# MATH 442 , SPRING 2018
## MWF 10-10:50
## TH 321

- Instructor : Kevin Whyte (kwhyte@uic.edu)
- Text : Differential Geometry of Curves and Surfaces (revised 2nd edition), by Do Carmo
- Office Hours (SEO 515) : M 2-3, F 11-12, and by appointment
- Course website : www.math.uic.edu/ kwhyte/math442.html

**Overview.** In this class we will study the geometry of curves and surfaces in $\mathbb{R}^3$, using the tools of multivariable Calculus and linear algebra. We will begin with the study of curves and develop their canonical local reference frames and some global characterizations. We will then move on to the idea of a regular surface in $\mathbb{R}^3$, which is a basic object of study in many areas of mathematics and, in particular, the beginning of differential geometry and topology. Using ideas such as curvature and the Gauss map we will both understand the local structures and connect them to global topological properties and as metric spaces. Some of the main goals will be to prove the Gauss-Bonnet theorem, show the existence and uniqueness of geodesics, and explore the surfaces of constant curvature.

This material can only be learned by working through it oneself, not simply by listening to lectures and reading the book. Each week the students will be expected to have read the material assigned before the lectures and to contribute to the lectures with frequent questions and ideas. During the week students should work on the assigned homework problems, and classes on Fridays will be devoted to a discussion of the problems and collaborative work towards their solutions and related ideas. Participation is an essential part of the course and any expected absences should be discussed with the instructor as soon as the student knows about them.

**Grading.** The class grade will be based on:
- Participation/homework : 25 %
- Midterm exam : 35 % ( taken in class on Wednesday, March 21 )
- Final exam : 40 % ( Friday, May 11, 10:30 -12:30, room TBD )

**Tentative Schedule.** This is a tentative schedule for the material to be covered. We will adjust our pace as needed, so this is only a guide : each week's schedule and homework will be discussed in class on the previous Friday. If you miss this class, please e-mail the instructor or check with other students to get this information.

- Chapter 1
    - 1/17 - 1/19 (WF only) : Introduction and review
    - 1/22-1/26 : Regular curves, arc-length, curvature, global structure of planar curves
    - 1/29 - 2/2: Wedge product and orientations, torsion, Frenet coordinates
- Chapter 2
    - 2/5-2/9 : Level surfaces, regular values, differentials of functions and tangent planes for surfaces
    - 2/12-2/16 : Area and orientations on surfaces
    - 2/19-2/23 : Compact orientable surfaces
- Chapter 3
    - 2/26-3/2 : The Gauss map and basic properties
    - 3/5-3/9 : The Gauss map in coordinates, quadratic forms, and vector fields
    - 3/12 - 3/16 : Ruled and minimal surfaces
- Midterm week : review 3/19, exam on 3/21
- Spring Break : 3/26 - 3/30
- Chapter 4
    - 4/2-4/6 : Isometries and conformal maps, Gauss' Theorem
    - 4/9-4/13 : Parallel transport and geodesics, exponential map
    - 4/16-4/20: The Gauss-Bonnet theorem, geodesic polar coordinates
- Chapter 5
    - 4/23-4/27 : Constant curvature surfaces
    - 4/30-5/4 : Surfaces as metric spaces, the Hopf-Rinow theorem
- Final Exam week : 5/7 - 5/11

**Academic Integrity.** All UIC students are expected to maintain the standards of academic honesty described in the Guidelines for Academic Integrity available from the Office of the Vice Chancellor for Student Affairs web page:

$$http://www.vcsa.uic.edu/MainSite/departments/deanofstudents/$$

In particular, this policy prohibits plagiarism and giving or receiving aid on an examination.

**Religious holidays.** Students who wish to observe their religious holidays shall notify the faculty member by the tenth day of the semester of the date when they will be absent unless the religious holiday is observed on or before the tenth day of the semester. In such cases, the student shall notify the instructor at least five days in advance of the date when he/she will be absent. The instructor will make every reasonable effort to honor the request, not penalize the student for missing the class, and if an examination or project is due during the absence, give the student an exam or assignment equivalent to the one completed by those students in attendance.

**Disability Accommodation.** The University of Illinois at Chicago is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at UIC. Students with disabilities who require accommodations for access to and/or participation in this course are welcome, but must be registered with the Disability Resource Center (DRC). You may contact DRC at 312-413-2183 (v) or 773-649-4535 (VP/Relay) and consult the following: http://drc.uic.edu/guide-to-accommodations.