

## GCE Syllabus - Real Analysis

**Related course:** MA503 - Lebesgue Measure and Integration.

**Reference textbook:** Any one of the following.

*Real Analysis* (3<sup>rd</sup> Edition) by Royden, chapters 1-4, 6

*Measure and Integral* (1<sup>st</sup> edition) by Wheeden & Zygmund, chapters 1-6, 8, 9.1, 9.2.

**Expected skills:**

- Understanding the foundation of real analysis: basic concepts, theorems, their connections as well as the fundamental ideas behind definitions and theorems.
- Thinking, arguing, and deducing; proving classic theorems and propositions, and simple modifications.
- Reasoning, calculations and applying concepts and theorems to the solution of open ended problems.

**Topics:** The questions of the exam will be related to some of the following topics:

1. **Undergraduate analysis:** open, closed and compact sets (in  $\mathbb{R}^n$  and metric spaces); lim inf and lim sup; continuity and uniform convergence (see the catalog descriptions of MA 3831 and 3832).
2. **Lebesgue measure:** Lebesgue measure in  $\mathbb{R}^n$  including the Cantor set, the concept of a sigma-algebra, the construction of a nonmeasurable set, measurable functions, Egorovs and Lusins theorems, and convergence in measure.
3. **Lebesgue integral:** Properties of the Lebesgue integral, integral convergence theorems,  $L^p$  spaces.

**Exam setting:** 3 hours, closed book.

**Questions:** Usually 3-4 questions (each may include 2 or more parts).

**Note on grading:** In order to pass this exam, you must demonstrate sufficient understanding of the underlying definitions, concepts, and methods. Please keep in mind that this is possible without completely solving the problems, but serious mistakes are considered strong evidence of insufficient understanding.

This syllabus has been adopted by the Department of Mathematical Sciences on 12/08/2020 and is overseen by the Graduate Program Committee.