Math 5863-001 Topology II Spring 2003

Meets TuTh 9:00–10:30am in PHSC 120

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This is the second semester of the topology qualifier sequence. It is also a good course to take if you want to know about *the fundamental group* and *covering spaces*. The fundamental group provides a bridge between algebra and topology, which is of central importance in low-dimensional topology and geometric group theory.

We'll learn the basic tools necessary to compute fundamental groups (most important is the Seifert-van Kampen Theorem). We'll learn conditions which ensure that a topological space has a "universal covering space" and, for such a topological space, we'll develop the "Galois correspondence" between its based covering spaces and subgroups of its fundamental group.

Applications to topology will include the classification of surfaces, the Brouwer fixed point theorem for the disk, and the Jordan separation theorem. Applications to algebra include a proof of the fundamental theorem of algebra, a proof that subgroups of free groups are free, the Kurosh theorem on the structure of subgroups of free-products, and (perhaps) a proof of Grushko's theorem.

The textbook for the year-long topology sequence is the following:

- *Topology, 2nd ed.* by James R. Munkres. Prentice Hall (2000).

Other good books for this semester include:

- *Algebraic Topology: an introduction*, by William S. Massey. Springer Graduate Texts in Mathematics: #56
- Chapters 0 and 1 of the online book *Algebraic Topology* by Allen Hatcher. This is available at http://www.math.cornell.edu/~hatcher.