MATH 4513/RMBI 4220 Life Contingencies models and insurance risk

Course Outline- Spring 2024-2025

1. **Instructor(s)**

   Name: Shuoqing Deng

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2. **Teaching Assistant(s)**

   Name: Daorong Cui

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3. **Meeting Time and Venue**

   Lectures:

   Date/Time: Tuesday and Thursday (13:30-14:50)

   Venue: Room 1409

   Tutorials:

   Date/Time: Monday (18:00-18:50)

   Venue: Room 1410

4. **Course Description**

   Credit Points: 3

   Pre-requisite: ELEC 2600, or ISOM 3540, or MATH 2421, or MATH 2431.

   Exclusion: NIL

   Brief Information/synopsis:

   This is an undergraduate-level one-semester course on life contingencies models and insurance risk. The course also prepares students to take the Exam LTAM (Long-Term Actuarial Mathe- matics) of the Society of Actuaries and the Exam 3L (Models for Life Contingencies and Statistics) of the Casualty Actuarial Society.

5. Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Understand survival models and survival distributions and life tables.
2	Be able to carry out the calculations related to life benefits: life insurance and life annuity.
3	Conduct calculations related to net premiums.
4	Understand benefit reserves.
5	Understand multiple life functions and multi-state models

6. Assessment Scheme

a. Examination duration: 3 hrs

b. Percentage of coursework, examination, etc.:

Assessment	Assessing Course ILOs
15% by quiz	1, 2, 3, 4
30% by midterm	1, 2, 3
55% by final	1, 2, 3, 4, 5

c. The grading is assigned based on students' performance in assessment tasks/activities. Grades will not be assigned using a curve.

d. **Letter Grades:** Students should aim at getting a course total of 85% or above for A-/A/A+, and about 60% or above for B-/B/B+. For getting A- or above, students will need to achieve 85% of the course total, **and** submit a video presentation which demonstrates clear and accurate understanding of the chosen topic. Without a satisfactory submission of the presentation video, your grade will be capped by B+. For students who do not meet the 85%-cutoff, submission of a presentation video will **not** add bonus marks to the course total.

e. **Grade Descriptors:**

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	The student has mastered almost all concepts and techniques of differential geometry taught in the course, has excellent understanding of the deepest content of the subject, and acquired workable knowledge for further studies of abstract manifolds, Riemannian geometry, general relativity, and related fields.
B	Good Performance	The student has mastered most computational techniques of differential geometry taught in the course, yet the understanding of some challenging concepts may not be deep enough for further studies on related advanced subjects.
C	Satisfactory Performance	The student meets the minimum expectation of the instructor, has acquired some basic computational techniques of the subject, yet some concepts were not clearly understood.
D	Marginal Pass	The student is only able to recall some fragments of topics and is able to complete some of the easiest computations.

F	Fail	The student does not have sufficient understanding of even some fragments of topics, and is not even able to complete some of the easiest computations.

7. Student Learning Resources

Recommended textbook:

Study Guide for the Society of Actuaries Exam LTAM by S. Broverman, 2018 edition.

8. Teaching and Learning Activities

Scheduled activities: 4 hrs (lectures + tutorials)

Course AI Policy

Students are allowed to consult any person (including the instructor, TA, classmates, friends outside HKUST) in any homework for ideas and hints, but are required to write up the solutions by themselves. You are required to list the persons and references you have consulted in every homework.

9. Course Schedule

Keyword Syllabus:

- Survival models and survival distributions, life tables.
- Life insurance: insurance payable at the moment of death, insurance payable at the end of the year of death, other types of life insurance, some related recursive relationship and differential equations.
- Life annuities: continuous life annuities, discrete life annuities.
- Net premiums: fully continuous premiums, fully discrete premiums, other types of premiums and benefits.
- Benefit reserves: fully continuous benefit reserves, fully discrete benefit reserves, benefit reserves on a semi-continuous basis.
- Multiple life functions and multi-state models: joint distribution of future lifetimes, the joint-life status, the last-survivor status, dependent lifetime models, insurance and annuity benefits, special mortality assumptions.