

## MATH 689: Advanced Applied Mathematics II: Ordinary Differential Equations *Spring 2019 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:** A practical and theoretical treatment of boundary-value problems for ordinary differential equations: generalized functions, Green's functions, spectral theory, variational principles, and allied numerical procedures. Examples will be drawn from applications in science and engineering.

**Number of Credits:** 3

**Prerequisites:** Math 545 or Math 645, Math 613, and Math 631.

**Course-Section and Instructor**

Course-Section	Instructor
Math 689-002	Professor A. Oza

**Office Hours for All Math Instructors:** [Spring 2019 Office Hours and Emails](#)

**Textbooks:** It may be useful to own one of the following recommended texts but it is not required. Copies will be available on reserve in the library.

**Primary Textbook:** *Boundary Value Problems of Mathematical Physics, Volumes I and II.* By Ivar Stakgold. SIAM Classics in Applied Mathematics vol 29. ISBN: 0-89871-456-7.

**Also Useful:**

- *Green's Functions and Boundary Value Problems.* Third edition. By I. Stakgold and M. Holst. ISBN 0-470-60970-2.
- *Principles and Techniques of Applied Mathematics.* By B. Friedman. ISBN 0-486-66444-9.
- *Applied Mathematics.* By J.D. Logan. ISBN 0-471-74662-2.

**University-wide Withdrawal Date:** The last day to withdraw with a **W** is **Monday, April 8, 2019**. 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:

Homework	65%
Midterm Exam	10%
Final Exam	25%

**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.

AttendanceNote

**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](mailto: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: **Spring 2019 Academic Calendar, Registrar**)

Date	Day	Event
January 22, 2019	T	First Day of Classes
February 1, 2019	F	Last Day to Add/Drop Classes
March 17 - 24, 2019	Su - Su	Spring Recess - No Classes, NJIT Open
April 8, 2019	M	Last Day to Withdraw
April 19, 2019	F	Good Friday - No Classes, NJIT Closed
May 7, 2019	T	Friday Classes Meet/ Last Day of Classes
May 8 & 9, 2019	W & R	Reading Days
May 10 - 16, 2019	F - R	Final Exam Period

## Course Outline

Week	Sections	Topic
1-1	1	Introduction. Linear two-point boundary value problem for an ODE. Examples. The inner product and adjoint operator.

2-3	2	Introduction to distributions (generalized functions). Test functions. The Dirac delta function. Green's functions. Examples of the use of the Dirac delta function.
4-6	3	General, linear, second order boundary value problems. Solution in terms of the Green's function. Discussion of the role of boundary conditions. Self-adjoint and non self-adjoint problems. Problems of general order. The Fredholm alternative and the modified Green's function. Applications and examples.
7-9	4	General theory of eigenfunction representations. Sturm-Liouville eigenvalue problems and their occurrence in the solution of PDE's. Overview of spectral theory of linear operators. Spectral representation. Eigenfunction expansion of the Green's function and modified Green's function.
10-12	5	The eigensystem of a general non self-adjoint operator. Discrete and continuous spectrum. Singular problems. Applications and examples.
13-14	6	Approximation of eigenvalues and eigenfunctions by variational methods. The Rayleigh-Ritz method. Applications and examples. Further topics.

*Updated by Professor A. Oza - 1/21/2019  
Department of Mathematical Sciences Course Syllabus, Spring 2019*

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