

COURSE NAME:

## Mathematics 573/673 - Actuarial Models I

PREREQUISITES: MATH 570, MATH 572.

The class is offered on both undergraduate (573) and graduate level (673).

COURSE DESCRIPTION:

This is the first course in the two semester sequence: Math 573/673 - Math 574/. This course covers the material for the **Society of Actuaries Exam MLC, Actuarial Models, Life Contingencies** without Poisson Processes and Markov Processes.

### LEARNING OUTCOMES – LIFE CONTINGENCIES SEGMENT

#### A. Survival models

1. Define survival-time random variables
  - a) for one life, both in the single- and multiple-decrement models;
  - b) for two lives, where the lives are independent or dependent (including the common shock model).
2. Calculate the expected values, variances, probabilities, and percentiles for survival-time random variables.
3. Define the continuous survival-time random variable that arises from the discrete survival-time random variable using a:
  - a) uniform distribution;
  - b) constant force of mortality; or
  - c) hyperbolic assumption.

#### C. Life insurances and annuities

1. Define present-value-of-benefit random variables defined on survival-time random variables:
  - a) for one life, both in the single- and multiple-decrement models;
  - b) for two lives, where the lives are independent or dependent (including the common shock model).
2. Define and calculate the expected values, variances and probabilities for:
  - a) present-value-of-benefit random variables;
  - b) present-value-of-loss-at-issue random variables, as a function of the considerations (premiums);and
  - c) present-value-of-loss random variables, as a function of the considerations (premiums).
3. Calculate considerations (premiums) for life insurances and annuities,
  - a) using the Equivalence Principle; and
  - b) using percentiles.
4. Calculate liabilities, analyzing the present-value-of-future-loss random variables:
  - a) using the prospective method;
  - b) using the retrospective method;
  - c) using special formulas.
5. Calculate
  - a) gross considerations (expense-loaded premiums);
  - b) expense-loaded liabilities (reserves);
  - c) asset shares.
6. Using recursion, calculate expected values (reserves) and variances of present-value-of-future-loss random variables for general fully-discrete life insurances written on a single life.

### Texts - Life Contingencies Segment\*

- *Actuarial Mathematics* (Second Edition), 1997, by Bowers, N.L., Gerber, H.U., Hickman, J.C., Jones, D.A. and Nesbitt, C.J., Chapter 3, Chapter 4, Sections 4.1–4.4, Chapter 5, Sections 5.1–5.4, Chapter 6, Sections 6.1(excluding utility-theory approach), 6.2–6.4, Chapter 7, Sections 7.1(excluding utility-theory approach), 7.2–7.6, Chapter 8, Sections 8.1–8.4, Chapter 9, Sections 9.1–9.5, 9.6.1, 9.7, 9.9, Chapter 10, Sections 10.1–10.4, 10.5–10.5.1, 10.5.4, 10.6, Chapter 11, Sections 11.1–11.3 and Chapter 15, Sections 15.1–15.2.1, 15.4, 15.6–15.6.1.