

## Syllabus for Math 501, Real Variables.

All reading assignments are to sections in the text of Folland *Real Analysis: Modern Techniques and their Applications*, and of Lieb and Loss, *Analysis*, and to notes posted online.

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**WEEK 1: Sep 3:** (Subject: Introduction to the course, and topological foundations)

Reading: Section 1 of Notes on Topology, posted online

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**WEEK 2: Sep 8,10:** (Subject: topological foundations)

Reading: Sections 2,3 of Notes on Topology, posted online

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**WEEK 3: Sep 15,17:** (Subject: topological foundations,  $\sigma$ -algebras and measurable functions)

Reading: Sections of Notes on Topology, posted online, and then Section 1.1-1.2 and 2.1 in Folland. 1.2-1.3 in Lieb and Loss.

First homework assignment: due Mon, Sep. 15

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**WEEK 4: 22,24:** (Subject: measures on  $\sigma$ -algebras and integration of measurable functions)

Reading: Sections 1.3 and 2.2-2.3 in Folland, 1.4 in Lieb and Loss.

Second homework assignment: due Wed., Sep. 24.

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**WEEK 5: Sep 29, Oct 1:** (Subject: construction of Lebesgue measure on the real line and other useful measures)

Reading: Sections 1.4-1.5 in Folland and online Notes.

Third homework assignment: due Wed., Oct 1.

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**WEEK 6: Oct 6,8:** (Subject: modes of convergence, convergence theorems)

Reading: Section 2.4 of Folland, 1.6-1.9 in Lieb and Loss.

Fourth homework assignment due: Thr., Oct. 9

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**WEEK 7: Oct 13,15,16:** (Subject: product measures, Fubini's Theorem)

Reading: Sections 2.5-27 in Folland and 1.10-1.12 in Lieb and Loss.

• First Midterm Exam Wed., Oct 15. This will be based on the material from weeks 1 through 6.

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**WEEK 8: Oct 20,22:** (Subject: introduction to  $L^p$  spaces as complete metric spaces and applications of the completeness)

Reading: Online notes, Section 6.1 in Folland, 2.1-2.4 and 2.7 in Lieb and Loss.

Fifth homework assignment due: Wed., Oct 22

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**WEEK 9: 27,29:** (Subject: The Reisz-Fischer Theorem and Hilbert space methods)

**Reading:** Online notes, Sections 5.5 in Folland and 2.21 in Lieb and Loss

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**WEEK 10: Nov 3,5:** (Subject: The Lebesgue-Radon-Nikodym Theorem and related matters)

**Reading:** Sections 3.1-3.3 in Folland.

**Sixth homework assignment due:** Thr., Nov 6

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**WEEK 11: Nov. 10,12:** (Subject: complex measures and functions of bounded variation)

**Reading:** Folland Sections 3.1 and 3.5.

**Seventh homework assignment due:** Wed Nov 13

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**WEEK 12: Nov 17,19:** (Radon measures, integration on locally compact Hausdoff spaces)

**Reading:** Sections 4.5 and 7.1-7.2 in Folland.

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**WEEK 13: Nov 24:** (The Riesz Representation Theorem)

**Reading:** Sections 7.3 of Folland, 6.22 in Lieb and Loss.

**Eighth homework assignment due:** Mon. Nov. 24

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**WEEK 14: Dec 1,3,4:** (Subject: Products of Radon measures, construction of Weiner measure)

**Reading:** Section 7.4 in Folland and online notes.

• **Second Midterm Exam:** Wed., Dec. 4

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**WEEK 15: Dec 5,10:** (Selected applications)

**Reading:** Online Notes.

**Ninth homework assignment due:** Wed., Dec 10

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