The aim of the course is to provide a mathematically precise account of the arbitrage theory of financial derivatives. A self-contained treatment of stochastic differential equations and the Itô calculus will be presented, and will include the Feynman-Kac formula, and the Kolmogorov equations. Risk neutral valuation formulas and martingale measures will be introduced through Feynman-Kac representations.

The course will cover pricing and hedging problems in complete as well as incomplete markets. Barrier options, options on dividend-paying assets, as well as currency markets will be studied. Interest rate theory will include short rate models and the Heath-Jarrow-Morton approach to forward rate models. A self-contained treatment of stochastic optimal control theory will be used to study optimal consumption/investment problems. The course will be geared towards concrete computations involving stochastic differential equations.