Course Specification
(Bachelor)

Course Title:	**Actuarial Mathematics**
Course Code:	**AFM 1345**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**08/10/2024**

Table of Contents

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	☒ Program	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: 6 /3 or 8/ Year4					
4. Course general Description:					
This module offers a comprehensive introduction to actuarial mathematics, emphasizing the application of probability and financial concepts for assessing risk and valuing insurance products. Key topics include the fundamentals of probability and interest theory, the impact of variable interest rates, and continuous-time payment streams. It explores in-depth interest calculations, annuities, loan amortization, and the characteristics of bonds, alongside an examination of mortality rates and their implications in actuarial work. Students will learn to interpret life tables, calculate expected values for various payments, and derive premium formulas, while also gaining insights into the effects of age on premium calculations. Overall, the course equips students with essential skills to analyze and apply actuarial principles in real-world contexts.					
5. Pre-requirements for this course (if any)**:**					
AFM 1235					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					

- **Foundational Knowledge**: To provide students with a solid understanding of key concepts in actuarial mathematics, including probability, financial mathematics, and the theory of interest.
- **Practical Application:** To enable students to apply mathematical principles to real-world actuarial problems, particularly in the areas of insurance and risk management.
- **Risk Assessment Skills:** To develop students' ability to assess and quantify financial risks using actuarial techniques and models.
- **Analytical Thinking:** To enhance students' critical thinking and problem-solving skills in the context of financial decision-making.
- **Preparation for Advanced Studies:** To prepare students for further studies in actuarial science and related disciplines by building a strong mathematical foundation.

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**	
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	To outline the fundamentals of the interest rate related to Loan and Mortgage refinancing.	K1, K2	•3 lecture hours\week	•Regular Exams
1.2	To memorize mortality tables and the interpretation of its force.	K1, K2	•2 tutorial hours\week •Self-study	•Assignments •Short Quizzes
2.0	**Skills**			
2.1	To develop techniques of life insurance.	S1, S2	Real-life problems	Short Quizzes
2.2	To present methods of premium	S4	Self-study	Participations

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	calculations clearly and precisely both orally and in writing.			
2.3	**To use Internet in searching for real insurance products**	**S5**	**Real-life problems**	**Short Quizzes**
2.4	**To demonstrate the efficiency of some insurance techniques.**	**S3**	**Self-study**	**Participations**
3.0	**Values, autonomy, and responsibility**			
3.1	**To work individually.**	**V1, V3**	**Personal questions**	**Participation**
3.2	**To work in groups.**	**V1, V2**	**Team work**	**Homework and Mini-projects**

C. Course Content

No	List of Topics	Contact Hours
1.	**Chapter 1: Basics of Probability & Interest** • Introduction to Probability • Theory of Interest • Variable Interest Rates • Continuous-time Payment Streams	**10**
2.	**Chapter 2: Interest & Force of Mortality** • Advanced Theory of Interest • Annuities & Actuarial Notation • Loan Amortization & Mortgage Refinancing • Illustration on Mortgage Refinancing • Coupon & Zero-coupon Bonds • Force of Mortality & Analytical Models • Comparison of Forces of Mortality	**15**
3.	**Chapter 3: Probability & Life Tables** • Interpreting Force of Mortality • Interpolation between Integer Ages	**15**

	• Binomial Variables & Law of Large Numbers • Exact Probabilities, Bounds & Approximations • Simulation of Life Table Data • Expectation for Discrete Random Variables • Rules for Manipulating Expectations • Some Special Integrals	
4.	**Chapter 4: Expected Present Values of Payments** • Expected Payment Values • Types of Insurance & Life Annuity Contracts • Formal Relations among Net Single Premiums • Formulas for Net Single Premiums • Expected Present Values for Continuous Contracts & Residual Life • Numerical Calculations of Life Expectancies	**10**
5.	**Chapter 5: Premium Calculation** • m-Payment Net Single Premiums • Dependence Between Integer & Fractional Ages at Death • Net Single Premium Formulas | Case (i) • Net Single Premium Formulas | Case (ii) • Approximate Formulas via Case (i) • Net Level Premiums • Benefits Involving Fractional Premiums	**10**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	During the term	10%
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15-16	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 Mathematics and Life-Table Statistics*, Eric V. Slud, CRC Press (Verlag), 2001.** (Main Reference). ISBN: 9781439861974

Supportive References	1. ***Fundamentals of Actuarial Mathematics*, S. David Promislow, Wiley, 2010.**ISBN: 978-0-470-68411-5. 2. ***Actuarial Mathematics*, by Newton L. Bowers, Hans U. Gerber, James C. Hickman, Donald A. Jones and Cecil J. Nesbitt (1997).** ISBN 10: 0938959468, ISBN 13: 9780938959465. 3. ***Actuarial Mathematics for Life Contingent Risks, 2nd Edition, David C. M. Dickson, Mary R. Hardy and Howard R. Waters, Cambridge University Press, 2013. ISBN: 9781107044074.***
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of algebraic and trigonometric concepts. • **Exhibition Rooms:** Spaces for showcasing projects and presentations to encourage collaborative learning.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of limits, continuity, and differentiation. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty, Program Manager, Students, Course Coordinator	- **Student Course Evaluation**: Student feedback surveys to assess teaching quality (clarity, engagement, delivery). - **Instructor Course Report**: Instructor reflection on their teaching effectiveness and challenges. - **Classroom Observations**: Conducted by the program manager or course coordinator to directly observe teaching methods. - **Benchmarking Between Male and Female Sections**: Compare student evaluations and performance across gender-based sections to identify any disparities in teaching effectiveness. - **Advisory Board Feedback**: Gathering insights on teaching methods from external academic or industry professionals.

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students' assessment	Faculty, External Reviewers, Program Manager, Course Coordinator	- **Alignment of Assessments with CLOs**: Ensuring exams, assignments, and projects measure the intended CLOs. - **Benchmarking Between Semesters**: Comparing assessment effectiveness across different semesters to maintain consistency and improvement. - **CLOs Assessment Excel Sheet**: Tracking student performance in relation to CLOs to evaluate the strength of assessments. - **Instructor Course Report**: Faculty analysis of assessment outcomes and potential adjustments. - **External Audit/Reviewers**: External examiners review assessments for rigor and fairness.
Quality of learning resources	Program Manager, Librarians, Faculty, Course Coordinator	- **Student Course Evaluation**: Students provide feedback on the usefulness and availability of learning resources (textbooks, software, etc.). - **Instructor Course Report**: Faculty report on the adequacy and relevance of learning materials. - **Resource Usage Statistics**: Data on the usage of learning resources (digital/physical) such as library access, software downloads. - **Benchmarking Between Sections/Semesters**: Compare resource satisfaction across male/female sections and over semesters. - **Advisory Board Input**: External experts suggest updated or alternative resources to align with industry or academic developments.
The extent to which CLOs have been achieved	Faculty, Program Manager, External Reviewers, Course Coordinator	- **CLOs Assessment Excel Sheet**: Regular tracking of student performance for each CLO based on exams, projects, and assignments. - **Instructor Course Report**: Faculty reflection on CLO achievement and any gaps identified. - **Student Course Evaluation**: Students assess whether they feel they've met the course learning outcomes. - **Benchmarking Between Semesters**: Analyze CLO achievement across different semesters to ensure continuous improvement. - **Advisory Board Feedback**: Assess whether CLOs are aligned with industry or academic standards and if students are adequately prepared.
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.	8/1446
DATE	05/04/1446 (08/10/2024)