Course content for MT3480/MT4480, Advanced Financial Mathematics

Prerequisites:
MT3470

Aims:
To investigate the validity of various linear and non-linear time series occurring in finance;
To extend the use of stochastic calculus to interest rate movements and credit rating.

Learning outcomes:
1. Make use of some of the ARCH (autoregressive conditionally heteroscedastic) family of models in time series;
2. Appreciate the ideas behind the use of the BDS test and the bispectral test for time series.
3. Understand the partial differential equation for interest rates and the assumptions that lead to it;
4. Be able to model forward and spot rates;
5. See how to model the prices for certain exotic options;
6. MT4480: Demonstrate a breadth of understanding appropriate for an M-level course.

Course content:
Financial time series: Linear time series: ARMA and ARIMA models, stationarity, autoregressions. Testing of linearity, using spectral analysis. ARCH and GARCH models.
Structure of financial series: The random walk model, trend and volatility, moments. Comparison with chaotic systems, dimensionality and memory effects in financial series. The nearest neighbour algorithm and the BDS test.
Interest rate analysis: Revision of ideas in stochastic calculus. Modelling of interest rates, the bond pricing equation. Bond derivatives. The Heath-Jarrow-Morton model.
Exotic options: Asian and barrier options.