Syllabus for Math 140a: Geometry of Manifolds

Instructor: Daniel Ruberman
Email: ruberman@brandeis.edu
Phone: (781) 736-3074

This course covers the basics of smooth manifolds including their analytic and topological structure. The main background needed is a good foundation in real analysis. Topics will include

1. Manifolds, change of coordinates, differential structure; manifolds with boundary.
2. Tangent vectors and the tangent bundle; differential of a smooth map.
3. Submersions and embeddings.
4. Immersed and embedded submanifolds.
5. Transversality and implicit function theorems.
6. Integral curves; flows; Lie derivative.

Optional (if time permits): Basic Lie Groups - Lie algebra, one parameter subgroups, structural equations, left and right invariant vector fields.

Prerequisites: MATH 110a and 110b or permission of the instructor. Math 151ab are both highly recommended.

Text: J. M. Lee, Introduction to smooth manifolds, Second edition. Please get hold of the second edition; it is fairly different from the first. Currently, the book may be downloaded (legally, and at no cost) from the publisher’s web site.

Additional References:
F. Warner, Foundations of Differentiable Manifolds and Lie groups.
J. Milnor. Topology from the Differentiable Viewpoint.
R. Bott and L. Tu, Differential Forms in Algebraic Topology.
V. Guillemin and A. Pollack, Differential Topology

Structure of the class:
This course will be taught entirely on Zoom; the link is on the class LATTE page https://moodle2.brandeis.edu/course/view.php?id=20730. Registration is required to access this page (using your UNET ID and password) but anyone interested in sampling the class without registering can contact me directly. All classes will be recorded, with the Zoom files accessible through the class LATTE page.
Most classes will mainly consist of lectures, together with discussion and in-class work in smaller groups using the Zoom breakout room feature. Some of the in-class work will grow out of the lectures, some will be for discussion of upcoming or past homework, and some will be based on readings provided in advance. Students who miss a class or are not able to participate synchronously because of their time zone will be able to view the class sessions as a Zoom recording. In-class participation requirements will be waived for such students, but such work may be made up in group discussions scheduled for a more convenient time.

Class meeting times: Monday, Wednesday, 12-1:30 pm.
Zoom Office hours: Thursdays 10-12. For link see the class LATTE page.

Credit hours: Success in this four-credit course is based on the expectation that students will spend a minimum of nine hours of study time per week in preparation for class (readings, papers, discussion sections, preparation for exams, etc.)

Required work and grade: The grade will be based on (90%) homework assignments (weekly or biweekly) and (10%) class participation. Homework may be discussed amongst students (indeed, some homework will be discussed as part of the class) but each student must write up their own solutions.

Academic Integrity: Every member of the University community is expected to maintain the highest standards of academic integrity. You are expected to be honest in all of your academic work. Please consult the document Brandeis University Rights and Responsibilities for all policies and procedures related to academic integrity.

Accommodations: Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, I want to support you. In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability of requesting accommodations, please contact Student Accessibility Support (SAS https://www.brandeis.edu/accessibility/) at 781.736.3470 or access@brandeis.edu.