

SYLLABUS – MAT 568
DIFFERENTIAL GEOMETRY, Fall 2020
Library E 4320 on Tues. and Thurs. 3:00 – 4:20

BLAINE LAWSON. Office: 5-109. Hours: T.-Th. 1:00 – 2:30 or by arrangement.

This course will be an introduction to Riemannian Geometry.

1. Quick Review: Vector fields and flows, Lie derivatives, differential forms, Stokes' Theorem, The de Rham Theorem, Lie groups and Lie algebras.
2. Connections on vector bundles: curvature, holonomy, Bianchi identities, direct sum and tensor product connections.
3. Connections on the tangent bundle: The Fundamental Theorem of Riemannian Geometry, geodesics and the exponential map, the existence of convex neighborhoods.
4. Completeness and the Hopf-Rinow Theorem.
5. Manifolds of negative curvature: The Cartan-Hadamard Theorem, existence of closed geodesics, Preissmann's Theorem, The Maximal Torus Theorem.
6. The First and Second Variations of Energy.
7. The Bonnet-Myers Theorem (for complete manifolds of positive Ricci curvature).
8. Manifolds of positive curvature: Theorems of Synge, Weinstein, Frankel and others.
9. Conjugate points and The Index Lemma.
10. The Rauch Comparison Theorem.
11. The Cartan-Ambrose-Hicks Theorem.
12. The Toponogov Triangle Theorem and the Soul Theorem (sketches).

I will be assigning homework exercises for you to sharpen your insights. It will not be required to do these exercises, but if you do them and hand them in, I will read them and comment.

This course will take place indoors in the Library room above. The university requires that you wear a mask for the entire period of each class. If you have a problem with this, please let me know right away so we can discuss it.

The best way to contact me is by e-mail, which I read all the time. My address is:

blaine@math.sunysb.edu

On the first day we can discuss the course. If there are topics you would rather have covered than some of those I have of the syllabus, we can talk about this together. We shall also talk about office hours on the first day of classes.

REFERENCES – MAT 568
DIFFERENTIAL GEOMETRY

1. P. Petersen, Riemannian Geometry.
2. Manfredo do Carmo, Riemannian Geometry.
3. M. Spivak, A Comprehensive Introduction to Differential Geometry. (5 volumes)
4. J. Cheeger and D. Ebin, Comparison Theorems in Riemannian Geometry.
5. S. Gallot, D. Hulin and J. Lafontaine, Riemannian Geometry.
6. S. Helgason, Differential Geometry and Symmetric Spaces.
7. S. Kobayashi and K. Nomizu, Foundations of Differential Geometry. (2 volumes)
8. M. Gromov, Metric Structures for Riemannian and Non-Riemannian Spaces.
9. J. Milnor, Morse Theory.
10. F. Warner, Foundations of Differential Geometry and Lie Groups.
11. J. Wolf, Spaces of Constant Curvature.
12. H. Guggenheimer, Differential Geometry.
13. S. Sternberg, Lectures on Differential Geometry.
14. R. Bishop and R. Crittenden, Geometry of Manifolds.
15. S. Goldberg, Curvature and Homology.

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.