

MATH 712: Numerical Methods II

Fall 2021 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: Numerical methods for the solution of initial- and boundary-value problems for partial differential equations, with emphasis on finite difference methods. Consistency, stability, convergence, and implementation are considered.

Number of Credits: 3

Prerequisites: **MATH 614**, **MATH 331** or departmental approval, and proficiency in a computer programming language (MATLAB, C, C++, Fortran, etc.)

Course-Section and Instructors:

Course-Section	Instructor
Math 712-001	Professor P. G. Petropoulos

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

Required Textbook:

Title	<i>Numerical Partial Differential Equations: Finite Difference Methods</i>
Author	Thomas, J.W.
Edition	1995
Publisher	Springer-Verlag New York
ISBN #	978-1-4419-3105-4
Optional Text	1) Finite Difference Schemes and Partial Differential Equations, by J. Strikwerda, SIAM, Philadelphia, 2004; ISBN 0-898715679 2) Finite Difference Methods for Ordinary and Partial Differential Equations, by R.J. LeVeque,

	SIAM, 2007; ISBN 978-0898716290
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University-wide Withdrawal Date: The last day to withdraw with a **W** is **Wednesday, November 10, 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	50%
Midterm Exam	20%
Final Exam	30%

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

A	90 - 100	C	70 - 74
B+	85 - 89	D	60 - 69
B	80 - 84	F	0 - 59
C+	75 - 79		

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. Exams are held on the following days:

Midterm Exam	October 14, 2021
Final Exam	December 15 - 21, 2021

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: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor’s note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

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

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: [Fall 2021 Hours](#))

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for [Instructor Office Hours and Emails](#).

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 Scott Janz, Associate Director of Disability Support Services at [973-596-5417](tel:973-596-5417) or via email at scott.p.janz@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and 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 Office of Accessibility Resources and Services (OARS) website at:

<https://www.njit.edu/studentsuccess/accessibility/>

Important Dates (See: [Fall 2021 Academic Calendar, Registrar](#))

Date	Day	Event
September 1, 2021	Wednesday	First Day of Classes
September 4, 2021	Saturday	Saturday Classes Begin
September 6, 2021	Monday	Labor Day
September 8, 2021	Wednesday	Monday Classes Meet
September 8, 2021	Wednesday	Last Day to Add/Drop Classes
November 10, 2021	Wednesday	Last Day to Withdraw
November 25 to November 28, 2021	Thursday to Sunday	Thanksgiving Recess - Closed
December 10, 2021	Friday	Last Day of Classes
December 13 and December 14, 2021	Monday and Tuesday	Reading Days
December 15 to December 21, 2021	Wednesday to Tuesday	Final Exam Period

Course Outline

	Topics
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1	Review of classification of Partial Differential Equations (PDEs), Fourier analysis of PDEs, symbols of operators, dispersion relations. Well-posedness of Initial-Value Problems for model PDEs
2	Numerical differentiation on a grid. Fourier analysis on a grid. The Evaluation, Truncation, and Interpolation operators.
3	Some simple explicit & implicit Finite Difference (FD) numerical schemes for the model PDEs
4	The concepts of Order of Accuracy, Stability, Consistency, and Convergence of FD numerical schemes
5	Stability of single- and multi-step FD schemes. Introduction to the effect of boundary conditions
6	Dispersion and Dissipation of FD schemes
7	FD schemes for Hyperbolic and Parabolic PDEs and systems in 1 and 2 dimensions
8	Well-posedness of Initial-Boundary-Value-Problems for model PDEs. Stability analysis of FD schemes for Initial-Boundary-Value-Problems for PDEs
9	Applications to nonlinear (Newton iteration) PDEs and to Elliptic PDEs

*Updated by Professor P. G. Petropoulos - 8/19/2021
Department of Mathematical Sciences Course Syllabus, Fall 2021*