. Linear Stability analysis	"
3	Population growth	"
4	Bifurcations: saddle-node and transcritical	"
5	Bifurcations: pitchfork and imperfect	"
6	Flows on the circle: oscillations	"
7	Two-dimensional linear systems.	"
8	Classification of linear systems	"
9	Phase portraits. Topology of the phase-space	"
10	Fixed-points and linearization	"

11	Conservative and reversible systems	“
12	Limit cycles	“
13	Poincare-Bendixon theorem	“
14	Relaxation oscillators: multi-scale systems	“
15	Weakly nonlinear oscillators	“
16	Applications from the scientific literature	“
17	Bifurcations in two-dimensional systems: saddle-node, transcritical and pitchfork	“:
18	Hopf bifurcations	“
19	Global bifurcations	“
20	Quasi periodicity	“
21	Poincaré maps	“
22	Introduction to Chaos and strange attractors	“
23	One-dimensional maps	“
24	Liapunov exponents	“
25	Review (will be intercalated in between lectures as necessary)	
26	Midterm evaluation	
27	Student presentations	
28	Student presentations	