Syllabus for MTH 782: Topics in Topology
Smooth 4-manifolds and Gauge Theory

University of Miami, Fall 2020

`www.math.miami.edu/~cscaduto/teaching/782-fall-2020/`

Instructor:
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Office hours: 1–2 Monday and Wednesday (via Zoom), or by appointment

◆   Class time and location: 11:15–12:05 MWF, Ungar 506 (and on Zoom)

References:
The ultimate reference for much of the course material is *The Geometry of Four-Manifolds* by Donaldson and Kronheimer. However, we will certainly not get to everything in the book in one semester. Other references for particular topics will be given throughout the course.

Description:
What makes dimension 4 special? If $n \neq 4$, any n-dimensional space which is homeomorphic to $\mathbb{R}^n$ is in fact diffeomorphic to it. A remarkable result says that this is not true for $n = 4$: there are uncountably many non-diffeomorphic spaces which are homeomorphic to $\mathbb{R}^4$. This is proved using *gauge theory*. In this course we will study this and other questions about smooth 4-manifold topology, and the gauge theoretic methods that answer them. Topics will include but are not limited to: smooth 4-manifolds, Yang-Mills instantons, Seiberg-Witten monopoles, and knots in 3-manifolds. The goal of the course will be to provide an overview of the subject, with an emphasis on recurring ideas and themes.

Homework:
I will give suggested homework exercises throughout the class.

Grading:
Homework exercises are greatly encouraged, but grading will be based primarily on: (i) your attendance and participation in the course; (ii) you will be asked to give a presentation on a topic related to the course material near the end of the semester.