

MAT4735/9735 - oral exam Spring 2026

The final evaluation for the course is an oral exam held at the blackboard for circa 40 minutes, on the topics of the course.

Question will be drawn from the following list of topics, which cover and cross the spread of the program. Subquestions can be asked to detail the statements.

Topics:

1. Equity (stock) markets: self-financing portfolios, arbitrage opportunity, first fundamental theorem of asset pricing, connection with risk-neutral measures. Concept of non-arbitrage price (definition) and pricing formula for replicable claims. Comparison with Electricity market: Electricity as a flow commodity, the meaning of this and the impact that this “flowing” has in non-arbitrage pricing of derivatives in the electricity market.
2. Black and Scholes markets: model, pricing measure (Girsanov theorem), pricing of a Vanilla option and its relationships with PDEs. Example of call option and put option (including put-call parity).
3. Stochastic volatility modelling: introduction, Heston model. Option pricing and hedging in a Heston stochastic volatility market model (PDE approach).
4. Jump processes: Poisson processes, Compound Poisson processes and Levy processes in general. Characteristic functions and Levy-Khinchine formula in general and the specific form of the Brownian motion, Poisson process, compound Poisson process. Stochastic integration with jumps.
5. Ito formula in the jump diffusion context. SDEs with jumps, solution of the linear type SDEs. Stochastic exponential.
6. Jump diffusions, Levy-Ito representation theorem. Change of measures: Girsanov theorem for Brownian motion and for jumps; Esscher transform.
7. Equity (stock) market model with jumps: risk neutral measures. Hedging and quadratic hedging of the minimal variance type. Explicit solution by means of the Non-Anticipating (NA) derivative.
8. Future/forward contracts and Forward prices in equity and electricity markets. Future/forward contract in electricity markets and type of settlement. Representation of the forward prices in terms of pricing measure.
9. Electricity forward prices modelling starting from el-spot. The case of 2-factor models (use of Girsanov and Esscher transforms).
10. Electricity forward prices modelling with Heath-Jarrow-Morton (HJM) approach without and with jumps.
11. Concept of arbitrage in electricity markets due to overlapping delivery periods. Discussion in the case of HJB approach.