



Course Specifications

Course Title:	Models for Financial Economics
Course Code:	ACTU 473
Program:	Actuarial and Financial Mathematics
Department:	Mathematics
College:	Science
Institution:	King Saud University

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A. Course Identification

1. Credit hours: 4 (3+2+0)
2. Course type 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"/>
3. Level/year at which this course is offered: Level 7
4. Pre-requisites for this course (if any): ACTU 471
5. Co-requisites for this course (if any):

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75 Hours	
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	
3	Tutorial	30
4	Others (specify)	
	Total	75

B. Course Objectives and Learning Outcomes

1. Course Description

This course gives an understand of the following terms and concepts:

The binomial option pricing including: one-period binomial model on a non-dividend-paying stock, principle of no-arbitrage, risk-neutral pricing formula, one-period binomial model on stocks, currency, and futures contract, Multi-period setting for pricing European and American options. Binomial model from market stock price data, Forward binomial tree, Cox-Ross-Rubinstein tree, lognormal tree, the Black-Scholes option pricing model, lognormal distribution, probabilities and percentiles, means and variances, conditional expectations, analytic pricing formulas: cash-or-nothing calls and puts, asset-or-nothing calls and puts, ordinary calls and puts (the Black-Scholes formula), gap calls and puts, risk-neutral pricing formula using Monte-Carlo simulation, inverse transformation, path-independent and path-dependent options, Antithetic variate, stratified sampling, control variate. Black-Scholes formula to price exchange options, rate of appreciation, historical volatility, implied volatility, option Greeks (Delta, Gamma, Theta, Vega, Rho, and Psi), Option elasticity, Sharpe ratio and instantaneous risk premium for both an option and a portfolio of options and the underlying stock, delta hedging, gamma hedging.

2. Course Main Objective

To develop the candidate's knowledge of the theoretical concepts of certain models of options pricing and how to control risk by using options in a hedging context.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge and Understanding: The student will be able to	
1.1	Describe some models of option pricing in financial markets.	K2
1.2	Demonstrate mastery of fundament concepts of option pricing in discrete and continuous cases	K3
2	Skills : The student will be able to	
2.1	Apply option pricing methods to evaluate derivatives	S1
2.2	Control risk by using options in a hedging context.	S2
2.2	Model the Binomial and the Black Scholes option pricing for derivatives	S3
3	Values:	
3.1	Study, learn and work in team to perform tasks with responsibility.	V2
3.2	Prepare students to IFM exam of SOA	V3

C. Course Content

No	List of Topics	Contact Hours
1	1. The Binomial Option Pricing Model <ul style="list-style-type: none">a. One-period binomial model on a non-dividend-paying stock, principle of no-arbitrage, risk-neutral pricing formula.b. One-period binomial model on stocks, stock paying dividends continuously at a rate proportional to its price, currency, and futures contract, Multi-period setting for pricing European and American options.c. Binomial model from market stock price data, Forward binomial tree, Cox-Ross-Rubinstein tree, lognormal tree.	25
2	2. The Black-Scholes Option Pricing Model <ul style="list-style-type: none">a. Black-Scholes model: lognormal distribution, probabilities and percentiles, means and variances, conditional expectations.b. analytic pricing formulas: cash-or-nothing calls and puts, asset-or-nothing calls and puts, ordinary calls and puts (the Black-Scholes formula), gap calls and puts.c. risk-neutral pricing formula using Monte-Carlo simulation, inverse transformation, path-independent and path-dependent options, Antithetic variate, stratified sampling, control variate.d. Black-Scholes formula to price exchange options, rate of appreciation, historical volatility, implied volatility.	25

3	3. Option Greeks and Risk Management Option Greeks (Delta, Gamma, Theta, Vega, Rho, and Psi), Option elasticity, Sharpe ratio and instantaneous risk premium for both an option and a portfolio of options and the underlying stock.	25
Total		75

D. Teaching and Assessment

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

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	Describe some models of option pricing in financial markets.	Lecture strategy Problem solving strategy	Quizzes Midterms Final exam
1.2	Demonstrate mastery of fundamental concepts of option pricing in discrete and continuous cases		
2.0	Skills		
2.1	Apply option pricing methods to evaluate derivatives	Problem solving strategy	Quizzes Midterms Final exam
2.2	Control risk by using options in a hedging context.		
2.3	Model the Binomial and the Black Scholes option pricing for derivatives		
3.0	Values		
3.1	Study, learn and work in team to perform tasks with responsibility.	Discussion and dialogue Critical thinking	Quizzes Midterms Final exam
3.2	Prepare students to IFM exam of SOA	Solving problems from IFM exams of (SOA)	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Tests, Quizzes	3/4	5%
2	First Midterm exam	5/6	25%
3	Tests, Quizzes	7/8	5%
4	Second Midterm exam	10/11	25%
5	Final exam	15/16	40%

*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 :

1. 10 office hours weekly.
2. Encouraging students to get in touch with the instructor via LMS (Bb).

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Derivatives Markets (Third Edition), 2013, by McDonald, R.L., Pearson Education, ISBN: 978-0-32154-308-0
Essential References Materials	ACTEX MFE Study Manual with StudyPlus+ Spring 2018, by: Johnny Li, Ph.D., FSA, Andrew Ng, Ph.D., FSA
Electronic Materials	https://www.soa.org http://www.casact.org/
Other Learning Materials	LMS (Bb), Webinars, TeamViewer, google apps, virtual classroom.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Classrooms
Technology Resources (AV, data show, Smart Board, software, etc.)	AV, data show, Smart Board, LMS (Bb)
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	LMS (Blackboard), ZOOM, Cisco WebEx

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course evaluation by the students at the end of the semester	Students	Website: edugate.ksu.edu.sa
Students' opinion about the course under consideration	Students	Questionnaires
Colleagues' opinions about students' performance in this course	Faculty Program Committee	Analyzing the course evaluation conducted by students at the end of the semester
Effectiveness of teaching and assessment	Instructor	Identification of the level of the students in solving homework and quizzes and answering oral questions

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

Council / Committee	Department of Mathematics/Actuarial and Financial Mathematics
Reference No.	
Date	January 2, 2021