King Saud University
Department of Mathematics
Syllabus of Actuarial Mathematical Models II
Second semester 2024-2025

Course code: ACTU-472
Course title: **Actuarial Mathematical Models II**
Pre-Requisite: ACTU-372
Instructor: Mhamed Eddahbi
Room 2A65, Building 4, Mathematics Department.
Text Book: ACTEX MLC Study Manual Fall 2019, **Volume II**, by: Johnny Li, Ph.D., FSA, Andrew Ng, Ph.D., FSA
References: Actuarial Mathematics for life contingent Risks (Third Edition, 2020) by Dickson, D.C.M. and Hardy, M.R. and Waters, H.R

Course objectives

This course is a continuation of the study of Actuarial Mathematical models I ACTU372. Topics include characterization of discrete and continuous multiple decrement models in insurance and employee benefits, multiple life models and Interest Rate Risk, Management of Universal life insurance policies. This course will prepare students for the second part of the life contingencies segments of actuarial professional examinations (Exam ALTAM: Advanced Long-Term Actuarial Mathematics).

Course learning outcomes

Students completing this course successfully will be able to:

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	Demonstrate mastery of concepts and theories of actuarial models and their applications in multiple states and lives insurance contracts.	K3
2	**Skills:**	
2.1	Quantify, evaluate and solve complex problems of risks in multiple states and multiple life insurance policies.	S2
2.2	Model different actuarial problems in multiple states and multiple life insurance policies.	S3
2.3	Use Excel and R in computing premiums and reserves for different insurance policies.	S5
3	**Values:**	
3.1	Study, learn and work collaboratively and constructively.	V2
3.2	Qualify students to pass in the ALTAM exam of SOA.	V3

Course content

No	List of Topics	Contact Hours
1	Multiple Decrement Models: Theory a. Multiple Decrement Table b. Forces of Decrement c. Associated Single Decrement d. Construct a multiple decrement model using associated single decrements e. Apply various assumptions to calculate decrement rates	6
2	Multiple Decrement Models: Applications a. Calculate APV of cash flows under a multiple decrement model b. Understand surrender charge and cash value c. Calculate reduced paid-up and extended term d. Calculate asset share under a multiple decrement model Calculating Actuarial Present Values of Cash Flows e. Calculating Reserve and Profit	6
3	Multiple State Models a. Applications of Discrete-time Markov Chain b. Calculating APV of Cash Flows c. Applications of Continuous-time Markov Chain d. Kolmogorov's Forward Equations e. Calculating Actuarial Present Value of Cash Flows f. Calculating Reserves	6
4	Multiple Life Functions a. Multiple Life Statuses b. Insurances and Annuities c. Dependent Life Models	8
5	Interest Rate Risk d. Yield Curves e. Interest Rate Scenario Models f. Diversifiable and Non-Diversifiable Risks	4
6	Profit Testing a. Profit Vector and Profit Signature b. Profit Measures c. Using Profit Test to Compute Premiums and Reserves	6
7	Universal Life Insurance a. Basic Policy Design b. Cost of Insurance and Surrender Value c. Other Policy Features d. Projecting Account Values e. Profit Testing f. Asset Shares for Universal Life Policies	6
8	Participating Insurance a. Dividends b. Bonuses	3
Total		45

Grading	Date of the test	Percentage
Midterm 1 exam	March xx, 2024	20%
Midterm 2 exam	May xx , 2024	20%
Project with R	Week 17/18	20%
Final exam	June 5, 2024	40%
Total		**100%**