Math 546 **Topology and Geometry of Manifolds** **Spring 2000**

Additional Reading Suggestions

Any of the books listed on the Math 545 list would be appropriate, or you can choose one of the following.

- R. Abraham and J. E. Marsden, *Foundations of Mechanics*, second edition, Benjamin/ Cummings, 1978. A complete treatment of symplectic geometry and its application to classical mechanics.
- R. L. Bishop and S. I. Goldberg, *Tensor Analysis on Manifolds*, Macmillan, 1968. A classic exposition of manifold theory and Riemannian geometry. This one is particularly useful for its complete treatment of the linear algebra of tensors and multilinear maps.
- R. C. Gunning, *Lectures on Riemann Surfaces*, Princeton University Press, 1966. An introduction to the theory of Riemann surfaces, or one-dimensional complex manifolds. Includes a proof of the uniformization theorem: every surface is complex-analytically covered by the disk, the sphere or the plane.
- J. M. Lee, *Riemannian Geometry: An Introduction to Curvature*, Springer-Verlag, 1997. My introduction to Riemannian metrics, connections, and curvature, designed as a textbook for Math 547, *Geometric Structures*, the sequel to this course. More advanced than this course, but at least it will give you an idea where this all leads.
- J. R. Munkres, *Analysis on Manifolds*, Addison-Wesley, 1991. A general introduction to differential and integral calculus in $\mathbb{R}^n$, including differential forms and Stokes's theorem for submanifolds of $\mathbb{R}^n$.
- B. O'Neill, *Elementary Differential Geometry*, second edition, Academic Press, 1997. The Riemannian geometry of curves and surfaces in 3-space, viewed as concrete subsets of $\mathbb{R}^3$ rather than as abstract manifolds. The fundamental ideas of Riemannian metrics and curvature are developed here without all the excess baggage of abstract manifold theory that's needed to treat the higher-dimensional case.
- B. O'Neill, *Semi-Riemannian Geometry with Applications to Relativity*, Academic Press, 1983. An excellent treatment of the general theory of pseudo-Riemannian (which O'Neill calls semi-Riemannian) metrics, which provide the basic mathematical models of gravitational fields in general relativity. It starts from scratch and treats Riemannian metrics together with pseudo-Riemannian ones, so could in principle be used as an introduction to Riemannian geometry as well.
- M. Spivak, *Calculus on Manifolds*, Benjamin, 1965. This concise little book covers essentially the same material as the book by Munkres listed above. It's too terse to be useful as an undergraduate text (for which it was designed), but it's famous for the economy and elegance of its prose, and useful as a reference.