Course Specification
— (Bachelor)

Course Title: **Actuarial Mathematics (2)**

Course Code: **AFM 1444**

Program: **Bachelor of Science in Actuarial 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	☒ Program	☐Track	☐Others
B.	☒ Required			☐Elective	

3. Level/year at which this course is offered: Level 7 / Year 4

4. Course general Description:

This course is the second part of the Actuarial Mathematics (1) course. This course describes applications of multiple life functions and multiple decrement models in the actuarial context. steps involved in modelling life insurance portfolios to determine the probability of survival and death in a multiple decrement basis. In addition, a practical applications of the course through a software based assignment required for the valuation of the reserves for an individual life insurance policyholder. A software used in the actuarial field will be incorporated in the course so that students develop practical skills.

5. Pre-requirements for this course (if any):

AFM 1343

6. Co-requisites for this course (if any):

None.

7. Course Main Objective(s):

The main objective of this course is to provide a grounding in the principles of modelling as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value cashflows that are dependent on death, survival, or other uncertain risks.

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	**Define financial markets, investment theory, interest rates, and asset-liability management.**	**K3**	2 lecture hours\week	Direct: **Regular Exams**
1.2	**Describe morbidity risk for health insurance and disability insurance products**	**K3**	• 2 tutorial hours\week • Self-study	Direct: **Short Quizzes**
1.3	**Deduce the insurance or pension business.**	**K3**	• Real-life problems	Direct: **Regular Exams**
2.0	**Skills**			
2.1	**Identify potential risks, quantifying their impact, and developing strategies for reinsurance issues.**	**S1, S2**	• Self-study • Real-life problems	Direct: • **Participations** • **Short Quizzes**
2.2	**Analyze actuaries mortality rates and life expectancy trends.**	**S1**	Self-study	Direct: **Participations**
2.3	**Develop complex calculations, models, and data analysis using actuarial software and tools.**	**S2**	Real-life problems	Direct: **Short Quizzes**
2.4	**Evaluate the potential duration of benefit payments for pension plans and annuities.**	**S2**	Self-study	Direct: **Participations**
3.0	**Values, autonomy, and responsibility**			
3.1	**Debate with independecnce and in work teams.**	**V1, V2**	Personal questions	Direct: **Participation**
3.2	**Develop personal values and attributes such as honesty, empathy and respect for others.**	**V1, V2**	Teamwork and class discussions.	Direct: **Homework and Mini projects**

C. Course Content

No	List of Topics	Contact Hours
1.	Joint life and last survivor benefits: joint life notation- independent future lifetime- a multiple state model for independent future lifetimes- model with dependent future lifetimes- the common shock model-	10
2.	Pension Mathematics: the salary scale function; setting the DC contribution; the service table- valuation of benefits (final salary plans- Career average earnings plans) - funding plans	10
3.	Emerging costs for traditional life insurance: profit testing a term insurance policy(time step- profit test basis- incorporating reserves – profit signature)- profit testing principles(Assumptions-the vector of profit – the profit signature – the net present value) -profit measures (calculate the premium and reserves by using the profit test- profit testing for multiple state models.	10
4.	Participating and Universal life insurance: Participating insurance- universal life insurance (key design features- projecting account values- profit testing universal life policies (Universal life Type A- Universal life Type B- no lapse guarantees- comments on UL profit testing- Comparison between UL and whole life insurance policies.	10
5.	Emerging costs for equity linked insurance: Equity linked insurance- Deterministic profit testing for equity linked insurance- stochastic profit testing – stochastic pricing – stochastic reserving (quantile reserving – CTE reserving- comments on reserving.	10
6.	Option pricing: the " no-arbitrage" assumption – options- the binomial option pricing model (pricing over a single and two time periods)- the Black-Scholes -Merton option pricing formula.	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 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	Dickson, D.C., Hardy, M., Hardy, M.R. and Waters, H.R.. Actuarial mathematics for life contingent risks. Cambridge University Press, Second edition (2020). (**Main Reference**)
Supportive References	1- Promislow, S. D. (2015) Fundamentals of actuarial mathematics. Third edition. West Sussex, England: John Wiley & Sons Ltd. 2-Dickson, D.C., Hardy, M., Hardy, M.R. and Waters, H.R.. Solutions manual for actuarial mathematics for life contingent risks. Cambridge University Press, Second edition (2013). 3-Rob Kaas, Marc Goovaerts, Jan Dhaene, Michel Denuit- Modern Actuarial Risk Theory Using R (2009), Springer 4-Computational Actuarial Science with R, First Edition,Kindle Edition by Arthur Charpentier(Editor)(2016)
Electronic Materials	None
Other Learning Materials	None

2. Required Facilities and equipment

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.**
Other equipment (depending on the nature of the specialty)	**None**

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**

Assessment Areas/Issues	Assessor	Assessment Methods
		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.	**8/1446**
DATE	**05/04/1446 (08/10/2024)**