Math 527 - TOPOLOGY

A brief outline or overview of the course content:
Review of general topology, fundamental group, homology theories, index theory, CW complexes, examples of calculations of principal topological invariants.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:

1. Review of general topology. Topological spaces, separation axioms, compactness, connectedness, and path-connectedness. 7 hours
2. Fundamental group. Fundamental group and covering spaces. Definition and basic properties, product. Classification of covering spaces. Free actions of discrete groups, and relation to fundamental group of factors. Fundamental groups of Lie groups. Functorial properties of the fundamental group. Seifert- Van Kampen theorem. 9 hours
4. Index Theory. Differentiable manifolds, including implicit and inverse function Theorems, Sard’s Theorem. Degree of a map. Intersection number. Index of a fixed point for a map and a vector field, Poincare-Hopf, Lefschetz fixed-point formula and its applications. 9 hours
6. Examples of applications of the theory to neural engineering and computational biology. 2 hours

Course Description:
This course provides an overview of the fundamental concepts of Geometric and Algebraic Topology and presents examples of calculations of principal topological invariants. It starts with review of general topology and covers the following topics: fundamental group, homology theories, index theory, CW complexes, and examples of calculations.