UCLouvain

lactu2240

2026

Actuarial Science in Finance: Advanced Processes and Life Insurance Engineering

5.00 credits	30.0 h	Q1

This learning unit is not open to incoming exchange students!

Teacher(s)	Hainaut Donatien ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	LACTU2030 Actuariat de l'assurance-vie LACTU2170 Valorisation financière des engagements actuariels.
Main themes	Jump-diffusion and Lévy or stochastic volatility processes, valuation of participating life insurance contracts using hybrid interest-rate models.
Learning outcomes	
Evaluation methods	The assessment consists of a project and a written exam, for which the student has a formula sheet. The instructor reserves the right to question the student orally on both the exam answers and the project content. Where applicable, the use of AI will comply with the guidelines for the responsible use of generative artificial intelligence within the Faculty of Science.
Teaching methods	The course consists of 13 theoretical lessons which the student is required to attend.
Content	The course contains two parts, respectively dedicated to Lévy processes and to the valuation of life-insurance contracts in hybrid rate-stock models. Part 1 : Lévy process · Introduction & review of probability concepts · Lévy processes : first contact · Valuation by simulations with jump-diffusions (Ratchet GMAB) · Estimation of a jump-diffusion under the real measure · Lévy process & infinite divisible distributions · Subordination · Valuation by simulations with VG and NIG (unit-linked contract with lookback guarantee) · Estimation of VG and NIG under P · Jump measures & Lévy-Itô decompositions · Stochastic calculus for Lévy processes · Switching regime processes · Hamilton's filter Part 2 : Life insurance engineering & hybrid models · Short reminder about IR, change of numeraire and B&S · GMAB valuation in a hybrid Hull & White model · Estimation of the HW hybrid model & numerical GMAB valuation · The HJM framework for interest rates · Valuation of hybrid products in a HJM G2++ framework · Estimation of the G2++ hybrid model & GMAB valuation · Forward rates · Libor forward model (LFM) · LFM estimation under P · Participating contracts with caps, floors in the LFM (Cash-Max insurance) · GMAB in a hybrid LFM. · Hybrid LFM estimation under under P & GMAB valuation · Introduction to stochastic volatility: Heston model
Inline resources	Moodle website

Bibliography	Les diapositives disponibles sur moodle peuvent être complétées si besoin par • Lévy processes in Finance : Pricing Financial Derivatives. Schoutens W. 2003, Wiley Series in Probability and Statistics. • Interest rate models : Theory and Practice (with Smile, Inflation and Credit). Brigo D., Mercurio F. 2016. Springe Finance. • Actuarial Mathematics for Life Contingent Risks. Dickson, D.C.M., Hardy, M.R., Waters, H.R. 2009, Cambridge University Press.
Faculty or entity in charge	LSBA

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mathematics	MATH2M	5		🔍
Master [120] in Actuarial Science	ACTU2M	5		🔍
Master [120] in Mathematical Engineering	MAP2M	5		🔍