Math 547 | **Geometric Structures** | **Fall 2015**

SYLLABUS

Lectures: MWF 1:30–2:20
Padelford C-401

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Course Web site: www.math.washington.edu/~lee/Courses/547-2015

General description:

This course introduces the most important concepts and tools of Riemannian geometry. The central focus of the course is developing an intimate acquaintance with the geometric meaning of *curvature*, and the technical tools for working with it. After introducing the definitions and studying local properties of curvature, we will proceed to some of the "big theorems" relating curvature to global topological properties.

Text:

The only required text is the following draft book that I will be revising throughout the quarter. (You'll all be partners with me in making sure the book is as good as possible!) Updated versions will be posted on the course website as they become available:

- [RM] J. Lee, *Riemannian Manifolds: An Introduction to Curvature*, 2015 draft second edition.

Reserve Books:

For further information, you might wish to consult the following sources (all will be on reserve in the Mathematics Research Library):

- [ITM] J. Lee, *Introduction to Topological Manifolds*, 2nd edition, Springer, 2011. (Also available online through the Math Research Library website.)
- [ISM] J. Lee, *Introduction to Smooth Manifolds*, 2nd edition, Springer, 2013. (Also available online through the Math Research Library website.)
- M. do Carmo, *Riemannian Geometry*, Manfredo do Carmo, Birkhäuser, 1992.
- P. Petersen, *Riemannian Geometry*, 2nd edition, Springer, 2006. (Also available online through the Math Research Library website.)
- M. Spivak, *A Comprehensive Introduction to Differential Geometry*, Vols. I–V, Publish or Perish, 1979.
- J. Cheeger and D. G. Ebin, *Comparison Theorems in Riemannian Geometry*, Elsevier, 1975.

Prerequisites:

Mathematics 544/545/546, *Topology and Geometry of Manifolds*; specifically, the material in [ITM] and [ISM].

Homework:

I'll assign a problem set at irregular intervals, usually every couple of weeks. In addition, you should do all the assigned reading, and figure out how to do all the *exercises* included in the text, whether assigned or not. The problems listed as "problems to hand in" are to be written up and handed in for grading. When you write them up, please try to follow these guidelines:

- **Citing results:** You may freely cite theorems, propositions, corollaries, lemmas, and exercises from earlier in the book. (For this purpose, the appendices are considered to be earlier than all the other chapters.) But (unless I announce otherwise) the result of a *problem* can only be used if it has been previously assigned, or if you give its solution. You may also use anything from [ITM] or [ISM], including the results of problems and exercises, unless they are substantially identical to what you're being asked to prove. If you look up and use something proved in any other book or on the internet, please explain what you found and where you found it, and write up a proof in your own words of any result that you need to use to solve a homework problem. Please don't look up specific solutions to the assigned problems.

- **Collaboration:** I strongly encourage you to work with other students on the homework. Discussing problems and ideas with your classmates is one of the best ways to absorb new ideas. But when writing up solutions to hand in, please *write your own solutions in your own words.*

- **Assembly:** Arrange your solutions in numerical order, just as they appear on the assignment sheet, with each problem starting on a new page. Problems that are out of order might not get credit. Please staple the pages of each assignment together.

- **Identification:** Make sure the first page of each homework packet is clearly labeled with your name and the assignment number.

- **Typesetting vs. handwriting:** If you are comfortable doing so, I encourage you to submit computer-typeset assignments. I highly recommend LaTeX, since that is the de facto standard in mathematics; but any typesetting program will do. I've posted some helpful typesetting links on the class web page. I'm also happy to accept handwritten assignments, as long as they are neat and legible (see below).

- **Legibility:** If you write by hand, write your answers neatly and legibly, not too small, with as few erasures or crossouts as possible. Be sure to distinguish clearly between similar symbols, such as a/α, $b/6$, $C/\subset$, $\in/\varepsilon$, $g/q/9$, h/n, $I/l/1$, p/ρ, r/γ, $s/5$, $t/+$, $u/v/\nu$, $U/\cup$, $x/\times/\chi$, $y/4$, $z/2$, ζ/ξ, and uppercase/lowercase letters. Unless mathematical ideas spring fully and impeccably realized from your pen, your first draft is not acceptable.

- **White space:** Don't be stingy with white space. *Leave one-inch margins on all sides of your pages.*

Grading:

Your grade will be based on the required homework problems; there are no exams. Roughly speaking, the cutoff for a 4.0 will be somewhere in the 80–90% range, and the cutoff for a 3.0 somewhere around 60–70%.

If you wish, you may register for this course on an S/NS basis (for example, if you have passed prelims and chosen a PhD committee, and are therefore no longer required to register for graded courses). Be sure to tell me if that's what you're doing. In this case, if you attend regularly and hand in complete written solutions to at least two homework problems, I'll record your grade as a 2.7 (for grad students) or 2.0 (for undergrads), which will be converted by the registrar to S (satisfactory).