MATH 435: VECTOR ANALYSIS
AND INTRODUCTION TO DIFFERENTIAL GEOMETRY
SPRING 2019 SYLLABUS

Disclaimer: This syllabus does not constitute a contract. The instructor reserves the right to make changes at his discretion throughout the semester.

General information:

- **Prerequisites: MATH 226 + One of the 3 courses: MATH 225, 245, or 471.**
- **Lectures:** 2:00–2:50 am MWF in KAP 163. **Attendance is mandatory.**
- **Textbook(s):** There is no textbook for this course, but rather a list of suggested readings. (To be updated.) Attendance is mandatory as lectures will be your unique reference.
- **Instructor:** Dr. Guillaume Dreyer
  Office: KAP 258
  Email: gdreyer@usc.edu
  Office hours: TBA
- **Teaching Assistant:** TBA
  Office: TBA
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Course topics and learning objectives: Differential geometry and topology is a topic at the intersection of multiple mathematical areas: multivariable calculus, differential equations, linear algebra, real analysis, topology and algebraic topology, and geometry of course. It is a journey that takes you a bit everywhere. Getting familiar with the language of differential geometry requires reflection, patience and naturally hard work. Ultimately, this course will be a unique opportunity to develop a more mature overview of mathematics. It will illustrate how different powerful mathematical theories and methods are brought together to deliver some of the finest results in mathematics. This course will also be a great opportunity to review and consolidate all the mathematical knowledge and skills you've learned so far.

- <u>Surfaces:</u> coordinate patch, atlas, differential structures on surfaces, surfaces in $\mathbb{R}^3$, abstract surfaces, smooth path, tangent vector, tangent plane, orientation, examples and construction of surfaces;
- <u>Differential calculus on surfaces:</u> smooth map between surfaces, tangent map, vector field, differential form, exterior derivative, integration, singular chain, Stokes' theorem;
- <u>Elements of Riemannian geometry:</u> 1st and 2nd fundamental forms, connection, covariant derivative, parallel transport, geodesic, Gaussian curvature, locale Gauss-Bonnet formula;
- <u>Elements of differential topology:</u> polygonal/cell decomposition of a surface, Euler-Poincare invariant, global Gauss-Bonnet formula, index of a vector field and Hopf theorem, additional topics if time permits.

In addition to the above topics, lectures may include as needed short reviews of key concepts of linear algebra, topology, advanced multivariable calculus, differential equations.

Homework: Weekly homework will be posted on BB every Wednesday. **Assignment are due the following Wednesday in class at the beginning of our lecture**. Late and electronically submitted homework will not be accepted, no exceptions. You are allowed to drop one HW score. (Keep that one-time deal for that day you find yourself sick.)

You are strongly encouraged to discuss homework problems with your peers and to work in groups. This is a most efficient and rewarding way to learn and work. However, you must write your own solutions. **Homework which is simply copied from another source (friend, another textbook, internet, etc.) will be considered as plagiarism, a serious offense to USC Student Code of Conduct.**

Exams: There will be two midterms and a final.
- **Midterm 1:** Friday, February 15th, in class.
- **Midterm 2:** Friday, March 29th, in class.
- **Final:** Monday, May 6th, 2:00–4:00 am.

If there is a scheduling conflict for an exam, **you must let me know at least 2 weeks ahead**. A scheduling conflict must involve an activity sponsored and approved by USC (marching band, athlete event, etc.). In particular, the university club or organization in question must send an official request, with the Dean's approval, to all faculty. Personal activities do not qualify. **Failure to attend an examination will not be excused under no circumstances.**

No calculator, no cell/smart phone or other electronic device will be allowed during examinations.

Resources: The Math Center is located in KAP 263 and is open weekdays from 8 am to 7 pm (it closes earlier at 5 pm on Fridays). For up-to-date information on the consulting hours, visit the Math Center homepage `http://dornsife.usc.edu/mathcenter`. The purpose of the Math Center is to provide an environment where students can stop by to get help on their math classes. Math TAs at USC hold their office hours there. It is probably better to attend office hours of TAs who are teaching Math 126 this term. However, you are welcome to stop by the Math Center at any time and seek for help from any of the Instructors or TAs who are present at that time.

Students with disabilities: Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester and a letter of verification detailing approved accommodations must be delivered to your Instructor as early in the semester as possible. DSP is located in STU 301 and is open 8:30–5:00 pm, Monday through Friday. The phone number for the DSP office is (213) 740–0776.