Lectures: MWF at 10:00 in E17-136.


Office Hours: My office hours are WF 9:00-10:00.

Text: A Course in Minimal Surfaces, by Colding and Minicozzi, AMS Graduate Studies in Mathematics, Volume 121.


Presentations: Students will present several 40 minute lectures in groups. Students will also give a 20 minute presentation on their project.

Projects: Students will do a project in the subject area (topics will be suggested). They will write up a 10 page LaTeX article on the project and then do a revision. They will also give a 20 minute presentation on the project in class.

Exams: There are NO EXAMS.

Grading: The presentations will count 50%, the project 40% and participation/attendance 10%.

Course Timeline: (Subject to change)

- 9/9 and 9/11 Introductory Lectures (Harmonic functions and Section 1.1).
- Student lectures 9/14, 16; Discussion 9/18.
- Student lectures 9/21, 23; Discussion 9/25.
- Student lectures 9/28, 30; Discussion plus project topics 10/2.
- Student lectures 10/5, 10/7; Discussion and project topics due 10/9.
- Student lectures 10/13, 14; Discussion 10/16.
- Student lectures 10/19, 21; Discussion and partial draft due 10/23.
- Student lectures 10/26, 28; Discussion 10/30.
- Student lectures 11/2, 4; Discussion and projects due 11/6.
- Student lectures 11/9; Discussion 11/13.
- Student lectures 11/16, 18; Discussion and revised projects due 11/20.
- Student lectures 11/23; Discussion 11/25.
- Project presentations 11/30, 12/2, 12/4 - and final projects due.
- Project presentations 12/7, 12/9.

This syllabus will be updated in the semester if there are any changes. The current version was prepared on August 27, 2015.
Student Lecture Topics:

1. Chapter 1: Sections 1.2 and 1.3 - Submanifolds and First Variation.
2. Chapter 1: Section 3 - Consequences of First Variation: Harmonicity, Convex Hull Property, Monotonicity and Meanvalue Inequalities.
3. Chapter 1: Section 4 and Exercise 5 - Gauss Map and the Catenoid.
4. Chapter 1: Section 6 - Weierstrass Representation.
5. Strong maximum principle for elliptic equations (pages 326 to 333 in Evans).
7. Chapter 1: Section 8 up to (but not including) 8.3 - Second Variation and Stability.
8. Chapter 1: 8.3 up to (not including) Proposition 1.39 - Stability and Bernstein’s Theorem.
9. Harnack inequality (pages 333-334 in Evans, PDE) and Fredholm Alternative (page 303 in Evans, PDE).
11. Chapter 1: Appendix on the Bochner Formula.
15. Chapter 2: Section 3 - Curvature and Area - finish with Section 3.2.
16. Chapter 2: Section 3 - Curvature and Area - Section 3.3.
20. Chapter 7: Sections 3, 4 - Reilly Formula and Choi-Wang.

Some suggested Project Topics:

- The isoperimetric inequality for minimal surfaces (see, e.g., Chakerian, Proceedings of the AMS, volume 69, 1978).
- The Sobolev inequality (see Chapter 3).
- The Gauss-Bonnet Theorem (see Singer and Thorpe’s book).
- Classify minimal surfaces in $\mathbb{R}^3$ whose Gauss map is one to one (see Theorem 9.4 in Osserman’s book).
- Osserman’s proof of the Nirenberg Conjecture: A complete minimal surface whose Gauss map omits an open set must be flat (Theorem 8.1 in Osserman’s book).
- Mean curvature flow and Huisken’s monotonicity formula (Huisken, JDG, volume 31, 1990).
- Constant mean curvature spheres and the Hopf problem (Hopf, Springer Lecture Notes in Math., volume 1000).