

COURSE NAME: **Models for Financial Economics**

COURSE CODE: **MATH3803**

LEVEL: **III**

SEMESTER: **II**

NUMBER OF CREDITS: **3**

PREREQUISITES: ***MATH3801***

RATIONALE

This is a compulsory level III course which is an important course in actuarial science and finance. Candidates should master the fundamental concepts as indicated in the “Learning outcomes”. This course allows the candidate to prepare for the professional examinations (exam MFE - Models: Financial Economics) of the Society of Actuaries and Financial Economics (CT8) of the Institute of Actuaries. This course will enhance the critical thinking and communication skills required to value financial derivatives.

COURSE DESCRIPTION

The purpose of the syllabus is to develop the candidate’s knowledge of the theoretical basis of certain actuarial models and the application of those models to insurance and other financial risks. This course builds on the material in Financial Mathematics II and covers forwards, futures, swaps, and options. By the end of the course, students will have good knowledge of how these products work, how they are used, how they are priced, and how financial institutions hedge their risks when they trade the products

LEARNING OUTCOMES

On completion of this course the student should be able to:

- Explain the properties of a lognormal distribution
- Explain the Black-Scholes formula as a limited expected value for a lognormal distribution
- Simulate lognormal stock price.
- Accelerate convergence using variance reduction.
- Identify arbitrage opportunities

- Define the following terms: Hedging, Arbitrage, Diversifiable risk, Nondiversifiable risk, Synthetic forwards, Spreads, Collars, Straddles (including strangles) and butterfly spreads, Convertible bond,
- Explain how derivative securities can be used to manage financial risk.
- Discuss the reasons to hedge and not to hedge.
- Evaluate the payoff/profit of hedging strategies.
- Define the following terms: Forward contract, Implied repo rate, Cost of carry, Futures contract
- Determine forward price from prepaid forward price.
- Explain the relationship between forward price and futures price.
- Use the concept of no-arbitrage to determine the theoretical value of futures and forwards.
- Given any four of call premium, put premium, forward price, strike price and interest rate, calculate the remaining item using the put-call parity formula.
- Define the following terms: Swap, Notional Amount, Interest rate swap, Deferred swap
- Use the concept of no-arbitrage to determine the theoretical value of a swap.

CONTENT

Rational Valuation of Derivative Securities

European Option Valuation (binomial model, Black-Scholes Model, Risk Neutral model, State Price Vectors ...); put-call-parity; Greeks, Explain the properties of a lognormal distribution and explain the Black-Scholes formula as a limited expected value for a lognormal distribution.

Simulation

Simulate lognormal stock prices. Variance reduction techniques for accelerated convergence.

Risk Management

Delta hedging.

Hedging and Investment Strategies

Hedging, arbitrage, hedging strategies.

Futures & Forwards

Forward contract, futures contract, forward price, no-arbitrage (theoretical) price,

Swaps

Simple swap, commodity swap, interest rate swap. Determine no arbitrage (theoretical) value of a swap.

TEACHING METHODOLOGY:

This course will be delivered by a combination of theoretical classes, practices (tutorials) and other group activities. The delivery mode will be largely interactive. The total estimated 39 contact hours are broken down as follows: 26 hours of lectures and 13 hours of tutorials. The course material (complimentary notes, practice problems and assignments) will be posted on ourvle <http://ourvle.mona.uwi.edu/>

ASSESSMENT:

The course assessment will be divided into two components: a coursework component worth 30% and a final exam worth 70%.

- One coursework examination (1 hour) worth 20% of the final grade
- Two written assignments each worth 5% of the final grade
- The final examination will be two hours in length and consist of compulsory questions.

REFERENCE MATERIAL

Prescribed Text:

Hull, J. C. (2009). *Options, Futures, and Other Derivatives" (8th Edn)*, Prentice-Hall, ISBN: 0135009944

Recommended Text:

Kellison, S.G. (2009). *The Theory of Interest (3rd Edn)*. Irwin/McGraw-Hill; ISBN: 978-0-07338-244-9; other ISBN: 0073382442

Broverman, S. A. (2010), *Mathematics of Investment and Credit (5th Edn)*, ACTEX Publications; ISBN: 978-1-56698-767-7; other ISBN: 1566987679.

Highly Recommended Text:

McDonald, R.L. (2006). *Derivative Markets (2nd Edn)*. Addison Wesley, ISBN-10: 0201729601, ISBN-13: 978-0201729603

Online resources:

The following are free online lectures which the student may access for revision purposes:
<http://www.scribd.com/doc/22351427/The-Theory-of-Interest-Stephen-G-Kellison>.