Course Specification

(Postgraduate Programs)

Course Title:	**Actuarial Models**
Course Code:	**AFM 6102**
Program:	**Executive Master of Science in Actuaries and Financial Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**None**

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A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☐ College	☐ Department	☐Track	☒ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: Level 1 / Year 1					
4. Course general Description:					
This course provides an in-depth understanding of actuarial models used in the assessment of risk and uncertainty in insurance and finance. Students will learn to apply statistical and mathematical techniques to model various types of risks and make informed decisions based on data.					
5. Pre-requirements for this course (if any):					
• Calculus • Probability and Statistics • Introduction to Actuarial Science (recommended)					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
The main objective of this course is to: • Understand the fundamental concepts of actuarial science and risk theory. • Develop and analyze actuarial models for different insurance products. • Apply statistical methods to estimate probabilities and expected values. • Use software tools for data analysis and model implementation. • Communicate results effectively to stakeholders.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	30
5.	**Others (specify)**	0
Total		**60**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Identify the principles of actuarial modelling	K1	2 lecture hours\week	Direct: Regular Exams
1.2	Describe the general principles of stochastic processes and their classification into different types.	K2	• 2 tutorial hours\week • Self-study	Direct: Short Quizzes
2.0	**Skills**			
2.1	Apply and define and a Markov jump process.	S1	Self-study	Direct: • Participations • Short Quizzes
2.2	Use the concepts of survival models.	S3	Real-life problems	Direct: Simulation mini-projects
2.3	Develop an estimation procedures for lifetime distributions.	S2	Real-life problems	Direct: Cases study
2.4	Perform and derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.	S2	Self-study	Direct: Project
3.0	**Values, autonomy, and responsibility**			
3.1	Create and describe the two-state model of a single decrement and compare its assumptions	V1	Personal questions	Direct: Participation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	with those of the random lifetime model, derive maximum likelihood estimators for transition intensities and state the Poisson approximation to the estimator in the case of a single decrement.			
3.2	**Generate how to estimate transition intensities depending on age, exactly or using the census approximation.**	**V2**	**Teamwork and class discussions.**	**Direct: Real-life project**

C. Course Content

No	List of Topics	Contact Hours
1.	**Preliminary Facts from Probability and Interest:** Probability and Random Variables, Expectation, Some Basic Distributions, Moment Generating Functions, Convergence of Random Variables and Distributions, Limit Theorems, Conditional Expectations. Conditioning and Elements of the Theory of Interest	5
2.	**Comparison of Random Variables. Preferences of Individuals:** A General Framework and First Criteria, Comparison of R.V.s and Limit Theorems, Expected Utility, Non-Linear Criteria and Optimal Payment from the Standpoint of an Insured	5
3.	**An Individual Risk Model for a Short Period:** The Distribution of an Individual Payment, The Aggregate Payment Premiums and Solvency and Approximations for Aggregate Claim Distributions Some General Premium Principles.	5
4.	**A Collective Risk Model for a Short Period:** Three Basic Propositions, Counting or Frequency Distributions, The Distribution of the Aggregate Claim and Premiums and Solvency. Normal Approximation.	5
5.	**Random Processes and Their Applications I:** A General Framework and Typical Situations, Poisson and Other Counting Processes, Compound Processes and Markov Chains. Cash Flows in the Markov Environment.	5
6.	**Random Processes and Their Applications II:** Brownian Motion and Its Generalizations and Martingales.	3
7.	**Global Characteristics of the Surplus Process:** A General Framework, Ruin Models and Criteria Connected with Paying Dividends.	4
8.	**Survival Distributions:** The Probability Distribution of Lifetime, A Multiple Decrement Model and Multiple Life Models	5
9.	**Life Insurance Models:** A General Model, Some Particular Types of Contracts, Varying Benefits, Multiple Decrement and Multiple Life Models and On the Actuarial Notation	4
10.	**Annuity Models:**	12

	Two Approaches to the Evaluation of Annuities, Level Annuities. A Connection with Insurance, Some Particular Types of Level Annuities, More on Varying Payments, Annuities with m-thly Payments and Multiple Decrement and Multiple Life Models.	
11.	**Premiums and Reserves:** Premium Annuities and Reserves.	2
12.	**Pensions Plans and Risk Exchange: Reinsurance and Coinsurance:** Valuation of Individual Pension Plans, Pension Funding. Cost Methods, Reinsurance from the Standpoint of a Cedent, Risk Exchange and Reciprocity of Companies and Reinsurance Market	5
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Quizzes, Mini projects, Real-life project**	**During the semester**	**30%**
2.	**Midterm**	**Week 8-9**	**30%**
3.	**Final Exam**	**Week 15**	**40%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	***Actuarial Models; The Mathematics of Insurance*, Vladimir I. Rotar,** 2nd Edition, 2015, Chapman & Hall.
Supportive References	***Actuarial Mathematics for life contingent Risks*, David C. M. Dickson, Mary R. Hardy, and Howard R. Waters,** 2nd Edition, 2013, Campridge.
Electronic Materials	**None**
Other Learning Materials	**Basic Computer applications (like MS- office, media player, Google chrome) for enhanced knowledge & learning. MS- Project will be more helpful to understand practical side of project management.**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (projector, smart board, software)	▪ **The rooms should be equipped with data show and Smart Board.**

Items	Resources
Other equipment (depending on the nature of the specialty)	▪ **Projectors** ▪ **Printers, scanners, etc.**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Effectiveness of Students assessment	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
The extent to which CLOs have been achieved	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Other	**None**	

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	**20/1446**
DATE	**11/08/1446 (10/02/2025)**