



جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

DEPARTMENT OF MATHEMATICS & STATISTICS

Dhahran, 31261, Kingdom of Saudi Arabia

AS 381: Actuarial Contingences I

Term 171 (Fall 2017 Semester)

Instructor: Mr. Yassir M. Khalid, ASA

Office: Building – 5, Room – 304 **Phone:** 4181 **E-mail:** ykhalid@kfupm.edu.sa

Office Hours: Sunday, Tuesday and Thursday: 10:00 – 10:50 and Wednesday: 09:15 – 11:45
(or by appointment).

For regular announcements, students are advised to check the **Blackboard** regularly.

Course Descriptions:

This course is an introduction to life insurance mathematics based on a stochastic approach. Major topics include life insurance, annuities, benefit premiums, net & gross reserves, and interest rate risk. Parallel treatment of topics based on Takaful system may also be addressed. Students are assumed to be proficient in Multivariable calculus. A required course for Actuarial Science majors.

Credit: (3 – 0 – 3).

Prerequisite: AS201 and STAT301.

Required Textbook and Package:

1. Bowers, Gerber, Hickman, Jones, & Nesbitt, *Actuarial Mathematics*, 2nd edition, Society of Actuaries Publishing, 1997.
 2. *Texas BAI plus* calculator or *Texas BAI professional*.
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References:

1. David Dickson, Mary Hardy, & Howard Waters, *Actuarial Mathematics for Life Contingent Risks*, 2nd edition, Cambridge University Press, 2013.
 2. Johnny Li & Andrew Ng, *SOA Exam MLC Study Manual*, ACTEX Publications, 2017.
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Learning Outcomes:¹

1. Understand key concepts concerning tabular or parametric survival models for single-life insurance policies.
2. Calculate and interpret standard probability functions including:
 - survival and mortality probabilities;
 - force of mortality; and
 - complete and curtate expectation of life.
3. Perform calculations on the present value random variables associated with benefits and expenses
4. Calculate and explain premium-calculation methodologies such as:
 - the equivalence principle;
 - the portfolio-premium principle; and
 - premiums determined by specified profit objectives.
5. Calculate and interpret several types of reserves for insurances and annuities including:
 - benefits reserves;
 - gross premium reserves;
 - expense reserves; and
 - modified reserves.
6. Apply appropriate approximation methods such as:
 - uniform distribution of deaths (UDD);
 - constant force;
 - Woolhouse; and
 - Euler.
7. Identify the diversifiable and non-diversifiable risks in a portfolio of single-life insurance policies.

General Notes on the SOA MLC Exam:

- The duration of the SOA MLC examination is four-hours plus 15 minutes reading time at the start of the examination. It consists both multiple-choice questions (MCQ) and written questions.
- The exam have 96 points, two points for each MCQ (approximately around 20 MCQs in total but can vary) with the remaining points for the written part.

Important Notes on Attendance & Academic Integrity:

Attendance:

- ✓ **Attendance** on time is **very** important. Mostly, attendance will be checked within the **first five minutes**. Entering the class after that, is considered as one late, and **every two times late** equals to one absence.
- ✓ In accordance with the University rules, **“a grade of DN in a course is given if the student's unexcused absences are more than 20% of the lecture and laboratories sessions scheduled for the course”**. Therefore, students who accumulates **nine**, or more, unexcused absences will receive a **DN** grade.
- ✓ For every one absence, two points will be deducted from the classwork.

Academic Integrity: All KFUPM policies regarding **ethics** and **academic honesty** apply to this course.

¹ The syllabus of this course covers about 50% of the SOA MLC Exam. Interested students, who plan to sit for this exam, are advised to wait until they study the core course AS482, which covers the remaining part.

Grading Policy:

Assessment for this course is based on **class work (attendance and six class tests)**, *two major (written) exams* and a *comprehensive final exam*, as described in the table below:

Activity	Weight
Classwork²	15% (60 points)
Homework³	5% (20 points)
Applied Project	10% (40 points)
Major Exam I (Sections 3.1 through 4.4) Date: Wednesday, October 25 (Week 6). Time: 17:30-19:30. Location: TBA.	20% (80 points)
Major Exam II (Sections 5.1 through 7.6) Date: Wednesday, December 13 (Week 13). Time: 17:30-19:30. Location: TBA.	20% (80 points)
Final Exam (Comprehensive) Date: Tuesday, January 02, 2018. Time: 19:00-22:00. Location: TBA.	30% (120 points)

Exam Questions:

- ❖ The questions of the common exams are based on the examples, homework problems, and the exercises of the textbook but in a similar fashion to the MLC format.
- ❖ While the first two major exams are 2-hours written exams, the **Final Exam** is a 3-hours exam and has a combination of multiple-choice questions and written questions.

Missing Exam I or Exam II:

- No makeup exam will be given under any circumstance. When a student misses Exam I or Exam II for a legitimate reason (such as medical emergencies), his grade for this exam will be determined based on the existing formula, which depends on his performance in the non-missed exam and in the final exam.

Grading Scales:

Letter Grade	A+	A	B+	B	C+	C	D+	D	F
Range (in points)	360+	340+	320+	300+	280+	260+	230+	200+	<200

There is no quote on the number of students who can obtain "A+"!

² Classwork is based on attendance and six class tests (60 points). Class tests are all of written type and not of multiple choice type questions.

³ The suggested homework problem will be announced weekly in the Blackboard.

Course Schedule⁴

Week # (Dates)	Sections	Topics
Week 1 (Sep 17 – 21)	3.1 – 3.2	Survival Distributions: The Survival Function. Time-until Death and Curtate-Future-Lifetime Random Variables. Actuarial Notations. Force of Mortality.
(September 24, 2016) National Day Holiday		
Week 2 (Sep 24 – 28)	3.3 – 3.5	Life Tables: Life Table Functions. Moments of Future Lifetime Random Variables.
Week 3 (Oct 1 – 5)	3.6 – 3.8	Life Tables (Cont.): Fractional Age Assumptions. Select and Ultimate Life Tables. Some Analytical Laws of Mortality.
Week 4 (Oct 7 – 12) ⁵	4.1 – 4.2	Life Insurances: Continuous Life Insurances.
Week 5 (Oct 15 – 19)	4.3 – 4.4	Life Insurances (Cont.): Discrete and <i>mt</i> hly Life Insurances. Relation between Life Insurances.
Week 6 (Oct 22 – 26) ⁶	5.1 – 5.2	Life Annuities: Continuous Life Annuities.
Week 7 (Oct 29 – Nov 2)	5.3 – 5.4	Life Annuities (Cont.): Discrete and <i>mt</i> hly Life Annuities. Relation between Life Annuities.
Week 8 (Nov 5 – 9)	6.1 – 6.2	Benefit Premiums: The Equivalence Principle. Fully Continuous Premiums.
Week 9 (Nov 12 – 16)	6.3 – 6.4	Benefit Premiums (Cont.): Fully Discrete Premiums. True <i>mt</i> hly Payment Premiums.
Week 10 (Nov 19 – 23)	7.1 – 7.3	Benefit Reserves: Fully Continuous Reserves.
Week 11 (Nov 26 – 30)	7.4 – 7.6	Benefit Reserves (Cont.): Fully Discrete Benefit Reserves. Benefit Reserves based on True <i>mt</i> hly Benefit Premiums.
Week 12 (Dec 3 – 7)	Assigned Reading	Insurance Models Including Expenses: Gross Premium. Gross Premium Reserve.
Week 13 (Dec 10 – 14) ⁷	Assigned Reading	Insurance Models Including Expenses (Cont.): Expense Reserve and Modified Reserve. Asset Share and Profit.
Week 14 (Dec 17 – 21)	Assigned Reading	Interest Rate Risk: Yield Curves. Interest Rate Scenario Models.
Week 15 (Dec 24 – 28)	Assigned Reading	Interest Rate Risk (Cont.): Diversifiable and Non-Diversifiable Risks.
Final Exam (Comprehensive): as posted on the registrar website		

⁴ For **Important Dates** and **Academic Calendar**, check the Registrar's [website](#).

⁵ Normal Sunday Classes are scheduled on **Saturday, October 07**.

⁶ Major Exam I is scheduled on **Wednesday, October 25** (Week 6).

⁷ Major Exam II is scheduled on **Wednesday, December 13** (Week 13).