NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 222: Differential Equations
Spring 2020 Coordinated 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 for solving ordinary differential equations are studied together with physical applications, Laplace transforms, numerical solutions, and series solutions.

Number of Credits: 4

Prerequisites: Prerequisite: MATH 112 with a grade of C or better or MATH 133 with a grade of C or better.

Course-Section and Instructors

Course-Section	Instructor
Math 222-002	Professor I. Cohanoschi
Math 222-004	Professor Y.-N. Young
Math 222-006	Professor R. Goodman
Math 222-010	Professor C. Turc
Math 222-012	Professor I. Cohanoschi
Math 222-014	Professor R. Bouayad
Math 222-018	Professor R. Bouayad
Math 222-024	Professor M. Potocki-Dul
Math 222-030	Professor M. Potocki-Dul
Math 222-102	Professor J. Ratnaswamy
Math 222-104	Professor B. Patiak

Office Hours for All Math Instructors: Spring 2020 Office Hours and Emails

Required Textbook:

Title	*Elementary Differential Equations and Boundary Value Problems*

Author	Boyce and DiPrima
Edition	11th
Publisher	John Wiley & Sons, Inc.
ISBN #	978-1119447399
Website	http://bit.ly/math222njit

Additional Information: Some review materials are on the course homepage. Exam solutions, and MATLAB help are also posted there.

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, April 6, 2020**. It will be strictly enforced.

COURSE GOALS

Course Objectives

- Students should:
  - learn elementary analytical solution techniques for the solution of ordinary differential equations (ODEs)
  - understand the solution structure of linear ODEs in terms of independent homogeneous solutions and non-homogeneous solutions
  - interpret the solutions using plots and methods of calculus.
  - understand the language used to describe elementary ODEs and their solutions and be able to use it.
- Students should:
  - understand by exposure to examples how systems and phenomena from science and engineering can be modeled by ODEs
  - how solution of such a model can be used to analyze or predict a system's behavior. A key example is the damped, forced, simple harmonic oscillator.
- Students should understand the role of initial value problems for ODEs in examples from science engineering, and should be introduced to the role of two-point boundary value problems and Fourier series.
- Students should understand an elementary method for the numerical solution of ODEs and have some familiarity with the solution of ODEs using MATLAB.

Course Outcomes

- Students have improved problem-solving skills, including knowledge of techniques for the solution of ODEs.
- Students have an understanding of the importance of differential equations in the sciences and engineering.
- Students should be prepared for further study in science, technology, engineering, and mathematics.

Course Assessment: The assessment of objectives is achieved through homework assignments and common examinations with common grading.

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	10%
MATLAB	6%
Common Midterm Exam I	18%
Common Midterm Exam II	18%
Common Midterm Exam III	18%

Final Exam	30%

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

A	88 - 100	**C**	58 - 63
B+	83 - 87	**D**	45 - 57
B	73 - 82	**F**	0 - 44
C+	64 - 72		

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: When there is no exam scheduled, homework will be collected once a week during those weeks. Each week one or two problems will be graded. The selected problem(s) to be graded will be the same for all sessions.

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

Common Midterm Exam I	February 12, 2020
Common Midterm Exam II	March 11, 2020
Common Midterm Exam III	April 22, 2020
Final Exam Period	May 8 - 14, 2020

The time of the midterm exams is **4:15-5:40 PM** for daytime students and **5:45-7:10 PM** for evening students. 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 and put away during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Spring 2020 Hours)

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 Kupfrian Hall, Room 201. 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: Spring 2020 Academic Calendar, Registrar)

Date	Day	Event
January 21, 2020	T	First Day of Classes
January 31, 2020	F	Last Day to Add/Drop Classes
March 15 - 22, 2020	Su-Su	Spring Recess: No Classes/ University Open
April 6, 2020	M	Last Day to Withdraw
April 10, 2020	F	Good Friday - University Closed
May 5, 2020	T	Friday Classes Meet - Last Day of Classes
May 6 & 7, 2020	W & R	Reading Days
May 8 - 14, 2020	F - R	Final Exam Period

Course Outline

Week + Dates	Section # + Topic		HW Problem Numbers
WEEK 1: 1/21—1/24	1.1	Some Basic Models; Direction Fields	5, 6, 7, 11, 12, 19
	1.2	Solutions of Some Differential Equations	1, 7 (should say dp/dt), 10
	1.3	Classification of Differential Equations	1, 2, 4, 6, 9, 11, 12
WEEK 2: 1/27—1/31	2.1	Linear Equations; Integrating Factors	6(c), 8(c), 10, 11, 13(b,c), 17, 18, 21, 23, 24, 25
	2.2	Separable Equations	2, 4, 6, 9, 12
	2.3	Modeling with First Order Equations	2, 5, 7, 12, 14(a)
WEEK 3: 2/3—2/7	2.5	Autonomous Equations and Population Dynamics	2, 4, 6, 8, 10, 11
	2.7	Numerical Approximation; Euler's Method	2
	3.1	Homogeneous Equations with Constant Coefficients	3, 5, 6, 8, 10, 13, 15, 16
WEEK 4: 2/10—2/14	**COMMON EXAM 1: WEDNESDAY, FEBRUARY 12, 2020**		
	3.2	Solutions of Linear Homogeneous Equations and the Wronskian	2, 4, 5, 7, 9, 14, 17, 19, 20, 21, 23
	3.3	Complex Roots of the Characteristic Equation	1, 2, 4, 5, 8, 12, 19
WEEK 5: 2/17—2/21 *Matlab assignment #1 due.*	3.4	Repeated Roots; Reduction of Order	1, 5, 7, 9, 11, 12, 19, 22
	3.5	Nonhomogeneous Equations; Undetermined Coefficients	2, 4, 8, 13, 14, 16(a), 17(a), 21(a)
WEEK 6: 2/24—2/28	3.6	Variation of Parameters	2, 6, 7, 9, 10, 12, 13
	3.7	Mechanical and Electrical Vibrations	1, 2, 3, 4, 6, 7, 9, 11, 12, 13
WEEK 7: 3/2—3/6	3.8	Forced Vibrations	1, 4, 6

	5.1	Review of Power Series	15, 17, 18, 19
WEEK 8: 3/9—3/13	**COMMON EXAM 2: WEDNESDAY, MARCH 11, 2020**		
	5.2	Series Solutions of Variable Coefficient Second Order Linear ODEs	3(a,b), 5(a,b),6(a,b),7(a,b)
	6.1	Definition of the Laplace Transform	3, 5, 10, 12, 16, 19, 20, 21
SPRING RECESS, MARCH 15 - 21, 2020			
WEEK 9: 3/23—3/27	6.2	Laplace Transform Solution of Initial Value Problems	1, 2, 3, 4, 6, 10, 16, 17
	6.3	Step Functions	1, 3, 5, 8, 10, 12,14, 15
	6.4	ODEs with Discontinuous Forcing Functions	2, 3, 4, 7, 11, 14
WEEK 10: 3/30—4/3	6.5	Impulse Functions	1, 2, 7
	6.6	The Convolution Integral	4, 5, 7, 8, 9, 14
WEEK 11: 4/6—4/10	7.1	System of First Order Linear ODEs	1, 3, 4, 7(a,b)
	7.2	Review of Matrices	1, 2, 4, 7, 17
WEEK 12: 4/13-4/17	7.3	Review of Linear Algebraic Equations, Eigenvalues, and Eigenvectors (2x2)	14, 15, 16
	7.4	Some Theory for Linear Systems of ODE	none
	7.5	Homogeneous Linear Systems with Constant Coefficients	2b, 3b, 5b, 10, 11
WEEK 13: 4/20—4/24 *Matlab assignment #2 due.*	**COMMON EXAM 3: WEDNESDAY, APRIL 22, 2020**		
	7.6	Complex Eigenvalues	1b, 4b, 8, 11, 14, 23
	10.1 + supplement	Two-Point Boundary Value Problems + Supplement	1, 3, 5, 10, 14, 15, 18 + problems from supplement
WEEK 14: 4/27—5/1	10.2	Fourier Series	1, 5, 6, 7, 13, 15, 16, 19(a,b), 20(a,b), 22(a,b)
	10.4 + supplement	Even and Odd Functions (plus PDF supplement on Fourier Series for BVP)	2, 3, 4, 7, 9, 15, 16, 21, 23(a,b), 27(a,b) + problems from supplement
	REVIEW FOR FINAL EXAM		
WEEK 15: 5/4—5/5, REVIEW FOR FINAL EXAM			
FINAL EXAM PERIOD: MAY 8 - 14, 2020			

Updated by Professor R. Goodman- 3/4/2020
Department of Mathematical Sciences Course Syllabus, Spring 2020