SYLLABUS

MAT 441 **Introduction to Topology**
Spring, 2009

College of Engineering, Forestry, and Natural Sciences
Dept. of Mathematics and Statistics
9:10 – 10:00 am, MWF
3 credit hours

Lecturer: Michael Falk, Professor of Mathematics Office: AMB 132, 523-6891
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Course web page: http://www.cefns.nau.edu/∼falk/classes/441/index441.html

Office hours: MF 4:00 – 5:00, TWTh 3:00 – 4:00.
I'm also available to students at other times during the week; no appointment necessary.
Virtual office hours - I encourage students to e-mail me with questions - my e-mail address is above. I will respond quickly.

Web page and e-mail: The course web page given above will include links to exams and problem sets, hints and solutions, study outlines, and other useful information. In case I want to communicate with the entire class, I will express myself on the web page. I will not use the Vista shell, except to procide a link to the course web page.
I will also send occasional e-mails to the entire class. If at some point you decide you do not wish to receive these e-mails, please let me know. Make sure I have an e-mail address for you that is checked regularly.

Prerequisite: Grade of C or better in MAT 431, Real Analysis.

Text: *Beginning Topology*, by Sue Goodman. There are many other introductory topology texts that students may find helpful, including those by Armstrong, Croom, Massey, Munkres, Singer and Thorpe, Roseman, Adams and Franzosa, and many of which are in the Cline Library holdings.

Course Description: Topology is the study of properties of geometric objects that are invariant under continuous transformation or deformation. Such objects may be, for example, curves, surfaces, or higher-dimensional *manifolds*, algebraic or analytic *varieties* (sets defined by algebraic or analytic equations), embeddings of such objects in others (such as knotted circles in three-space), metric spaces, ranging from (Cayley) graphs to infinite dimensional spaces, and even more general sets, such as sets of functions, that are endowed with "topological structure." The title of this course is very appropriate: students will be introduced to several of the diverse flavors of topology: point set (or set-theoretic) topology, geometric topology, algebraic topology, combinatorial topology (and topological combinatorics), and, if time permits, differential topology.

Course outline: We will begin with a study of the basic concepts of point set topology: open sets, connectedness, compactness, subspaces, products, and quotients. These ideas will be applied to the classification of compact surfaces, and to the basic invariant of more general cell complexes, the Euler-Poincaré characteristic. We will then study simplicial (and cellular) homology and betti numbers. Then we will study the definition and basic properties of the fundamental group of a topological space, and compute fundamental groups of cell complexes via the Seifert-Van Kampen theorem. Finally, we will study some knot theory, focusing on polynomial invariants developed in the 1980's, and/or vector fields and differential topology. Students will pursue other parts of the field in individual or group research projects. We will follow the book through Chapters 1, 2, 3, and 6, with some additional material, and then Chapters 5 and/or 7.

Student Learning Outcomes: Students successfully completing this course will understand the basic notions of topology and be able to apply them to solve problems and prove simple topological statements, be able to read and understand elementary papers on topology, and be able to communicate topological ideas orally and in writing in formal mathematical style.

Evaluation: Grades will be based exam performance, scores on daily and weekly homework assignments, and group projects. Grades will be based students' efforts, abilities, and background as reflected in their performance on homework and exams worth a total of 500 points. There will be three midterm exams worth 60, 65, and 75 points respectively, and a *cumulative* final worth 120 points. There will be six problem sets worth 15 points each, 90 points total. There will be two group projects, involving a brief written report and oral presentation, worth 25 points each. There will be a handful of additional suggested exercises from the text, which will be collected at the end of each chapter and checked for completeness, but not graded, worth a total of 20 points. Finally, attendance will be taken in randomly chosen classes, for a total of 20 points. Here is a summary: Midterm exams: 200 points (40%); Final exam: 120 points (24%); Problem sets: 90 points (18%); Projects: 50 points (10%); Exercises: 20 points (4%); Attendance: 20 points (4%).

In particular, *daily and weekly work accounts for over 30% of the course grade.* Thus it is crucial that students hand in assigned homework, especially problem sets, to be successful in this class.

At the end of the semester, I will translate the numerical scores into letter grades, based on clusters and natural breaks in the distribution of students' overall point totals, and my objective assessment of the difficulty of the course and the quality of student performance. Based on my experience in previous classes, I have set the following (high) benchmarks: A – 425 points (85%); B – 375 points (75%); C – 300 points (60%); D – 325 points (55%). In other words, if you can get 750 points you are guaranteed to get at least a B. It is likely that the actual letter-grade cutoffs will be lower. Whatever is the median score will be at least in the middle of the C range; usually the median score is between 62% and 68%. It is very unlikely that the lowest C will be below 50%.

Students may obtain information on their class standing from me at any time. After each exam, I will produce a "provisional curve" to indicate to the class what grades I might give at various points during the semester, but these intermediate curves have no bearing on final grades.

Attendance: Students are expected to attend class, and to make positive contributions to the class by paying attention, taking notes, participating in individual and group exercises, asking questions and/or making relevant comments and corrections.

Exams are based on the lectures and homework, not on the text. The lectures will follow the text sometimes, but not always, and the emphasis of the lectures is often different from that of the text. Students are strongly encouraged to take careful notes. If you miss class, it would be wise to borrow someone's notes to copy.

Homework: There will be two types of homework. Problem sets, worth 15 points each, will be assigned about once per week. (Problem sets will be worth 90 points in all.) Students receive half credit if this work is handed in on time, with evidence of effort. (Keep that in mind when you see your scores: e.g., a score of 10 out of 15 means you got 33% on the graded part of the assignment.) Exercises will be assigned from the text and collected periodically. These will not be graded; rather students will get 2 points per exercise, one point for handing in on time, and one point for merely showing their work, or otherwise indicating that they thought about the exercise (e.g., with a specific question). Exercises are worth 20 points in all; scores are based on the percentage of assigned exercises completed.

Late homework can be handed in any time during the semester for half credit; if handed in by the class period following the due date, the student will receive up to 3/4 credit. Students may *use* posted solutions as they work on late homework, but must rewrite the solutions in their own words – copying verbatim from my solutions is plagiarism. (I won't prosecute.)

Projects : There will be two projects, dues dates listed below. A few weeks into the semester, I will provide a list of possible topics, and a list of sources for other possible topics. Students should work in groups of two or three. Each group will produce a brief, concise, written review (2-4 paragraphs) and make a brief presentation (10-20 minutes) to the class.

Course policies : *Students may bring one sheet of notes to consult during in-class exams.* This is a blanket policy, and will apply even if it is not explicitly announced in class. Three to four pages of notes will be allowed for the final exam.

Students are encouraged to work together and to seek assistance from the lecturer on all homework. It is expected that all written homework will be composed and written individually by each student in a concise, grammatically correct, and readable form.

Tentative exam dates:	Exam 1	Friday 2/13
	Exam 2	Friday 3/13
	Exam 3	Friday 4/17
	Final Exam	Wednesday 5/6, 7:30 – 9:30 am

Exams cover material presented in class and on assigned homework, through the class period prior to the exam. Precise coverage will be announced in class in advance of the exam.

Other important dates :	Friday Jan. 23	last day to add, change to audit, file for grade rplcmt.
	Friday February 6	last day to drop/delete
	Tuesday March 10	midsemester grades submitted
	Friday March 13	last day to drop with a "W"
	Mon - Fri March 16-20	Spring Break
	Friday May 1	Last day of classes

NORTHERN ARIZONA UNIVERSITY
DEPARTMENT OF MATHEMATICS AND STATISTICS
UNIVERSITY AND DEPARTMENT POLICIES – SPRING 2009

Course Prerequisites and Placement: Prior to enrollment in a course in the Department of Mathematics and Statistics a student must have completed the course prerequisites or have proper placement for the course. It is the students' responsibility to check that they are properly enrolled in a course and to drop the course if they are not. Failure to do so could result in not receiving credit for the course. The department may cancel students' registration in a course in which they are not properly enrolled. However, it is the student's responsibility to monitor their own enrollment.

Administrative Drops: An instructor may administratively drop from a course any student who does not attend the first two class meetings. Students who have not met all prerequisites for a course may be administratively dropped. However, it is the student's responsibility to monitor their own enrollment.

Class Attendance: Students are expected to assume full responsibility for class attendance and are accountable for work missed because of absences. Instructors are under no obligation to make special arrangements for students who have been absent unless such absence has been excused by a formal institutional excuse. Institutional excuses permit a student to be absent from classes to represent the University in athletics and extracurricular or academic activities. Institutional excuses must be hand-delivered to the instructor and arrangements made for the work missed prior to the planned absence from class.

Dropping/Auditing a Course: The last day you may drop a course (and receive a **W)** is **March 13, 2009.** Academic policy requires that a student who never attended class or stopped attending class receive an **F** should the student fail to officially drop the course. The deadline to change from credit to audit or vice versa is **January 23, 2009**. Once a student has registered and completed a class as an auditor, the audit grade cannot be changed to a credit-earning grade. The grade of **AU** is awarded to auditors for satisfactory attendance. See the most recent *Undergraduate Catalog* for more information at http://www4.nau.edu/academiccatalog/2008/academiccatalog.htm

The Grade of Incomplete: A grade of **I** is given by an instructor only if a student is unable to finish a course due to extraordinary, unforeseeable circumstances, and the deadline to drop has passed. An incomplete is only given to a student who was passing the course with a grade of **C** or higher at the time the student was forced to stop attending. Before a grade of **I** can be given the student and instructor must complete the official department form indicating the work to be completed, as well as the date(s) by which the work must be completed. A grade of **I** not removed within a one-year period automatically reverts to a grade of **F**.

End of Semester Week: The Department of Mathematics and Statistics has been granted exemption from the University End of Semester Week policy and has explicit university approval to schedule tests during End of Semester Week.

Final Examinations: Final examinations are required in all classes and must be given at the scheduled times and dates indicated in the university final exam schedule. An exception to the official Final Examination Schedule can be made if a student is scheduled to take more than two examinations in one day.
See http://home.nau.edu/registrar/calendars/FinalExam1101.asp for more information.

Other University Policies
Students are responsible for the following policies: Safe Environment, Students with Disabilities, Institutional Review Board, Academic Integrity, and Academic Contact Hour. A copy of these policies may be downloaded from the web site http://www2.nau.edu/academicadmin/UCCPolicy/plcystmt.html.

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