

Current Lecture Hours: Thursday 16h10-18h00 BA 6183 (guest lecturer Oct 25)
Office Hours: Thursday 18h05-18h50 BA 6124 (except Oct 25 and Nov 22)

Texts: Readings to be provided (at cost)

Recommended: Cedric Villani “Topics in Optimal Transportation” AMS (2003) and
“Optimal Transport, Old and New” www.umpa.ens-lyon.fr/~cvillani/surveys.html#oldnew

The theme of this course will be the interplay between mathematical analysis and its application to problems arising in physics, economics, and geometry. It will be a true topics course, in the sense that its focus will be a series of problems with classical roots yet strong connections to ongoing research — optimal transportation of mass in curved landscapes, stability in competition, minimal and other surfaces with prescribed curvature, nonlinear diffusion processes, statistical mechanics (the art of extracting macroscopic properties which govern systems composed of enormously large numbers (like 10^{23}) of identical but interacting components), entropy, phase transitions and critical phenomena — and their connections with classical analysis: invariance of domain and the maximum principle, minimax theorems and convex duality, calculus of variations, Hodge theory, Lyapunov functions, differential equations, symmetry, regularity, geometric inequalities, combinatorics, limit theorems, continuity and compactness in infinite dimensions. Much of the relevant analysis will be developed in parallel with the applications, and it is to be hoped that the physical motivation will provide deeper insight into the mathematics.

The material will be presented by the students, based on readings assigned at the beginning of each semester. The format for the course will be as follows:

1) Readings will be assigned at the beginning of each semester; each student will be asked to present one (or more) reading per semester.

2) All students are responsible for doing the primary reading assigned in advance of each week’s presentation. They are responsible for familiarizing themselves with the issues addressed by the article and its main conclusions.

3) Before each lecture, all students other than the presenter are required to submit a one paragraph written summary of the article to be discussed that day, along with two questions they have formulated about the article. This summary can also be submitted by E-mail in advance.

4) The student presenting is responsible for having read and digested their article as completely as possible, at least one week prior to the presentation. It is MANDATORY that they meet with the instructor either before class or during office hours, no later than one week in advance of their presentation to resolve difficulties. (Suggested times: R 14h10 or T 16h10). They should come to this meeting prepared with a written outline of the structure of their presentation. Failure to arrange this meeting or inadequate preparation will be reflected in the presentation grade.

5) Some of these readings are DIFFICULT. Begin preparing for your presentation AS FAR AHEAD AS POSSIBLE. You are welcome to consult me at any time.

6) In the spring we may have the chance to hear several guest speakers lecture on topics close to current research, in addition to student presentations. Students will be asked to submit brief written reports on these guest lectures.

Grading Scheme:

50% Presentations

30% Written Summaries of Other Readings

20% Class Attendance and Active Participation

Late summaries will not be accepted; a grade of zero will be assigned.