

**COURSE NAME: Financial Mathematics II**

**COURSE CODE: MATH3801**

**LEVEL: III**

**SEMESTER: I**

**NUMBER OF CREDITS: 3**

**PREREQUISITES:**

Financial Mathematics I (MATH2701), Financial Management I (MGMT2023), Financial Management II (MGMT3048), Introduction to Probability Theory (MATH2404)

**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 begin preparation for the professional examinations Financial Mathematics (FM) of the Society of Actuaries and Financial Economics (CT8) of the Institute of Actuaries. This course will help develop the critical thinking and communication skills required to construct asset liability models and to value financial derivatives.

**COURSE DESCRIPTION**

This course builds on the material in Financial Mathematics I and Financial Management I and II, introducing further tools and techniques of asset/liability management, general product design, as well as issues of pricing, valuation and asset management. By the end of the course, students will have good knowledge of how fixed income and derivative products work, how they are used, how they are priced, and how financial institutions hedge their risks when they trade derivative products.

**LEARNING OUTCOMES**

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

- Define the terms current value, duration (Macaulay, modified, effective), convexity, spot rate, forward rate,
- Determine the duration and convexity of a set of cash flows
- Determine the approximate change in present value given a change in interest rate

- Define the terms cash flow matching, immunization
- Construct an investment portfolio to immunize a set of liability cash flows
- Construct an investment portfolio to match the present value and duration of a set of liability cash flows
- Define the following: derivative, underlying asset, OTC market, ask price, bid price, bid-ask spread, short selling, short position, long position, net profit, net payoff, stock index, marking-to-market, margin, maintenance margin, margin call
- Evaluate the margin position of an investor based on asset values
- Define the following call option, put option, expiration, exercise/strike price, European option, American option, Bermudan option, in-the-money, at-the-money, out-the-money, covered call, naked writing, put-call-parity
- Evaluate the payoffs of derivative contracts
- Value an option using binomial option pricing model, Black-Scholes Option Pricing model, risk neutral valuation

## **CONTENT**

### **Bond price Sensitivity**

Review bond valuation. Bond price sensitivity to changes in coupon rate, yield rate, and term to maturity.

### **General Cash flow and Portfolios**

Duration and convexity of a set of cash flows. Spot rates, forward rates, yield curve, bootstrapping.

### **Immunization**

Cash flow matching, immunization, construction of investment portfolios.

### **Introduction to Derivatives**

OTC market, ask/bid price, short selling, short/long position, credit risk, marking-to-market, margin; derivative: call/put option, European/American/Bermudan Option, covered call, naked writing, protective put, put-call-parity. Option Valuation (binomial model, Black-Scholes Model, Risk Neutral model ... ).

## **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:**

John C. Hull, "Options, Futures, and Other Derivatives" (8<sup>th</sup> Edn), 2009, Prentice-Hall, ISBN: 0135009944

### **Recommended Text:**

Kellison, S.G., *The Theory of Interest* (Third Edition), 2009, Irwin/McGraw-Hill; ISBN: 978-0-07338-244-9; Other ISBN: 0073382442

### **Highly Recommended Text:**

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

### **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>