MATH 222 : ANALYSIS II – MEASURE & INTEGRATION
SPRING 2020

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Instructor: GAUTAM BHARALI http://math.iisc.ac.in/∼bharali/teaching.htm

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THIS IS THE LAST TIME THAT A HANDOUT WILL BE PASSED OUT IN HARD-COPY!
All future announcements/assignments will be posted on the course webpage.

Course summary: This course is an introduction to measure theory and integration, with a considerable emphasis on the real line and $\mathbb{R}^n$. We will begin with basic notions, set up the Lebesgue integral — for positive measures **in general**, but the Lebesgue measure on $\mathbb{R}^n$ will reappear as a recurring example — and explore several notions of convergence of sequences of measurable functions. Thereafter, we shall study product measures, and look at several important results in $\mathbb{R}^n$ that stem from Fubini's Theorem. Finally, we shall study the concept of "change of variables" and the Radon–Nikodym theorem.

Textbooks: Your class notes, and your own solutions to problems (provided they are clearly and systematically written) will form the core of the knowledge acquired from this course. I shall **not follow any single textbook.** The material presented will be sampled from the following:

1. G.B. Folland, *Real Analysis: Modern Techniques and their Applications, 2nd Edition*, John Wiley & Sons, 1999.
   (This is a good source of problems at the level at which the course will be taught)

2. E. Hewitt and K. Stromberg, *Real and Abstract Analysis, 3rd Edition*, Graduate Texts in Mathematics no. 25, Springer-Verlag, 1975.

3. H.L. Royden, *Real Analysis, 3rd Edition*, Macmillan, 1988.
   (I shall follow Royden's approach in most discussions concerning the real line.)

   In my treatment of **some** topics involving the $\mathbb{L}^p$ spaces, I shall loosely follow:
4. R.L. Wheeden and A. Zygmund, *Measure and Integral: An Introduction to Real Analysis*, Marcel Dekker, 1977.
   (**Optional;** recommended if you are interested in exploring deeper results in $\mathbb{R}^n$.)

Tutorials: 5:00–6:00 p.m. on **Wednesdays**

The importance of homework: During the course of the lectures, I shall indicate various problems — which will include points in the proof of a theorem being presented — for you to work on. These, plus other problems will be compiled into assignments. You will not be asked to submit this homework, but it is **essential** for your understanding of the subject that you work on these problems. Also see the section below on **quizzes.** On most weeks, a new assignment will be posted on the course webpage on **Friday night** before 1:00 a.m. of (the following) Saturday.

Assessment: Your assessment will be based on:

- **Quizzes:** The homework assignments will form the material for quizzes, which will be given during the tutorial. These **will not be announced** in advance! The problem(s) on the quiz

will be drawn from the most recent assignment that has been up on the webpage for **at least** 4 days.

- **Mid-term examination:** February 20, 2020, at 10:00 a.m.
- **Final examination:** This will be held during the final-examination week. Date and time will be decided in class some time in March.

  Approximate weightage: Quizzes: *20–25%*, Mid-term exam: *25–30%*, Final exam: *50%*

  where the relative weights of the mid-term exam and the quizzes will be finalised some time after the mid-term exam has been graded.

Tutor for this course: Babhrubahan Bose

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Office hour	**:**	To be decided