Mathematics 621: Differential Geometry

Spring 2018   Wednesdays, Fridays 3:05–4:20pm   Physics building 205

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Course web site: I will post assignments, office hours, and other information at `https://services.math.duke.edu/~ng/math621/`.

Course synopsis: This course is a graduate-level introduction to foundational material in differential geometry. Differential geometry underlies modern treatments of many areas of mathematics and physics, including geometric analysis, topology, gauge theory, general relativity, and string theory. The main topics of study will be organized into two overall sections:

- differential topology: differential manifolds, vector fields, tensors, differential forms, and vector bundles

- Riemannian geometry: Riemannian metrics, connections, geodesics, curvature, and topological curvature theorems.

Textbook: The textbook for this course is *Riemannian Geometry* by Manfredo Perdigão do Carmo. As supplementary sources, some of the material covered in the class can be found in *Riemannian Geometry* by Gallot, Hulin, and Lafontaine, and *Smooth manifolds* by Lee. Lecture notes from last year's version of this course are available at `https://services.math.duke.edu/~ng/math621s17/`.

Office hours: TBA, and by appointment (set up in person or by email).

Assignments: There will be weekly problem sets, typically due on Wednesdays. Your grade is based on the problem sets and a take-home final exam.

Monday classes: I will need to be away several times during the semester, and consequently some of our classes will be canceled. I will schedule make-up classes on occasional Mondays in the same time slot (3:05–4:20).

Prerequisites: The formal prerequisite for this course is Math 532, which we will mainly use for the Inverse and Implicit Function Theorems. If you haven't taken Math 532 or an analogous course, **please consult with me** to see if Math 621 is appropriate for you. Our course is fast-paced and I strongly discourage you from taking it if you haven't taken 500-level math courses in the past, at a minimum. There is a 400-level version of this course, Math 421, which is more concrete and less abstract and is also being taught this semester.