Partial Differential Equations and Dynamic Games

Prof. Martino Bardi[1], Prof. Yves Achdou[2]

[1] *University of Padova*
Department of Mathematics
Email: bardi@math.unipd.it

[2] *University of Paris-Diderot*
Laboratoire Jacques-Louis Lions and UFR de Maths
Email: achdou@ljll.univ-paris-diderot.fr

Timetable: about 22-24 hrs, first part (about 16 hours) by Bardi, second part (6-8 hours) by Achdou.
(Part one) First lecture on November 18th, 2016, 11:00 (dates already fixed, see the calendar), Torre Archimede, Room 2BC/30.
(Part two) First lecture on February 13, 2017, 11:00 (dates already fixed, see the calendar), Torre Archimede, Room 2BC/30 (Room 2AB/45 for the lecture of February 16, 2017).

Course requirements: Basic knowledge of PDEs and stochastic processes.

Examination and grading: the exam will be tailored on the students who will attend the course.

SSD: MAT/05 (Math. Analysis) and MAT/06 (Probability)

Aim: to present some classical connections among PDEs and diffusion processes, optimal control and differential games, and to provide an introduction to the recent theory of Mean-Field Games.

Course contents:

- Motivations: deterministic and stochastic controlled dynamical systems, optimisation problems for one and for many players (Nash equilibria).
- Recall of basic stochastic calculus and partial differential operators associated to diffusion processes.
- Verification theorems for optimal control problems and differential games, Hamilton-Jacobi-Bellman and Isaacs equations. Examples: Linear-Quadratic problems, Merton's model of optimal portfolio selection, ...
- The Kolmogorov-Fokker-Planck equation.
- Dynamic Programming and viscosity solutions of Hamilton-Jacobi-Bellman equations.
- The Mean-Field Game system of PDEs: heuristic derivation.
- Connection of the Mean-Field Game equations with the large population limit of N-player games.
- Selected topics in Mean-Field Games (prof. Yves Achdou).