MATH 690: Advanced Applied Mathematics III: Partial Differential Equations
Fall 2020 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 2020 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 9, 2020**. 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, 2020
Final Exam Period	December 15 - 21, 2020

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 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: Fall 2020 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2020	T	First Day of Classes

September 5, 2020	S	Saturday Classes Begin
September 7, 2020	M	Labor Day
September 8, 2020	T	Monday Classes Meet
September 8, 2020	T	Last Day to Add/Drop Classes
November 9, 2020	M	Last Day to Withdraw
November 25, 2020	W	Friday Classes Meet
November 26-29, 2020	R - Su	Thanksgiving Recess - University Closed
December 10, 2020	R	Last Day of Classes
December 11 & 14, 2020	F & M	Reading Days
December 15 - 21, 2020	T - M	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.

Updated by Professor A. Oza - 8/5/2020
Department of Mathematical Sciences Course Syllabus, Fall 2020

E. t. www. On the differential equations of physics. On the partial differential equations of mathematical physics. Introduction. The object of this paper is the solution of Laplace's potential. and of the general. and of other equations derived from these. the general solution of the potential equation is found. In 3, number of results. chiefly relating to particil. solutions of the equation, of the general solution. of them. solution of the. mothons 18 given. number of deductions from this general solution 19 given, equation can simple. plane waves, of gravitation. The general solution Equations of Mathematical Physics (Dover Books on Physics) by A. N. Tikhonov Paperback $31.99. Only 3 left in stock - order soon. Ships from and sold by Amazon.com.Â Soviet mathematician Sergei L. Sobolev specialized in mathematical analysis and partial differential equations. He introduced several mathematical notations that are now fundamental to advanced mathematics, including Sobolov spaces, generalized functions, and the theory of distribution. Product details. Publisher : Dover Publications; Revised edition (February 17, 2011). Save for LaterSave Partial Differential Equations of Mathematical Physics and Integral Equations For Later. Create a List. Download to App.Â Students of mathematics, physics, engineering, and other disciplines will find here an excellent guide to mathematical problem-solving techniques with a broad range of applications. For this edition the authors have provided a new section of Solutions and Hints to selected Problems. Suggestions for further reading complete the text. - Resources for Partial Differential Equations Applets: Heat/Diffusion/Parabolic Equations B. Terrell, Heat equation with modifiable input J. Feldman, Heat Equation J. Blanchard, Parabolic Eq Heat eqn adjustable Dirichlet boundary values, first four eigen-solutions, steady state.Â Texts: P. J. Olver, Lecture Notes on PDEs H. R. Beyer, Introduction to Classical PDEs L. N. Trefethen, Finite Difference and Spectral Methods for ODe and PDEs Matthew J. Hancock, Linear PDEs J. Nearing, Mathematical Tools for Physics E. M. Harrell, J.V. Herod, Linear Methods of Applied Mathematics A. Hood, Applied Mathematics and PDEs B. Birnir, Elementary PDEs and Applications Needs postscript.