

Fall 2019

# MATH 645-001: Analysis I

C. Muratov

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## MATH 645: Analysis I

### *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:** This is the first part of the two-semester course that introduces an application-minded student to foundations and modern techniques of real analysis. Topics covered in this course include measure and integration theory,  $L^p$  spaces, integral inequalities, topological and metric spaces, Banach and Hilbert spaces, contraction mapping, duality, weak convergence, compactness.

**Number of Credits:** 3

**Prerequisites:** **MATH 546** or departmental approval.

**Course-Section and Instructors**

Course-Section	Instructor
Math 645-001	Professor C. Muratov

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

**Required Textbooks:**

<b>Title</b>	<i>Analysis</i>
<b>Author</b>	Lieb and Loss
<b>Edition</b>	2nd
<b>Publisher</b>	Academic Mathematical Society
<b>ISBN #</b>	978-0821827833

**University-wide Withdrawal Date:** The last day to withdraw with a **W** is **Monday, November 11, 2019**. It will be strictly enforced.

### OTHER TEXTS

- J. K. Hunter and B. Nachtergaele, *Applied Analysis*, World Scientific
- H. L. Royden and P. M. Fitzpatrick, *Real Analysis*, Fourth Edition, Pearson

- N. V. Kolmogorov and S. V. Fomin, *Introductory Real Analysis*, Dover
- W. Rudin, *Real and Complex Analysis*, 3rd edition, McGraw-Hill

## 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	30%
Midterm Exam	30%
Final Exam	40%

**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.

**Homework Policy:** Homework will be assigned during class times and collected every couple of weeks.

**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 24, 2019
Final Exam Period	December 15 - 21, 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](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](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:

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

**Important Dates** (See: **Fall 2019 Academic Calendar, Registrar**)

Date	Day	Event
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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

Week	Topics
1	Review of advanced calculus
2	Introduction to measure theory, Monotone Class theorem
3	Uniqueness of measures, measurable functions, Lebesgue integral
4	Monotone convergence and dominated convergence theorems
5	Fatou's lemma, product measures, Fubini's theorem, other theorems
6	Definition of $L^p$ spaces, convexity, Jensen's inequality
7	Hölder's and Minkowski's inequalities
8	<b>MIDTERM (OCT. 25)</b> completeness of $L^p$ spaces
9	Continuous linear functionals, weak convergence, lower semicontinuity of the norms, uniform boundedness principle
10	Dual of $L^p$ , Riesz representation theorem, convolutions, Young's inequality
11	Approximation by smooth functions, Banach-Alaoglu theorem for $L^p$
12	Introduction to function spaces: Hilbert, Banach, metric, topological spaces
13	Spaces of continuous functions, Hölder's spaces, Arzela-Ascoli theorem
14	Contraction mapping theorem and its applications
<b>FINAL EXAM WEEK: DECEMBER 14 - 20, 2019</b>	

*Updated by Professor C. Muratov - 8/6/2019  
Department of Mathematical Sciences Course Syllabus, Fall 2019*