Fall 2019

MATH 690-001: Advanced Applied Mathematics III - Partial Differential Equations

A. Oza

NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 690: Advanced Applied Mathematics III: Partial Differential Equations
Fall 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 initial- and boundary-value problems for partial differential equations: Green's functions, spectral theory, variational principles, transform methods, and allied numerical procedures. Examples will be drawn from applications in science and engineering.

Number of Credits: 3

Prerequisites: MATH 689.

Course-Section and Instructors

Course-Section	Instructor
Math 690-001	Professor A. Oza

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

Required Textbooks:

Title	*Partial Differential Equations of Mathematical Physics and Integral Equations*
Author	R. B. Guenther and J. W. Lee
Edition	1st
Publisher	Dover
ISBN #	978-0486688893
Reference	*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.
Notes	It may be useful to own a book for this course but it is not required. The texts by Kevorkian and Stakgold and a copy of the lecture notes will be on reserve at the library circulation desk.

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, November 11, 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	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.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam. The final exam will be held during the following week:

Midterm Exam	October 15, 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: 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 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. 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

Weeks	Sections	Topic
1-4	Guenther & Lee, Chapters 5 & 9	The diffusion equation. The free -space Green's function or fundamental solution and its construction by various methods. Solution on an infinite, semi-infinite, or bounded domain in 1D. Comparison of different solution techniques: Green's function, eigenfunction expansion, and Laplace transform. Solution in higher space dimensions. Uniqueness of solutions.
5-8	Guenther & Lee, Chapter 8	The Laplace and Poisson equations. The free -space Green's function or fundamental solution. The potential due to distributions of monopoles and dipoles in free -space. Green's formula and fundamental properties of harmonic functions. The Poisson formula and solution of Dirichlet and Neumann problems. Construction of Green's functions for simple geometries. Uniqueness results. Solution in terms of an integral equation. The Helmholtz equation. Fundamental solution and examples.
9-12	Guenther & Lee, Chapters 4 & 10	The wave equation. The D'Alembert solution. The free -space Green's function or fundamental solution. Comparison of different solution techniques on unbounded and bounded domains in 1D. Solution in higher space dimensions. Uniqueness results.
13-14	Guenther & Lee Chapter 11, Lecture notes	**Brief discussion of weak solutions of linear elliptic equations**, Ritz-Galerkin method, Lax-Milgram theorem.