San José State University
Department of Mathematics

Spring 2009

Math 213: Advanced Differential Geometry

Instructor: Slobodan Simić

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Required Text: William M. Boothby, *An Introduction to Dierentiable Manifolds and Riemannian Geometry*, second revised edition, Academic Press, 2002

Other recommended books: (not required)

- John M. Lee, *Introduction to Smooth Manifolds*, Springer, GTM 218, 2006
- Michael Spivak, *A Comprehensive Introduction to Differential Geometry*, third edition, Publish or Perish, 2005
- Manfredo P. Do Carmo, *Riemannian Geometry*, Birkhäuser, 1992

Prerequisite: Math 113 (with a grade of "C–" or better; we actually won't be using much of Math 113) **or** *instructor consent*.

Office hours: TBA (check the web site)

Homework: Weekly homework assignments will be collected and graded.

It is **essential** that you do *every* homework exercise. My late homework policy is: one class late – 50% penalty, two classes late – no credit.

Tests: There will be a midterm and a final exam (both take-home). Each student will also write a short literature review paper on topic of his choice and present it to the whole class.

Midterm: March 12–19, 2009

Final exam: May 12–19, 2009

There will be no make-up exams.

Grading policy: Homework 20%, Midterm 20%, Paper 20%, Final 40%

Course outline: Introduction to manifolds (Chapter I). Brief review of calculus of several variables (parts of Ch. II). Dierentiable manifolds and submanifolds (Ch. III). Vector elds on manifolds (parts of Ch. IV). Riemannian metric and Riemannian manifolds (Ch. V.1-4). Integration on manifolds (parts of Ch. VI). Covariant dierentiation, parallel transport, the curvature tensor, geodesics (parts of Ch. VII). Curvature (parts of Ch. VIII).

Main goals: Our main goal will be to understand the concept of a Riemannian manifold and its fundamental properties.

The notion of an abstract smooth manifold involves ideas from topology, analysis, and geometry, which is why it is not easy to grasp. We will spend about half of the semester studying smooth manifolds without any extra structure. In the second half, we will focus on the notion of a *Riemannian* manifold, that is, a smooth manifold equipped with a Riemann structure. Our goal will be to understand the notions of geodesics, parallel transport, and curvature, generalizing some of the results of classical differential geometry to higher-dimensional abstract manifolds.

Participation: During class please feel free to stop me at any time and ask questions. I encourage and greatly appreciate students' participation.

Feedback: I appreciate constructive feedback which you can give me via the anonymous feedback form on the class web page, by email, or in person.

Academic integrity: From the Office of Student Conduct and Ethical Development: Your own commitment to learning, as evidenced by your enrollment at San José State University, and the Universitys Academic Integrity Policy, require you to be honest in all your academic course work. Faculty are required to report all infractions to the Office of Student Conduct and Ethical Development. The policy on academic integrity can be found at `http://sa.sjsu.edu/student-conduct`.

Campus policy in compliance with the Americans with Disabilities Act: If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with your instructors as soon as possible, or see them during office hours. Presidential Directive 97-03 requires that students with disabilities register with DRC to establish a record of their disability.

Class attendance: According to University policy F69-24, Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading.