Instructor: Professor Anna L. Mazzucato
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Web page: www.personal.psu.edu/alm24/math501/
Office hours (subject to change): Monday 6 - 7:30 PM.

Please, email if you need to reach the Instructor outside of class or office hours.

**COURSE FORMAT:** There are three 50-minute lectures each week.
Class meets Mo We Fr 11:15AM - 12:05PM in 116 Osmond.

**ONLINE COURSE MANAGEMENT:** We will use CANVAS, Penn State new Course Management System. You can access CANVAS via ANGEL or directly at: https://psu.instructure.com/ or http://canvas.psu.edu.

**Course Description:** The centerpiece of the course is Lebesgue integration theory. The course also covers basic notions and results about abstract topological and metric spaces, as well as some applications of Lebesgue theory, in particular: $L^p$ spaces, convolutions, basic theory of the Fourier Transform.

**Prerequisites:** A good knowledge of basic Real Analysis (at the level of an advanced undergraduate course, such as Math 403-404) is necessary to understand the course.

**Textbook (optional):**

Excellent reference texts are:
- M. E. Taylor, *Measure Theory and Integration*, AMS, 2006,

**Course topics:** Topics in part (1) – (7) form the material for the Qualifying Exam in Analysis, Part A. Topics in part (8) will be covered time permitting.

(2) $\sigma$-algebras, measures and outer measures, sets of measure zero.
(3) Lebesgue measure on $\mathbb{R}^n$, measurable functions, approximation, Egoroff’s and Lusin’s Theorem.
(4) Integration, Fatou’s Lemma, Monotone and Dominated Convergence Theorems, product measures and Fubini-Tonelli Theorem.
(5) Differentiation: Radon-Nikodim Theorem, Lebesgue Differentiation Theorem, absolute continuity and BV functions (on $\mathbb{R}$).
(6) $L^p$ spaces, convolutions, mollifiers.
(7) The Fourier Transform on $L^1$ and $L^2$, inversion formula and Plancherel’s theorem.
(8) Possible additional topics:
    (a) Hausdorff measure and Hausdorff dimension. Fractal and Cantor sets.
    (b) Probability spaces and Brownian motion.

A more detailed list of course topics will be available on CANVAS.

Assignments. There will regularly assigned homework, two in-class midterms. Homework will be assigned and collected usually on Wednesday. The homework is due in class, in person. Homework assignments and solution will be available exclusively on CANVAS.

Midterm 1 is tentatively set for Wednesday October 12. Midterm 2 is tentatively set for Monday December 5.

Grading: Grades will be based on a 10-point scale (for example, A,A-=90%, B,B-, B+=80%). The final grade, an overall assessment of your performance in the course, may be curved.

- HOMEWORK: 50 %;
- MIDTERM 1: 25%;
- MIDTERM 2: 25%.

POLICIES: Collaborations on homework problems is allowed and encouraged. However, each student must turn in their own individual solutions. NO collaboration is allowed during in-class tests. I welcome questions both during and outside class. ALL questions are very useful to both the instructor and the students.

NO LATE HOMEWORK will be accepted for whatever reason. Your lowest homework score will be dropped. There will be NO MAKE-UP EXAMS, unless for documented
and valid reasons, such as illness. In this case, you must inform me IN ADVANCE of the test.

**Attendance** is not required for this course, but strongly encouraged. If you miss class, you are responsible for materials due, concepts covered, and assignments given. It will NOT BE TOLERATED that students arrive late, leave class early, or disrupt class in any way. I will make all efforts to start and finish class on time. Please, discuss any logistic problem with me.

**Classroom seating:** you may choose any seat you like in the classroom, but you are asked to keep the same seating throughout the semester to help me get to know you better.

**Cell Phones** must be TURNED OFF during ALL course activities. ANY electronic device (phones, ipods, ipads, computers, etc) used in class or that disturbs class activities, except when allowed by the instructor, will be CONFISCATED until the end of the class period.

You are required to carefully read and understand this syllabus. Occasional changes in the syllabus or schedule will be available on the Instructor’s web page, or through CANVAS, or announced in class.

**ACADEMIC INTEGRITY:** All Penn State policies regarding ethics and integrity apply to this course. For more information, see:
http://www.science.psu.edu/academic/Integrity/index.html

**DISABILITIES:** Penn State welcomes students with disabilities into the University’s educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at http://equity.psu.edu/ods/. In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at http://equity.psu.edu/ods/guidelines/documentation-guidelines). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.