TOPICS: This is a companion course to Math 581 — Extremal Graph Theory. The two courses are independent. *Structure of Graphs* includes topics are drawn from the following (not all will be covered).

*Elementary Structural Concepts* — structural and enumerative topics involving trees and related graphs, degree sequences, embeddings of graphs in product graphs. Graph packings and equitable colorings.

*The reconstruction problem* — is $G$ reconstructible from the deck of subgraphs obtained by deleting a single vertex? . . . a single edge?

*Connectivity* — min-max relations for connectivity and branchings, structure of $k$-connected graphs.

*Cycles* — Hamiltonian cycles and circumference in graphs and digraphs.

*Topological Graph Theory* — embeddings on surfaces (without edge crossings), characterizations and properties of graphs embeddable in the plane (separator theorems, proof of Kuratowski’s Theorem, Schnyder labelings), measures of non-planarity, voltage graphs and chromatic number of surfaces. Using discharging for coloring problems on surfaces.

*Joins and flows* — the language of conservative weightings for finding maximal joins and minimum $T$-joins, cycle covers and nowhere-zero flows.

*Graph Minors* — treewidth and the minor order, some discussion of Robertson-Seymour Theorem (every minor-closed family of graphs has infinitely many minimal forbidden minors), forbidden and forced minors.

COURSE REQUIREMENTS: There will be 5 problem sets, each requiring 5 out of 6 problems for 50 points total; no exam. The problems require proofs related to or applying results from class.

PREREQUISITES: Familiarity with elementary graph theory. Either of Math 580 and Math 412 provides sufficient preparation. Interested students with no graph theory background may browse a basic text in advance, such as Diestel, Graph Theory, or the Math 412 text: West, Introduction to Graph Theory (Prentice Hall, 2001, first seven chapters). Important results needed from elementary graph theory will be reviewed.

TEXT: D. B. West, The Art of Combinatorics, Volume II: Structure of Graphs. For some topics, instructor’s supplements will be provided.