



**ATTACHMENT 5.**

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

## Course Specifications

Institution: King Saud University	Date:
College/Department: Science, Mathematics	

### A. Course Identification and General Information

1. Course title and code: Credibility Theory and Loss Distribution ACTU. 475
2. Credit hours: 4(3+2+0)
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Actuarial and Financial Mathematics Program
4. Name of faculty member responsible for the course:
5. Level/year at which this course is offered: 8/4
6. Pre-requisites for this course (if any): ACTU 474
7. Co-requisites for this course (if any):
8. Location if not on main campus:
9. Mode of Instruction (mark all that apply):
a. traditional classroom What percentage? <input checked="" type="checkbox"/> 80
b. blended (traditional and online) What percentage? <input checked="" type="checkbox"/> 15
c. e-learning What percentage? <input checked="" type="checkbox"/> 5
d. correspondence What percentage? <input type="checkbox"/>
f. other What percentage? <input type="checkbox"/>
Comments:

## B Objectives

1. What is the main purpose for this course?

The goal of this course is introducing students to survival, severity, frequency and aggregate models, and learn them statistical methods to estimate parameters of such models given sample data. Students should at the end of the course to be able to identify steps in the modeling process, understand the underlying assumptions implicit in each family of models, recognize which assumptions are applicable in a given business application, and appropriately adjust the models for impact of insurance coverage modifications.

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 classroom).  
Use updated syllabus of C 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
1. Severity Models <ul style="list-style-type: none"> <li>a. Basic distributional quantities: (moments, Percentiles, Generating functions)</li> <li>b. Changes in parameters affect the distribution.</li> <li>c. Recognition of classes of distributions and their relationships.</li> <li>d. Techniques for creating new families of distributions.</li> <li>e. Identification and reasons of applications in which each distribution is used.</li> <li>f. Various measures of tail weight and interpret the results to compare the tail weights.</li> </ul>	2	6+4

<p>2. Frequency models for classical distributions</p> <ul style="list-style-type: none"> <li>a. Changes in parameters affect the distribution,</li> <li>b. Calculation of moments,</li> <li>c. Recognition of classes of distributions and their relationships.</li> <li>d. Techniques for creating new families of distributions.</li> <li>e. Identification and reasons of applications in which each distribution is used.</li> <li>f. Apply the zero-truncated or zero-modified distribution to an application given the parameters</li> </ul>	2	6+4
<p>3. Aggregate models</p> <ul style="list-style-type: none"> <li>a. Computation of relevant parameters and statistics for collective risk models.</li> <li>b. Evaluation of compound models for aggregate claims.</li> <li>c. Computation of aggregate claims distributions.</li> </ul>	1	3+2
<p>4. Severity, frequency and aggregate models</p> <ul style="list-style-type: none"> <li>a. Impacts of coverage modifications: <ul style="list-style-type: none"> <li>i. Deductibles</li> <li>ii. Limits</li> <li>iii. Coinsurance</li> </ul> </li> <li>b. Loss Elimination Ratios.</li> <li>c. Effects of inflation on losses.</li> </ul>	1	3+2
<p>5. Construction of empirical models</p> <ul style="list-style-type: none"> <li>a. Estimation of failure time and loss distributions using: <ul style="list-style-type: none"> <li>i. Kaplan-Meier estimator</li> <li>ii. Nelson-Åalen estimator</li> <li>iii. Kernel density estimators</li> </ul> </li> <li>b. Estimation of the variance of estimators and confidence intervals for failure time and loss distributions.</li> <li>c. Estimation of failure time and loss distribution: <ul style="list-style-type: none"> <li>i. Unbiasedness</li> <li>ii. Consistency</li> <li>iii. Mean squared error</li> </ul> </li> </ul>	2	6+4
<p>6. Estimation of decrement probabilities from large samples</p> <ul style="list-style-type: none"> <li>a. Estimation of decrement probabilities using both parametric and nonparametric approaches for both individual and interval data</li> <li>b. Approximation of the variance of the estimators</li> </ul>	1	3+2

<p>7. Construction and selection of parametric models</p> <p>a. Estimation of parameters of failure time and loss distributions using</p> <ol style="list-style-type: none"> <li>i. Maximum likelihood</li> <li>ii. Method of moments</li> <li>iii. Percentile matching</li> <li>iv. Bayesian procedures</li> </ol> <p>b. Estimate the variance of estimators and the confidence intervals for the parameters and functions of parameters of failure time and loss distributions.</p>	1	3+2
<p>8. Estimation of failure time and loss distributions:</p> <ol style="list-style-type: none"> <li>a. Unbiasedness</li> <li>b. Asymptotic unbiasedness</li> <li>c. Consistency</li> <li>d. Mean squared error</li> <li>e. Uniform minimum variance estimator</li> </ol>	1	3+2
<p>9. Fit and compare models using:</p> <ol style="list-style-type: none"> <li>a. Graphical procedures</li> <li>b. Kolmogorov-Smirnov test</li> <li>c. Chi-square goodness-of-fit test</li> <li>d. Likelihood ratio test</li> <li>e. Schwarz Bayesian Criterion</li> <li>f. Akaike Information Criterion</li> </ol>	1	3+2
<p>10. Credibility</p> <ol style="list-style-type: none"> <li>a. Limited fluctuation (classical) credibility including criteria for both full and partial credibility.</li> <li>b. Bayesian analysis using both discrete and continuous models.</li> <li>c. Bühlmann and Bühlmann-Straub models and understand the relationship of these to the Bayesian model.</li> <li>d. Bayesian analysis in the Poisson-Gamma model.</li> <li>e. Bayesian methods in the nonparametric and semiparametric cases.</li> </ol>	2	6+4
<p>Revision and preparation for the final exam</p>	1	3+2

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

		Lecture	Tutorial	Laboratory/ Studio	Practical (visit to companies)	Other:	Total
Contact Hours	Planned	42	30		3		75
	Actual	42	30		3		75
Credit	Planned	3	1		3		4
	Actual	3	1		3		4

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

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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 calculate the basic distributional quantities	Traditional lecture classroom	Quizzes Midterm and final exams
1.2	Calculate various measures of tail weight and interpret the results to compare the tail weights.	Traditional lecture classroom	Quizzes Midterm and final exams
1.3	Compute relevant parameters and statistics for collective risk models.	Traditional lecture classroom	Quizzes Midterm and final exams
1.4	Compute aggregate claims distributions and calculate loss elimination Ratios.	Traditional lecture classroom	Quizzes Midterm and final exams
1.5	Describe how changes in parameters affect the distribution.	Traditional lecture classroom	Quizzes Midterm and final exams
1.6	Recognize classes of distributions and their relationships.	Traditional lecture classroom	Quizzes Midterm and final

			exams
1.7	Describe how changes in parameters affect the distribution,	Traditional lecture classroom	Quizzes Midterm and final exams
<b>2.0</b>	<b>Cognitive Skills</b>		
2.1	Creating new families of distributions and identify applications and reasons in which each distribution given the parameters	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.2	Identify and describe two extreme value distributions.	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.3	Apply the zero-truncated or zero-modified distribution to an application given the parameters	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.4	Evaluate compound models for aggregate claims and the impacts of coverage modifications	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.5	Evaluate effects of inflation on losses.	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.6	Construction of Empirical Models by estimating failure time and loss distributions and estimating the variance of estimators and confidence intervals for failure time and loss distributions.	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.7	Apply the following concepts in estimating failure time and loss distribution and estimate decrement probabilities from large samples	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.8	Estimate decrement probabilities using both parametric and nonparametric approaches for both individual and interval data.	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.9	Approximate the variance of the estimators	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.10	Apply limited fluctuation (classical) credibility including criteria for both full and partial credibility	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.11	Perform Bayesian analysis using both discrete and continuous models	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.12	Apply Buhlmann and Buhlmann-Straub models and understand the relationship of these to the Bayesian model	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.13	Apply conjugate priors in Bayesian analysis and in particular the Poisson-gamma model	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.14	Apply empirical Bayesian methods in the nonparametric and semiparametric cases	Problem solving, flipped classroom	Quizzes Midterm and final exams
2.15	Construct and select empirical models	Problem solving, flipped	Quizzes

		classroom	Midterm and final exams
2.16	Determine the acceptability of a fitted model and/or compare models	Problem solving, flipped classroom	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: <ul style="list-style-type: none"> <li>- participate in class discussion.</li> <li>- participate in college and university activities.</li> <li>- be members of department committees and college committees.</li> </ul>	
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	Exchange with others, notions and methods on fitting data and credibility theory both in oral and written form clearly and in a well-organized manner	Encourage students to: <ul style="list-style-type: none"> <li>- Register and pass C exam of SOA/CAS</li> <li>- use department and college computing facilities.</li> <li>- use e-mail, LMS internet, college and department websites, and KSU central library.</li> </ul>	
4.2	Use IT facilities of the university to exchange ideas around the world		
4.3	Use SDL (libraries) to get updated with new developments about the course		
<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	4	5%
2	First Midterm exam	7	25%
3	Tests, Quizzes	10	5%
4	Second Midterm exam	12	25%
5	Final	15 or 16	40%



## D. Student Academic Counseling and Support

1. 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)

Office hours, exchange questions and answers by email: **10 hours per week**

## E Learning Resources

1. List Required Textbooks

1. Loss Models: From Data to Decisions, (Fourth Edition), 2012, by Klugman, S.A., Panjer, H.H. and Willmot, G.E., John Wiley & Sons, ISBN: 978-1-118-31532-3.

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, Virtual classroom, TeamViewer

2. Technology resources (AV, data show, Smart Board, software, etc.)  
Smart Board, LMS (Bb), TeamViewer, Email, Kahoot


3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

## G Course Evaluation and Improvement Processes

<p>1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching Surveys, Exams, quizzes</p> <ol style="list-style-type: none"> <li>1. Evaluation sheets to be completed by students at the end of each semester.</li> <li>2. Take the students' opinion about the course under consideration.</li> <li>3. Revise course syllabus with instructors who teach the same course (if any).</li> </ol>
<p>2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department</p> <ol style="list-style-type: none"> <li>1. The level of the students in solving homework and quizzes</li> <li>2. Colleagues' opinions about students' performance in this course.</li> </ol>
<p>3. Processes for Improvement of Teaching</p> <ol style="list-style-type: none"> <li>1. Encouraging students to get involved in the lecture.</li> <li>2. Getting the use of tutorial classes.</li> <li>3. Encouraging the students to read about the subject.</li> </ol>
<p>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)</p> <ol style="list-style-type: none"> <li>1. Common Examination</li> <li>2. Team grading.</li> <li>3. Exchanging experience by comparing students' results in other departments.</li> <li>4. Students who believe they are under graded can have their papers checked by a second reader.</li> </ol>
<p>5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.</p> <ol style="list-style-type: none"> <li>1. Providing reviews to develop the assigned textbook content.</li> <li>2. Providing a discussion for the course subject by a specialized committee.</li> <li>3. Compare the program with other well-known established universities.</li> <li>4. Consulting some course specialists for course evaluation.</li> </ol>
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Name of Course Instructor: \_\_\_Prof. Dr. Mhamed ED DAHBI\_\_\_\_\_

Signature: \_\_\_\_\_  
 \_\_\_\_\_ Date Specification Completed: March 11, 2018

Program Coordinator: \_\_\_\_\_

Signature: \_\_\_\_\_ Date Received: \_\_\_\_\_