

The Graduate Center of CUNY Ph.D.
Program in Mathematics Course Syllabus
- Fall 2020

Course Title: Functions of a real variable

Course #: 70100

Time and Location: Wed & Fri 2:00 - 3:30 p.m.

Instructor Name: Elena Kosygina

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Pre-Requisites: An undergraduate course in analysis (see the last paragraph below)

Office Hours: TBD at the first meeting

Description:

This is the first part of the two-semester course in real analysis. This sequence should, in particular, prepare the first year students to take the qualifying exam in real analysis. The goals are, of course, much broader than that and aim at giving the students the working knowledge of a good selection of topics in analysis. We shall consider: topological, metric, and normed spaces, continuous mappings, elements of general measure theory, construction of the Lebesgue measure on \mathbb{R} , Lebesgue integration, absolute continuity, and differentiation.

A more detailed tentative syllabus will be available on BlackBoard before the first meeting. Students need to be able to login to BlackBoard. The grade will be based on homeworks (30%), the midterm (30%) and the final exam (40%). The plan is to give both the midterm and the final exam in class (the reality might be different).

The course does not have a single recommended textbook. Instructor's lecture notes will accompany the course. The closest text for the part about measure theory and integral is by R. Bass, Real Analysis for Graduate Students, available at <http://bass.math.uconn.edu/real.html>. The list below includes standard and not so standard texts:

- A. Kolmogorov and S. Fomin, Intoductory Real Analysis, Dover, 1975 (friendly start)
- H. Royden and P. Fitzpatrick, Real Analysis, 4th ed., Pearson, 2010 (standard)
- G. Folland, Real Analysis: Modern Techniques and Their Applications, 2nd ed., Wiley, 1999 (standard)
- V. I. Bogachev, O. G. Smolyanov, Real and Functional Analysis, 2020 (comprehensive, condensed)

A working knowledge of rigorous undergraduate analysis (several chapters of Rudin's Principles of Mathematical Analysis or a similar undegraduate text) will be assumed. This includes, in particular, the real number system, including the least upper bound property, elementary aspects of cardinal numbers (countable and uncountable sets, the uncountability of the reals), differentiation in several variables, including the inverse and implicit functions theorems. Students are encouraged to review these topics before the beginning of the semester.