SYLLABUS – MAT 548
ADVANCED TOPOLOGY AND GEOMETRY, FALL 2025

Tues. and Thurs. 9:30-10:50 AM
in Physics P130

COURSE DESCRIPTION:

This course, together with MAT 531, forms the first year topology/geometry sequence for Ph.D. students. This course will cover important basic notions in geometry and topology and discuss relations between them.

Topics on the geometry side will include the basics of smooth manifolds and smooth maps, submanifolds, Sard's theorem, the notion of transversality and the Transversality Theorem for Families. There will be many applications of these concepts including, for example, the Whitney Immersion and Embedding Theorems. Vector fields and flows and basic Lie Group Theory will be discussed.

Topics on the topology side will include: The fundamental group and the complete theory of covering spaces, higher homotopy groups, the basics of CW complexes, fibre bundles, fibrations, and the topological classification of 1- and 2-manifolds.

A strong foundation in point-set topology will be assumed as a prerequisite. It will also be expected that the students have seen smooth manifolds and the fundamental group before, so this material is not entirely new, but we will develop the foundations in detail.

INSTRUCTOR: Blaine Lawson

Office: 5-109 Math Tower

E-mail: blaine@math.sunysb.edu

Web site: http://www.math.sunysb.edu/ blaine

Office Hours: Tu.-Thu. 11::00 AM – 12:30 PM, or make an arrangement for another time. The best way to contact me is by e-mail, which I read often.

GRADER: Yichen Cheng

E-mail: yichen.cheng@stonybrook.edu

Office: 2-109 Math Tower

Office hours:
- Wednesday 10:00am-11:00am
- MLC Hours are Tuesday 5:00pm-7:00pm.
- also by appointment

HOMEWORK. Homework will be due at the beginning of class each Tuesday.

EXAMS.
There will be two exams. The first will be on October 16th and the second will be on December 4th.

COURSE GRADING. Homework will count 30%, and each exam will count 35%.

TEXTBOOK No. 1.
Title: **Introduction to Smooth Manifolds, 2nd Edition** ,
Author: John M. Lee
Publisher: Springer, Graduate Texts in Mathematics, No. 218
ISBN 978-1-4419-9981-8

TEXTBOOK No. 2.
Title: **Algebraic Topology** ,
Author: Allen Hatcher
Publisher: Cambridge University Press
This book is available FREE online.

OTHER RESOURCE BOOKS
Title: Topology from the Differentiable Viewpoint
Author: John Milnor
I strongly suggest reading this book. It is a classic.

Title: Homotopical Topology
Authors: Fomenko, Fuchs
Publisher: GTM 273

Disability Support Services: If you have a physical, psychological, medical, or learning disability that may affect your course work, please contact Disability Support Services (DSS) office: ECC (Educational Communications Center) Building, room 128, telephone (631) 632-6748/TDD. DSS will determine with you what accommodations are necessary and appropriate. Arrangements should be made early in the semester (before the first exam) so that your needs can be accommodated. All information and documentation of disability is confidential. Students requiring emergency evacuation are encouraged to discuss their needs with their professors and DSS. For procedures and information, go to the following web site http://www.ehs.sunysb.edu and search Fire safety and Evacuation and Disabilities.

Academic Integrity: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instance of academic dishonesty to the Academic Judiciary. For more comprehensive information on

academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/.

Critical Incident Management: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, and/or inhibits students' ability to learn.