PHYS-581 syllabus

Official syllabus for the PHYS-581 one-credit course "Differential geometry for physicists." Please contact the instructor Jens Boos (jboos@wm.edu) with any comments or concerns.

1 Important dates

Classes: Friday, 11am, Small 122.
Website: http://spintwo.net/Courses/PHYS-581-Differential-Geometry-for-Physicists/
First day of class: September 3, 2021.
Last day of class: December 10, 2021.
Office hours: Monday, 10am–11am, Small 340.

Add/drop deadline: Friday, September 10, 2021.
Withdrawal deadline: Monday, November 1, 2021.
Be sure to contact the Registrar and Administrator of Graduate Student Services.

Final take-home exam handed out: 8am, December 13, 2021.
Final take-home exam due: 12pm, December 15, 2021.

2 Assignments, final exam, grading

There will be **10 assignments** during the course of the semester. They will be made available electronically at the course website, typically on the day of the lecture. The due date, if not otherwise stated on the assignment, will be at the beginning of the next session of class. Students are expected to work on the assignments by themselves, but they are encouraged to discuss with one another. There is **no midterm**.

There will be a **take-home final exam**. It will be distributed at 8am, December 13, 2021, and is to be returned by December 15, 2021, 12pm (see the official exam schedule here). Allowed resources for completing the take-home final are limited to the ten assignments of the semester as well as the course's lecture notes. Students are expected to work on the final by themselves; in completing this take-home exam students are reminded of William & Mary's Honor Code.

The final grade will be a weighted average with the assignments making up 2/3, and the take-home

exam making up the remaining 1/3. The boundaries between letter grades will be determined by the form of the distribution.

3 Materials covered

3.1 Core topics

These topics will be covered in detail in the course of the semester.

- vectors, matrices, tensors
- coordinates
- why you need a covariant derivative
- what is a metric
- geometry of 2D surfaces
- differentiable manifolds
- what is curvature
- why differential forms are useful

3.2 Advanced topics

A few select topics will be covered in the latter part of the semester.

- spacetime as a differentiable manifold
- Maxwell's equations in differential forms
- curvature in General Relativity
- black holes
- gauge theories and Lie groups
- holonomy and geometric phases

4 Anything else?

If there is something that has not been addressed adequately in this syllabus, please contact the instructor Jens Boos (jboos@wm.edu). And now let's learn some differential geometry!

jb, PHYS-581-syllabus-v1.tex, September 3, 2021.