Syllabus for Manifolds I. (Math 208 A). Fall, 2017. Prof. Richard Montgomery
web site: http://people.ucsc.edu/ rmont/classes/ManifoldsI/Fall2017/

STANDARD TEXT. Lee. Intro to Smooth Manifolds
OTHER TEXTS: B-G: Bishop-Goldberg
Milnor: Topology from a Differentiable Viewpoint.

Evaluations and grades :
are based on HW, class presentations, a midterm and a take-home final.
HOMEWORK and CLASS PRESENTATIONS : 60 percent, MIDTERM: 20 %, FINAL: 20 %

Skeleton Calendar.
Oct 2. (a Mon) 1st day of class.
Oct 25 (Wed). Midterm.
Nov 6, 8: Substitute (?)
Nov 10 : holiday (Veteran's)
Nov 24: holiday (Thanksgiving)
Dec 6 (Wed) Last Class

OVERVIEW Smooth manifolds are, roughly speaking, the most general topological spaces on which the differential calculus works. They are a central part of the language of modern mathematics, necessary for understanding today's dynamical systems, classical mechanics, general relativity, quantum field theory, algebraic geometry, and algebraic topology.

In our department Ginzburg, Lewis, Lin, Qing, Monard and myself use the language of manifolds, on a regular basis in our work.

Examples: Euclidean space. Spheres. Projective spaces over the reals or complexes. Riemann surfaces. Algebraic varieties over the reals or complexes. Lie groups (eg: $SO(3)$). Quotients of many of the above by "nice" group actions.

This course's goals include learning: what a manifold is and is not, a few examples, focusing on $SO(3)$, understanding what a vector, vector field, covector, one-form is and how to compute with them and in particular how to compute the Lie bracket and what it means. This requires the notion of the flow of a vector field. Also we will cover submanifolds, embeddings, immersions, submersions, the IFTs, and Sard's theorem; Whitney's embedding theorem, and the Poincaré-Hopf theorem. A higher level more philosophical goal is to be able to work in all the three modalities of pictures, coordinates, and algebra, and switch back and forth between these modes of thinking.
