

SYLLABUS

MA 725, FALL 2025

Instructor. Brian Williams. Office: CDS 411. email: bwill22@bu.edu.

- Office hours: M 3:30pm–4:30pm, F 11:30pm–12:30pm.
- Website: <https://brianrwilliams.github.io/>

Time and location. There are three lectures per week: MWF 2:30pm–3:20pm in KCB 201.

Course summary. This course is about the foundations of differential geometry. Topics include:

- (1) Riemannian metrics, affine connections, Levi–Civita connection.
- (2) Vector bundles, general theory.
- (3) Connections, (Riemannian) curvature(s).
- (4) Exponential maps in Riemannian geometry and Lie theory.
- (5) Characteristic classes of vector bundles.
- (6) Chern, Euler, and Pontryagin.
- (7) Principal bundles, connections, characteristic classes and Chern–Weil theory.
- (8) Further topics.

Textbook. The main reference will be lecture notes together with *Differential geometry: Connections, curvature, and characteristic classes*.

Prerequisites. The prerequisite for the class is the sequence MA 721–722 or equivalent. If you are having trouble enrolling, and you think you meet the course requirements, please email bwill22@bu.edu.

Assessment. Your grade will be determined by **five** homework assignments and a **take-home final** exam. Homework counts towards 50% of your grade and the final is worth the remaining 50% of your grade.

How to succeed in this class.

- This class moves at a fast pace and attendance in class is necessary.
- Turn your homework in. I **will not accept late homework** under any circumstances. For example, if you have only solved part of the homework assignment, it is in your best interest to turn in the work that you have done before the deadline.
- The same rule applies to the take-home final exam. The deadline for the final exam is final, and cannot be extended under any circumstances. (The final exam will be assigned 3 days prior to the last day of class, and will be due at midnight on the last day of class. Further details will appear as we get closer to the exam.)

This syllabus is subject to minor changes. If there is a change to the syllabus made after the first day of class there will be an announcement and it will be updated here.