

MATH 689: Advanced Applied Mathematics II: Ordinary Differential Equations

Spring 2021 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: 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 Instructors

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

Office Hours for All Math Instructors: [Spring 2021 Office Hours and Emails](#)

Required Textbooks:

Title	<i>Green's Functions and Boundary Value Problems</i>
Author	Stakgold
Edition	3rd Ed.
Publisher	---
ISBN #	978-0471610229
Notes	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. Principles and Techniques of Applied Mathematics. By B. Friedman. ISBN 0-486-66444-9.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 5, 2021**. 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	60%
Midterm Exam	15%
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.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

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 Chantonette Lyles, Associate Director of Office of Accessibility Resources and 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 Office of Accessibility Resources and Services 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 at:

- <https://www.njit.edu/studentssuccess/accessibility/>

Important Dates (See: **Spring 2021 Academic Calendar, Registrar**)

Date	Day	Event
January 19, 2021	T	First Day of Classes
January 23, 2021	S	Saturday Classes Begin
January 25, 2021	M	Last Day to Add/Drop Classes
March 14 - March 21, 2021	Su - Su	Spring Recess - No Classes
April, 2, 2021	F	Good Friday - No Classes
April 5, 2021	M	Last Day to Withdraw
May 4, 2021	T	Friday Classes Meet
May 4, 2021	T	Last Day of Classes
May 5 & May 6, 2021	W & R	Reading Days

Course Outline

Week	Topic
1-1	Introduction. Linear two-point boundary value problem for an ODE. Examples. The inner product and adjoint operator.
2-3	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	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	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	The eigensystem of a general non self-adjoint operator. Discrete and continuous spectrum. Singular problems. Applications and examples.
13-14	Approximation of eigenvalues and eigenfunctions by variational methods. The Rayleigh-Ritz method. Applications and examples. Further topics.

*Updated by Professor A. Oza - 1/10/2021
Department of Mathematical Sciences Course Syllabus, Spring 2021*