King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
AS481: Actuarial Contingencies 2 - Term 231   (3-2-4) 9am UTR

Course Objectives:
A continuation of Life Contingencies I. Development is based on a stochastic approach to insurance models. Major topics include benefit premiums and reserves, and multi-life and multiple-decrement models. Parallel treatment of topics based on Takaful system. Application of such area in life insurance and property.

Prerequisites: AS 380

Textbook and Package:
1. Camilli, S.J., Duncan, I., & London, R.L. (2014) *Models for Quantifying Risk, 6th edition*. ACTEX Publication: Winsted, USA.
2. Texas BAII Plus Calculator or Texas BAII Professional

Reference:
1. Dickson, D.C., Hardy, M. R., & Waters, H. R. (2020) *Actuarial Mathematics for Life Contingent Risks,* 3rd edition. Cambridge University Press: Cambridge, UK.
2. Bowers N., Gerber, H., Hickman, J., Jones, D. & Nesbitt, C. (1997 or later printing) *Actuarial Mathematics*, 2nd edition. Society of Actuaries Publishing.
3. Society of Actuaries regulations for FAM-L (Fundamental of Actuarial Models - Long Term) and ALTAM (Advanced Long Term Actuarial Models) and sample exams for FAM and ALTAM
4. Institute and Faculty of Actuaries (IFoA) CM1 professional exam

Instructor: Dr. Mohammad H. Omar   **Office:** Bldg – 5, room – 508.   **Phone:** 013 - 860 2471
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Office Hours: M: 2.00pm-3:00pm (office), T: 12.35pm-1.20pm (office) and R: 10am–10.50am (bldg. 24 158) or by appointment on MS Teams chat

Assessment

Assessment for this course will be based on the following:

Activity	Weight
Classwork (Attendance, Participation, and homework)	7%
Labwork (Attendance, computer assignments, and Quizzes)	20%
Major 1 Exam **Ch 3, ch 13 & ch 14 (Sun Oct 1, 6pm)**	18%
Major 2 Exam **Ch 12 & ch 15 (Sun Nov 5, 6pm)**	20%
Final Exam (Comprehensive) **(as posted on registrar website)**	35%

IMPORTANT NOTE on GRADES:

Letter grade	A+	A	B+	B	C+	C	D+	D	F	DN
Cut-off	90%	85%	80%	75%	67%	60%	55%	50%	<50%	$\geq$ 9+3 absences

Academic Integrity: All KFUPM policies regarding **ethics** and **academic honesty** apply to this course.
Exams:
Exam Questions: The questions of the exams are based on the examples, homework problems, and exercises in the textbook.
Cheating in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of **F** in the course along with reporting the incident to the higher university administration. Cheating in exams includes (but not restricted to)
 ➢ Looking at the papers of other students,
 ➢ Talking to other students,
 ➢ Using mobiles or any other electronic devices.

Exam Issues:
 ➢ No student will be allowed to take the exam if not having his/her KFUPM ID or National/Iqama ID.
 ➢ Students are not allowed to carry mobiles, smart watches, or electronic devices to the exam halls/rooms.
 ➢ Students must take the exam in the place assigned to them.

Missing an Exam:
In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), he must bring an official excuse from Students Affairs with the "Exam Included" box checked. Otherwise, he will get zero in the missed exam.

Attendance: Students must adhere to the attendance policy of KFUPM. Students are expected to attend all lecture and recitation classes.
 ➢ If a student misses a class, he is responsible for any announcement made in that class.
 ➢ A DN grade will be assigned to the eligible student after being warned twice by his/her instructor.
 ➢ A DN grade will be awarded to any student who accumulates
   o 12 unexcused absences in lecture and labs. (20%)
   o 20 excused and unexcused absences in lecture and recitation classes. (33%)
Note:

- *Attendance* on time is *very* important. Mostly, attendance will be checked within the *first five minutes* of the class. Entering the class after that, is considered as late (**2 lates= 1 Absence**) and
- **More than 10 minutes late = Absence** (regardless of any excuse).
- Only University Blue paper Official excuses will be accepted as valid excuse.
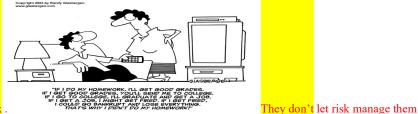
Absences are counted as follows:
- Missing a lab is counted as 2 absences.
- Missing a lecture is counted as 1 absence.

General Notes:

- Students are required to carry **pens, note-taking equipment** and a **calculator** to **EVERY lecture and exams**. It is strongly recommended to keep a **binder** for class-notes.
- Students are also expected to bring the book, take notes and organize their solved questions in a **binder** for easy retrieval to help them in study and review for class, exams, etc
  - It is to the student's advantage to keep a binder for storing class notes, homework, and other graded assignments. Students who are **organized** will find it **easier** to find important materials when **studying for exams**.

Home Work:

- To successfully prepare for the SOA exams, students MUST **solve problems** regularly and with discipline. The selected assigned problems are specifically designed to prepare you for major and final exams. So, it is expected that you complete these problems **step-by-step** and with comprehension.
- ➤ If you happen to stumble upon a *solution manual* somewhere, remember **2 important points**. (1) Due to publishing costs and deadlines, these solutions are brief and may have mistakes and (2) in your career as an actuary and your exams and quizzes in this class, you are expected to know **every step to a problem** and to know if a solution is incorrect. Thus, the best way to solve problem is without these brief solutions.
- ➤ Homework is due in Teams for the class on the first Sunday after completing a chapter.
- ➤ No late homework will be accepted, and
- ➤ Actuaries don't act like the guy in the cartoon below.

They **manage risk** .   They don't let risk manage them

- *Never round* your intermediate results to problems when doing your calculations. This will cause you to lose calculation accuracy. Your answers may then be different from the SOA exam key even when you use the right procedure.
- For every exam, so you need to bring with you *pens*, *pencils*, *a sharpener*, *an eraser*, and a *SOA approved calculator*.
- Students should wait until completion of course AS482 before they attempt to take the professional exam LTAM.

Learning Outcomes: From the Society of Actuaries Exam LTAM (Long-Term Actuarial Mathematics – Spring 2022) will be observed. By completing this course, students should be able to
- ➤ Demonstrate a thorough understanding of multi-decrement models
- ➤ Apply multi-life models to real situations
- ➤ Distinguish Actuarial Models with fixed interest rates from those with variable returns
- ➤ Calculate Premiums for Pension Funding of Pension payouts
- ➤ Compare effects of various assumptions for profit testing
- ➤ Explain main features of plans under Universal life insurance and participating Insurance
- ➤ Solve SOA type LTAM problems

Tentative Lecture Schedule

Week	Sections	Topics	Notes
1 (27/8 – 31/8)	Ch 3 & 5.5	**Review of Markov Chains (4-1/2 class).**	
2 (Sep. 3- 7)	Ch 3 & 5.5 Ch 13	**Review of Markov Chains (cont.)** **Multiple-Decrement Models.** Discrete Multi-Decrement Models. Theory of Competing Risks. Continuous Multi-Decrement Models. Uniform Distribution of Decrements.	
3 (Sep. 10 – 14)	Ch 13 Ch 14 & 6-5	**Multiple-Decrement Models. (cont.)** Miscellaneous Examples. **Multiple-Decrement Models (Applications).** Actuarial Present Value. Non-forfeiture Options. Multi-State Model representations, with Illustrations (14.4 & 6.5).(Excluding Asset Shares)	
4 (Sep. 17- 21)	Ch 14 & 6-5 Ch 12	**Multiple-Decrement Models (Applications -cont.)** Defined Benefit Pension Plans. **Models dependent on Multiple Survivals (Multi-life Models).** Joint-Life Model. The Last Survivor model. Contingent Probability functions.	
5 (Sep. 25- 28)	Ch 12 Appendix A.6	**Multi-life Models (cont.)** Contingent Contracts Involving Multi-Life Statuses. General Random Variable Analysis. Common Shock – A model for lifetime dependency. Multi-State Model Representation (5.5 & 12.5),	**(2 wks):** Midterm grade reports starts **National Day holiday Sept 24**

		Major 1 Exam (Ch 3, ch 13 & ch 14 - Sun Oct 1, 6pm)	
6 (Oct. 1 - 5)	Ch 15	**Models with Variable Interest Rates** Actuarial PV using Variable Interest. Deterministic Interest Rate Scenarios. Spot Interest Rates & Term Structure of Interest Rates.	
7 (Oct. 8 - 12)	Ch 15	**Models with Variable Interest Rates (cont.).** Forward Interest Rates. An Example with Simulated Rates of Return. Transferring the Interest Rate Risk.	
8 (Oct. 15 - 19)	Ch 16	**Universal Life Insurance** Basic Aspects. Indexed Universal Life Insurance.	
9 (Oct. 22 - 26)	Ch 16	**Universal Life Insurance (cont.)** Pricing Considerations (including Pricing for Secondary Guarantees).	
10 (Oct 29 - Nov. 2)	Ch 16 Ch 14.5	**Universal Life Insurance (cont.)** **Pension Mathematics**	
		Major 2 Exam (Ch 12 & ch 15 - Sun Nov 5, 6pm)	
11 (Nov. 5 - 9)	Ch 14.5	**Pension Mathematics (cont.)**	
12 (Nov. 12 - 16)	LTAM supplement	**Pension Mathematics (cont.)**	.
		Midterm Break: Nov. 19 - 23	
13 (Nov. 26 - 30)	Ch 17	**Profit Testing.**	
14 (Dec.3 - 7)	Ch 17	**Profit Testing (cont.)**	
15 (Dec. 10- 14)	Ch 17 Review	**Profit Testing (cont.)** **Review**	
Dec 17		**Review**	Normal Sunday
		Final Exam (Comprehensive): TBA	