

# METHODS IN FINANCE THEORY - FNCE 928

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**Course Description:** This doctoral level course introduces students to game theory and continuous-time methods. Both techniques represent fundamental approaches to organizing, modeling and understanding complex financial phenomena. The game theory half will cover equilibrium concepts, moral hazard, signaling and screening. Highlights include rigorous formulations and analyses of the perfect Bayesian equilibrium concept and the principal-agent relationship. Both ideas are central to theories of corporate finance and financial markets - subjects that the students will be exposed to in the spring. The continuous-time methods half will cover basic stochastic calculus and applications to investment options and optimal contracts.

**Organization:** We will meet once a week for about 3 hours.

**Prerequisites:** Some mathematical sophistication (e.g. ability to do proofs). A familiarity with the basic principles of microeconomics is useful but not required.

**Grading:** Students are expected to come to every class and participate actively. Grades will be based on participation, midterm and presentations.

**Texts:** There are four textbooks (\* means required):

- \*(MWG) Mas-Colell, Whinston and Green: Microeconomic Theory.
- \*(BD) Bolton and Dewatripont: Contract Theory.
- \*(DP) Dixit and Pindyck: Investment Under Uncertainty.
- Osborne and Rubinstein: A Course in Game Theory
- Karatzas and Shreve: Brownian Motion and Stochastic Calculus.

**Schedule** (Tentative):

- *Game Theory*
  - 08/27: Subgame Perfection. Chapters 7 and 9A, 9B, 9-Appendix A (MWG).
  - 09/03: Simultaneous Move Games. Chapters 8A, 8B, 8C, 8D (MWG). 8.D.3, 8.D.4\*, 8.D.5, 8.D.9
  - 09/10: Bayesian Nash Equilibrium. 8.E.1, 8.E.2\*, 8.E.3 Chapter 8E.
  - 09/17: Dynamic Games of Imperfect Information. 9.B.6, 9.B.9\*, 9.B.11, 9.B.14 Chapters 9A, 9B
  - 09/24: Perfect Bayesian Equilibrium. 9.C.2\*, 9.C.3, 9.C.6 Chapters 9C, 9D
  - 10/01: Asymmetric Information. 9.C.7, 13.B.4\*, 13.B.5 Chapters 13A, 13B
  - 10/08: Signalling (subject to pregnancy constraints). Chapters 13C (MWG) and Chapter 3 (BD)
  - 10/15: Midterm
- *Continuous-Time Methods*
  - 10/22: Chapter 3 Stochastic Processes and Brownian Motion (DP).
  - 10/29: Chapter 3/4 Brownian Motion and Recursion (DP).
  - 11/05: Chapter 4 Bellman Equations (DP).
  - 11/12: Chapter 4/5 Poisson Processes and Real Options (DP).
  - 12/3: Chapters 5 Real Options and Extensions (DP).
  - 12/10: Presentations