



# Course Specifications

<b>Course Title:</b>	Financial Mathematics
<b>Course Code:</b>	30114304-3
<b>Program:</b>	BSc. Mathematics 301100
<b>Department:</b>	Department of Mathematics
<b>College:</b>	Al-Leith University College
<b>Institution:</b>	Umm Al-Qura University

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## A. Course Identification

<b>1. Credit hours:</b>	3 credit hours
<b>2. Course type</b>	
a.	University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b.	Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
<b>3. Level/year at which this course is offered:</b>	8 <sup>th</sup> level
<b>4. Pre-requisites for this course (if any):</b>	Mathematical Statistics (30114303)
<b>5. Co-requisites for this course (if any):</b>	None

### 6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	(3 hours) x (15 weeks)	100%
2	Blended	0	0%
3	E-learning	0	0%
4	Correspondence	0	0%
5	Other	0	0%

### 7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
<b>Contact Hours</b>		
1	Lecture	(3 hours) x (15 weeks)
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (Exam)	8 hours
	<b>Total</b>	53 hours
<b>Other Learning Hours*</b>		
1	Study	70 hours
2	Assignments	15 hours
3	Library	0
4	Projects/Research Essays/Theses	0
5	Others (workgroup)	20 hours
	<b>Total</b>	115 hours

\* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

## B. Course Objectives and Learning Outcomes

### 1. Course Description

This course establishes the basics of the one-period model, shows how securities can be represented by vectors and matrices, and introduces the concept of hedging. Further, the course introduces important financial notions such as returns, arbitrage and state prices, and gives examples of asset pricing both in complete and incomplete markets. Then, we introduce the multi-period binomial model for stock prices and compute a dynamic hedging strategy that replicates a given option. Finally, we take the binomial modeling from the discrete-time numerical explorations to the continuous-time complete market model in Black-Scholes option pricing formula.

### 2. Course Main Objective

Provide students with basic knowledge using the mathematical techniques necessary to learn a wide range in the financial sector.

### 3. Course Learning Outcomes

CLOs		Aligned PLOs
<b>1</b>	<b>Knowledge:</b>	
1.1	State the mathematical foundations of quantitative finance	K1
1.2	Memorize the standard and advanced quantitative methodologies and techniques.	K1
1.3	Examine the theory and techniques in the area of financial mathematics.	K2
<b>2</b>	<b>Skills :</b>	
2.1	Create potential models for the price of shares.	S4
2.2	Analyze models for investments and securities.	S1
2.3	Design forward contract using arbitrage-free pricing methods.	S5
2.4	Develop connections within branches of Financial Mathematics between Probability and other disciplines	S2
2.5	Examine problems using a range of formats and approaches in basic science	S6
<b>3</b>	<b>Competence:</b>	
3.1	Apply scientific models and tools effectively.	C2
3.2	Write reports about basic Financial Mathematics principles.	C5
3.3	Integrate knowledge acquired during the course using computer applications	C4

## C. Course Content

No	List of Topics	Contact Hours
1	Review of Probability Theory and Random Variable	3
2	Interest: Simple and compound interest. Effective and nominal interest rates. Force of interest. Interest paid monthly.	6
3	Options and option pricing	6
4	The Arbitrage Theorem, Pricing Contracts via Arbitrage	6
5	Deferred and varying annuities, annuities payable continuously.	6
6	Loans, loan structure and equal payments. Discounted cash flow: Generalized cash flow model.	6
7	The Black-Scholes Formula	6
8	Measurement of investment performance.	6

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge</b>		
1.1	State the mathematical foundations of quantitative finance	Lectures      Tutorials Discussion    Problem Solving	Exams Home work.
1.2	Memorize the standard and advanced quantitative methodologies and techniques.		
1.3	Examine the theory and techniques in the area of financial mathematics.		
<b>2.0</b>	<b>Skills</b>		
2.1	Create potential models for the price of shares.	Lectures      Tutorials Solve Problem Brain Storming	Exams      Quizzes. Homework. Discussion
2.2	Analyze models for investments and securities.		
2.3	Design forward contract using arbitrage-free pricing methods.		
2.4	Develop connections within branches of Financial Mathematics between Probability and other disciplines	Cooperative education Competitive education	Home      work. Reports.    Quizzes. Discussion
2.5	Examine problems using a range of formats and approaches in basic science		
<b>3.0</b>	<b>Competence</b>		
3.1	Apply scientific models and tools effectively.	Lectures      tutorials brain storming	Home      work. Reports. Discussion
3.2	Write reports about basic Financial Mathematics principles.		
3.3	Integrate knowledge acquired during the course using computer applications		

### 2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Test (1)	6 <sup>th</sup> week	20%
2	Midterm Test (2)	12 <sup>th</sup> week	20%
3	Homework + Reports + Quizzes	During the semester	10%
4	Final Examination	End of semester	50%

\*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :**

Office hours per week in the lecturer schedule (6 hours per week).

Contact with students by e-mail, SMS, and e-learning facilities.

## F. Learning Resources and Facilities

### 1. Learning Resources

<b>Required Textbooks</b>	Kannoo Ravindran, The Mathematics of Financial Models: Solving Real-World Problems with Quantitative Methods, Wiley Finance, 2014  Aleš Cerný, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press, Second Edition, 2009
<b>Essential References Materials</b>	Sheldon M. Ross, An Elementary Introduction to Mathematical Finance Options and Other Topics, Cambridge University Press 2002, Second Edition
<b>Electronic Materials</b>	<a href="http://www.freetechbooks.com">http://www.freetechbooks.com</a> <a href="http://tutorial.math.lamar.edu/sitemap.aspx">http://tutorial.math.lamar.edu/sitemap.aspx</a> <a href="http://mathforum.org/advanced/numerical.htm/">http://mathforum.org/advanced/numerical.htm/</a>
<b>Other Learning Materials</b>	Microsoft Excel

### 2. Facilities Required

Item	Resources
<b>Accommodation</b> (Classrooms, laboratories, demonstration rooms/labs, etc.)	-The size of the room should be proportional to the number of students - Provide enough seats for students. - The number of student not exceed on 30 in the classroom - Library
<b>Technology Resources</b> (AV, data show, Smart Board, software, etc.)	-Hall is equipped with a computer - Provide overhead projectors and related items -Smart board

Item	Resources
<b>Other Resources</b> (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	---

### G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	deanship of registration and acceptance	Student feedback through electronic survey
Quality of learning resources	Program Leaders	Student feedback through electronic survey
Evaluation of the teachers by internal & external faculty members	Program Leaders	Course Reports, evaluation of random grading report
Program Quality	Peer Reviewer	Peer evaluation and feedback

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)

### H. Specification Approval Data

<b>Council / Committee</b>	<b>Council of the Mathematics Department</b>	<b>The mathematical sciences (college of applied sciences) and the mathematics (Al-Leith University College) department's first meeting of the coordinative committee</b>
<b>Reference No.</b>	<b>4101050782</b>	<b>First meeting</b>
<b>Date</b>	<b>Sunday, 17 November 2019</b>	<b>Thursday, 17 October 2019</b>

Department Head



Dr. Ali Hassani