MATH 752 **INTRODUCTORY TOPOLOGY** **SPRING 2011**

TR 2:00-3:15 **EMS E228**

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OFFICE HOURS: TR 12:30 - 1:45, and other times by appointment.

COURSE NOTES: available at https://pantherfile.uwm.edu/ancel/www/
in the folder MATH 752 SPRING 2011

COURSE TEXT: *Topology: Second Edition* by James R. Munkres

COURSE OBJECTIVES: Topology is the study of sets equipped with structures called "topologies" which allow one to take limits. A set equipped with a topology is called a "topological space". Topological spaces exist in fantastic variety, illustrating many different phenomena. One type of topological space - manifolds - is a primary focus of modern topology. A manifold is a space which looks locally like a Euclidean space or, more generally, like a topological vector space. Manifolds include Euclidean spaces, Hilbert and Banach spaces, Lie groups, etc. Because of the ubiquity of manifolds, topology finds application in analysis, algebra, geometry and beyond that in physics, chemistry, economics, etc.

Today, topology is broken into three major divisions: general topology, algebraic topology, and geometric topology. General topology investigates the axiomatic foundations of topological spaces and the effects of varying the axioms on these spaces. It delves into properties such as compactness, connectedness and continuity which are fundamental to the rest of topology, as well as to analysis, geometry and parts of algebra. Geometric topology is devoted to the study of manifolds in all their manifestations by intrinsic means. Extrinsic algebraic objects such as groups and rings can be naturally associated to a manifold in a way that illuminates its global structure. The study of these algebraic objects is the preserve of algebraic topology. A newer subarea of topology called geometric group theory in which methods of topology and geometry are used to study algebraic objects called groups has recently become a focus of research for topologists at UWM.

Math 752 will continue the exploration begun in Math 751 of the fundamental concepts and results of general topology including connectness, and product, quotient and function spaces. These ideas are valuable tools for the study of other parts of topology and other areas of mathematics and science. Then the course will turn to basic ideas from algebraic and geometric topology, including the fundamental group, covering spaces and surfaces – as time permits.

As in the first semester, an important pedagogical goal of the course continues to be the development of the students appreciation for and a facility with the method by which pure mathematics acquires knowledge: the regime of conjecture followed by either a proof (resulting in a theorem) or a counterexample. In particular, the course aims to nurture students' ability to understand and create sophisticated mathematical proofs.

CLASSROOM ACTIVITIES: The goal of the class remains the teaching topology while simultaneously developing the student's facility with the conjecture–proof–counterexample regime. Hence, as in the first semester, part of classroom time will still be devoted to student presentations of their solutions of the problems from the class notes. However, in the second semester, the proportion of classroom time devoted to student presentations will decrease while the proportion devoted to lecture will increase.

GRADES AND EXAMS. Grades will be based on three exams (including the final exam) and on in-class presentations of solutions to problems in the course notes. Each is worth 100 points, and in-class presentations are worth 125 points.

TENTATIVE EXAM DATES:

EXAM 1: Tuesday, March 1
EXAM 2: Tuesday, April 12
FINAL EXAM: Wednesday, May 18, 12:30 – 2:30

ADDITIONAL PROBLEMS: As in the first semester, a list of more challenging "Additional Problems" will be distributed. Students are encouraged to solve these and write up and hand in their solutions for extra credit.

SUGGESTIONS FOR PREPARING PROOFS: When you prepare an oral or written proof, remember: **the burden is on you to convince your audience that you know how to do the proof.**

Do not make unsupported assertions. Do not expect your audience to read your mind. If you omit an argument for an assertion in your proof, I will assume that you don't know a correct argument. If the argument in question is similar to an argument you have presented earlier, you should either repeat or refer to the earlier argument so that your audience has a clear idea of what is in your mind.

Do not introduce notation without defining or explaining it.

Proofread your work carefully. Points will be deducted for careless errors.

For work prepared outside of class: don't submit your first draft. Prepare a neat final draft.

The burden is on you to make a well organized and neat presentation of the proof. Points will be deducted for sloppiness and logical disorganization.