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| **Course Title** | : | Fundamentals of Actuarial Science |
| **Course Code** | : | RIM2202 |
| **Recommended Study Year** | : | 2 |
| **No. of Credits/Semester** | : | 3 |
| **Mode of Tuition** | : | Sectional Approach |
| **Class Contact Hours** | : | 3 hours per week |
| **Category in Major Programme** | : | Required course – BBA (Hons) Risk and Insurance Management Programme |
| **Prerequisite** | : | BUS1102 Statistics for Business |

## Brief Course Description

This course aims to provide students with fundamental knowledge of actuarial science and insurance pricing such as understanding the components of insurance pricing, process of predicting future losses / expenses and allocating these costs among various catagories of the insured's. Contents of the course include: function of actuarial science, insurance demand, distribution of loss probability, insurance pricing, measurement of mortality, life annuities, life insurance payable, net annual premium reserves and special topics.

## Aims

This course is designed to expose the students to the fundamental principles of general and life insurance pricing with applications in insurance industry.

## Learning Outcomes (LOs)

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

1. Understand both the ethic concept and the psychological effects related to insurance pricing model and its component.

2. Apply the probability distribution function to estimate the expected future loss related to a particular accident.

3. Understand the mortality table with international actuarial notation and estimate the force of mortality with fractional ages employing the mortality table.

4. Integrate life contingencies into a probabilistic framework to appreciate the mechanism by which, a variety of contracts are built from basic models of actuarial science, so that the calculation of annual premiums and deferred annuities may carried out properly.

## Indicative Contents

### Demand of Insurance
Expected loss. Expected utility hypothesis. Risk attitude and insurance demand.

### Distribution of Loss Probability
Discrete probability: Binomial distribution. Poisson distribution. and Hypergeometric distribution.
Continuous Probability: Normal distribution and Uniform distribution.

### Measurement of Mortality
Survival function. Mortality table. Force of mortality. Estimation of force of mortality from the mortality table. Methods for fractional ages. Selecting mortality tables. International actuarial notation.

### Life Annuities
Pure endowments. Life annuities with annual payments. Annuities payable more frequently than once a year. Continuous annuities. Varying annuities. The effect of variations in interest and mortality.

### Life Insurance Payable
Insurance payable at the end of the year of death. Relations between insurance and annuities. Insurance payable at the time of death. Varying insurance.

### Net Annual Premiums
Annual premiums for insurance and deferred annuities. Fractional premiums. Analysis of the endowment premium.

### Special Topics
Cash refund annuities. Annuities with a term-certain. Complete annuities. The retirement income policy. Family income benefits.


## Teaching Method/Class Activities
Class activities will include lectures and in-class exercises such as cases, team discussions, and student presentations. Conceptual and theoretical framework will be introduced in lectures. Take home exercise solutions will be discussions in the class. A high level of student participation in the classes is encouraged.

### Team Formation
Students in each section will form into various teams, each consisting of four or five members. The instructor has the right to determine the composition of the teams.

### Field/Group Study Project & Report
The field/group study project exercise is for the students, in their teams, to collect and analyze various insurance polices and their premiums. Teams are asked to collect at least 2 general insurance policies and 2 life insurance policies. These premiums and their

coverages are compared and the factors may affect the pricing of these policies are analyzed.

In this project, students are required to address issues of ethic concept and psychological effects related to the insurance pricing model and its components.

Guidelines for Field/Group Project
Purpose: To provide the students with the opportunity to apply what they have learned in their Fundamentals of Actuarial Science Course to a real business. The field/group project report will compare the real insurance policies to its premiums sold in the market. Particularly, the report will emphasize what are the different characteristics among these premiums and why they are different.

1.  Rules for the field/group project:

●   Teams can select at least 2 general insurance policies as the general insurance study sample and 2 life insurance policies as the life insurance study sample. The sample policies may be collected from one company or several companies, including local, mainland China or multinational based companies.

●   The insurance policies chosen within a sample set should be comparable. For instance, three automobile insurance policies with different coverages may be selected as the study sample for general insurance policy. Then the students may compare the differences between/among these coverages and premiums.

●   The instructor may suggest the students to select automobile insurance policies as a study sample for general insurance study and health insurance policy for life insurance study.   Do not take Investment Link Insurance policy as a study sample for life insurance because the pricing of the Investment Link Insurance is basically investment oriented rather than the risk transfer oriented life insurance.

●   However, if teams visit companies or consult some insurance practitioners to take other kinds of insurance policies as their study samples, it is permitted and encouraged.

●   Teams should give the instructor details of the principal contact person(s) of the companies or the ones they consulted with.

2.  Report format

    Format must include the following:

    a.   The title page. It should contain the Section Number, Student Names and ID Numbers.

    b.   Name of company (or consultant), principle contact, office telephone number of the principal contact (if the team has chosen to work with an existing company or insurance consultant).

c. Generally, the project report should contain:

- Background of the companies or consultants that the team contacts.

- Summary of the sample insurance policies. It should include:
  i. Insured's information: age, sex, occupation, and *etc*.
  ii. Insurance coverage: Named perils coverage, Exclusions, and Conditions.
  iii. Premiums.

- Interview Record
  It should mainly focus on the explanation of why the policies are designed to have different coverages for each type of insurance and how different coverages match to different premiums. The basic components of the insurance premium should be addressed.

- Group Discuss Record
  i. What kind of ethic and psychological concepts are involved in different coverages?
  ii. How do the different coverages match to different premiums?

- Summary and Conclusion
  What you have learned from this study project?

d. It is difficult to specify the number of pages of the report. However, the report should follow the above Guidelines completely.

**Measurement of Learning Outcomes**

1. Field/Group study report requires team to address the ethic concept and psychological effects related to insurance pricing model. Assignment requires distinguishing the risk premium from the insurance premium. Final exam may emphasize the relationship with insurance pricing components concerning the cases in the field study. (LO1, LO2, LO3, LO4)

2. Problem based continuous assessment is used to train the students to apply the different probability functions for estimation of the expected future loss. Quizzes and the final exam may assess the levels of the estimation skill. (LO2, LO3, LO4)

3. Class exercises are used to measure the students' ability of understanding the mortality table with international actuarial notation. Take home exercises and quizzes may assess the students' ability of employing the mortality table to estimate the force of mortality with fractional ages. (LO3)

4. Problem based continuous assessment is used to facilitate the comprehensive integration of life contingencies into a probabilistic framework. Class exercises and quizzes are used to measure the students' ability of calculating the annual premiums

and deferred annuities. Final exam may assess the understanding of the probability mechanism, by which, a variety of contracts are built from basic models of actuarial science. (LO2, LO3, LO4)

## Assessment

The assessment of the field/group study project will consist of a combined grade of the written report and student presentation. There will also be a continuous assessment, based on performance of a variety of exercise assignments as well as class participation and attendance.

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| Field/Group Study Project and Presentation | 15% |
| Continuous Assessment, Participation, Exercises, and Quizzes | 35% |
| Examination | 50% |
| **Total** | **100%** |

## Required/Essential Reading

Chan, Wai-Sum and Yiu-Kuen Tse, *Financial Mathematics for Actuaries*, latest edition, McGraw Hill.

## Recommended/Supplementary Readings

James W. Daniel and Leslie Jane Federer Vaaler, *Mathematical Interest Theory*, 2nd ed., Mathematical Association of America, , 2009.

Robert Muksian, *Mathematics of Interest Rates, Insurance, Social Security and Pensions,* Prentice Hall, 2003.

Bowers, Gerber, Hickman, Jones, and Nesbitt, *Actuarial Mathematics*, Society of Actuaries, 2002.

Harrington, S.E. and Niehaus, G.R., *Risk Management and Insurance*, 2nd ed., McGraw-Hill, 2003.

P67 Fundamentals of risk management, 2014 Study Text, Diploma in Insurance, CII.

P86 Personal Insurances, 2014 Study Text, Diploma in Insurance, CII.

P92 & M92 Insurance Business and Finance, 2014 Study Text, Diploma in Insurance, CII.

Note: Given the subject area is developing quickly, no single textbook is fully suitable. The lecture notes draw upon different sources and so may not fully follow any of the textbooks.

**Important Notes**

(1) Students are expected to spend a total of 9 hours (i.e. 3 hours of class contact and 6 hours of personal study) per week to achieve the course learning outcomes.

(2) Students shall be aware of the University regulations about dishonest practice in course work, tests and examinations, and the possible consequences as stipulated in the Regulations Governing University Examinations. In particular, plagiarism, being a kind of dishonest practice, is "the presentation of another person's work without proper acknowledgement of the source, including exact phrases, or summarised ideas, or even footnotes/citations, whether protected by copyright or not, as the student's own work". Students are required to strictly follow university regulations governing academic integrity and honesty.

(3) Students are required to submit writing assignment(s) using Turnitin.

(4) To enhance students' understanding of plagiarism, a mini-course "Online Tutorial on Plagiarism Awareness" is available on https://pla.ln.edu.hk/.