



## **ATTACHMENT 5.**

# **T6. COURSE SPECIFICATIONS (CS)**

## **ACTU 473 Models for Financial Economics**

1439/2018

## Course Specifications

Institution: <a href="#">King Saud University</a>	Date: <a href="#">01/02/2018</a>
College/Department: <a href="#">Science, Mathematics</a>	

### A. Course Identification and General Information

1. Course title and code: <a href="#">Models for Financial Economics ACTU 473</a>	
2. Credit hours: <a href="#">4(3+2+0)</a>	
3. Program(s) in which the course is offered. <a href="#">Actuarial and Financial Mathematics Program</a>	
4. Name of faculty member responsible for the course: <a href="#">Pr. Dr. Souhail Chebbi</a>	
5. Level/year at which this course is offered: <a href="#">6/3</a>	
6. Pre-requisites for this course (if any): <a href="#">ACTU 471</a>	
7. Co-requisites for this course (if any): <a href="#">None</a>	
8. Location if not on main campus:	
9. Mode of Instruction (mark all that apply):	
a. traditional classroom	<input checked="" type="checkbox"/> What percentage? <input type="text" value="100%"/>
b. blended (traditional and online)	<input type="checkbox"/> What percentage? <input type="text"/>
c. e-learning	<input type="checkbox"/> What percentage? <input type="text"/>
d. correspondence	<input type="checkbox"/> What percentage? <input type="text"/>
f. other	<input type="checkbox"/> What percentage? <input type="text"/>
Comments:	

## B Objectives

1. What is the main purpose for this course?

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.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)

Use LMS (Bb) or Webinar to interact with student (discussions, forums, virtual class room).  
Use updated syllabus of FM and Exams from SOA/CAS website.

## C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
<p><b>1. The Binomial Option Pricing Model</b></p> <p>a. One-period binomial model on a non-dividend-paying stock, principle of no-arbitrage, risk-neutral pricing formula.</p> <p>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.</p> <p>c. Binomial model from market stock price data, Forward binomial tree, Cox-Ross-Rubinstein tree, lognormal tree.</p>	4	15
<p><b>2. The Black-Scholes Option Pricing Model</b></p> <p>a. Black-Scholes model: lognormal distribution, probabilities and percentiles, means and variances, conditional expectations.</p> <p>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.</p> <p>c. risk-neutral pricing formula using Monte-Carlo simulation, inverse transformation, path-independent and path-dependent options, Antithetic variate, stratified sampling, control variate.</p> <p>d. Black-Scholes formula to price exchange options, rate of appreciation, historical volatility, implied volatility.</p>	4	20

<b>3. Option Greeks and Risk Management</b> 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.	3	15
<b>4. Interest Rate Derivatives</b> Black-Derman-Toy tree, interest rate caplets, floorlets and bond calls and puts	3	15

2. Course components (total contact hours and credits per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical (visit to companies)	Other:	Total
Contact Hours	Planned	45	30		None		75
	Actual	45	30		None		75
Credit	Planned	3	1		None		4
	Actual	3	1		None		4

3. Additional private study/learning hours expected for students per week. 6

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

**On the table below are the five NQF Learning Domains, numbered in the left column.**

**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
<b>1.0</b>	<b>Knowledge</b>		
1.1	To be able to: a. apply the principle of no-arbitrage, and identify arbitrage opportunities. b. apply the risk-neutral pricing formula.	Traditional lecture class room	Quizzes Midterm and final exams
1.2	To be able to apply the one-period binomial	Traditional lecture	Quizzes

	model on stocks to other underlying assets, including stock paying dividends continuously at a rate proportional to its price, currency, multi-period setting for pricing European and American options.	class room	Midterm and final exams
1.3	Understand binomial model from market stock price data using volatility, forward binomial tree, Cox-Ross-Rubinstein tree and lognormal tree	Traditional lecture class room	Quizzes Midterm and final exams
1.4	Understand option pricing using real probabilities and calculate the appropriate risk adjusted interest rate for discounting.	Traditional lecture class room	Quizzes Midterm and final exams
1.5	Understand the Black-Scholes model.	Traditional lecture class room	Quizzes Midterm and final exams
1.6	Calculate the following for future stock prices under the Black-Scholes model: a. probabilities and percentiles b. means and variances c. conditional expectations	Traditional lecture class room	Quizzes Midterm and final exams
1.7	Calculate pricing formulas for the following European options using risk neutral pricing formulas: a. cash-or-nothing calls and puts b. asset-or-nothing calls and puts c. ordinary calls and puts (the Black-Scholes formula) d. Simulate standard normal random variates by inverse transformation. e. Estimate prices of path-independent and path-dependent options, and compute the standard deviation of the estimate. f. Use the following variance reduction techniques to accelerate convergence: Antithetic variate, stratified sampling, control variate	Traditional lecture class room	Quizzes Midterm and final exams
1.8	The student will be able to interpret and compute the following under the Black-Scholes model: a. Option Greeks (Delta, Gamma, Theta, Vega, Rho, and Psi) b. Option elasticity, Sharpe ratio and instantaneous risk premium for both an option c. portfolio of options and the underlying stock.	Traditional lecture class room	Quizzes Midterm and final exams
1.9	a. Price interest rate derivatives under a binomial tree for interest rates.		

	b. Price interest rate caplets, floorlets and bond calls and puts by applying the Black formula.		
<b>2.0</b>	<b>Cognitive Skills</b>		
2.1	Pricing options under a one-period binomial model on a non-dividend-paying stock.	Problem solving	Quizzes Midterm and final exams
2.2	Extending the one-period binomial model on stocks in the following directions	Problem solving	Quizzes Midterm and final exams
2.3	stock prices under the Black-Scholes model.	Problem solving	Quizzes Midterm and final exams
2.4	<ul style="list-style-type: none"> <li>a. Recognize the underlying assumptions behind the Black-Scholes model.</li> <li>b. Construct a binomial model from market stock price data.</li> <li>c. Explain the properties of a lognormal distribution and calculate some parameter probability for future</li> </ul>	Problem solving	Quizzes Midterm and final exams
2.5	<ul style="list-style-type: none"> <li>a. Deduce the analytic pricing formulas for the following European options using risk neutral pricing formulas</li> <li>b. Explain the concepts underlying the risk-neutral approach to valuing derivative securities.</li> <li>c. Implement the risk-neutral pricing formula using Monte-Carlo simulation.</li> <li>d. Generalize the Black-Scholes formula to price exchange options.</li> <li>e. Estimate a stock's expected rate of appreciation and historical volatility from stock price data.</li> </ul>	Problem solving	Quizzes Midterm and final exams
2.6	<ul style="list-style-type: none"> <li>a. Approximate option prices using delta, gamma and theta.</li> <li>b. Recognize the relationship among delta, gamma and theta (the Black-Scholes equation).</li> <li>c. Explain and demonstrate how to control stock price risk using the methods of delta hedging and gamma-hedging</li> </ul>	Problem solving	Quizzes Midterm and final exams
2.7	<ul style="list-style-type: none"> <li>a. Recognize the features of a Black-Derman-Toy tree</li> <li>b. Apply put-call parity to European options on zero-coupon bonds</li> </ul>	Problem solving	Quizzes Midterm and final exams
<b>3.0</b>	<b>Interpersonal Skills &amp; Responsibility</b>		

3.1	Study, learn and work independently.	-Encourage students to: - participate in class discussion. - participate in college and university activities. - be members of department committees and college committees.	
3.2	Work effectively in teams.		
3.3	Meet deadlines and manage time properly.		
3.4	Exhibit ethical behavior and respect different points of view.		
<b>4.0</b>	<b>Communication, Information Technology, Numerical</b>		
4.1	Present financial mathematics to others, both in oral and written form clearly and in a well-organized manner	Encourage students to: - obtain the MFE exam of SOA/CAS - use department and college computing facilities. - use e-mail, lms, internet, college and department websites, and central library.	
4.2	Use IT facilities as an aid to mathematical processes and for acquiring available information		
4.3	Use library to locate mathematical information.		
4.4	Use Financial Calculator machine	Giving financial calculator group assignment	
<b>5.0</b>	<b>Psychomotor</b>		
	Not applicable	Not applicable	Not applicable

5. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Tests, Quizzes	3	5%
2	First Midterm exam	6	25%
3	Tests, Quizzes	9	5%
4	Second Midterm exam	12	25%
5	Final	15 or 16	40%

## D. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

1. 10 office hours weekly.
2. Encouraging students to get in touch with the instructor via e-mail.

## E Learning Resources

### 1. List Required Textbooks

1. Derivatives Markets (Third Edition), 2013, by McDonald, R.L., Pearson Education, ISBN: 978-0-32154-308-0
2. ACTEX MFE Study Manual with StudyPlus+ Spring 2018, by: Johnny Li, Ph.D., FSA, Andrew Ng, Ph.D., FSA

### 2. List Essential References Materials (Journals, Reports, etc.)

### 3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

1. <https://www.soa.org>
2. <http://www.casact.org/>

### 4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

LMS (Bb), Webinars, TeamViewer, google apps, virtual classroom.



## F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Classrooms
2. Technology resources (AV, data show, Smart Board, software, etc.) AV, data show, Smart Board, LMS (Bb)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

## G Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching Surveys, Exams, quizzes <ol style="list-style-type: none"> <li>An evaluation sheet for the course to be filled by the students at the end of each semester.</li> <li>Take the students' opinion about the course under consideration.</li> <li>Discussing the course with instructors who teach the same course.</li> </ol>
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department <ol style="list-style-type: none"> <li>The level of the students in solving homework and quizzes</li> <li>Colleagues' opinions about students' performance in this course.</li> </ol>
3. Processes for Improvement of Teaching <ol style="list-style-type: none"> <li>Encouraging students to get involved in the lecture.</li> <li>Getting the use of tutorial classes.</li> <li>Encouraging the students to read about the subject.</li> </ol>
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) <ol style="list-style-type: none"> <li>Common Examination</li> <li>Team grading.</li> <li>Exchanging experience by comparing students' results in other departments.</li> <li>Students who believe they are under graded can have their papers checked by a second reader.</li> </ol>
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

1. Providing reviews to develop the assigned book content.
2. Providing a discussion for the course subject by a specialized committee.
3. View other math departments in well-known universities and getting help from them.
4. Consulting some course specialists for course evaluation.

Name of Course Instructor: Prof. Dr. Souhail Mohsen Chebbi

Signature:



Date Specification Completed: 1/02/2016

Program Coordinator: Prof. Dr. Souhail Mohsen Chebbi

Signature



Date Received: 1/02/2016