NANYANG TECHNOLOGICAL UNIVERSITY
NANYANG BUSINESS SCHOOL
BA3205
ACTURIAL COMPUTING

Academic Year	:	2023/2024	**Semester**	: 2
Course Coordinator	:	Liew Min Liang		
Pre-requisites	:	AB1201 and AB1202		
No. of AUs	:	4		
Contact Hours	:	4 hours per week		

A) Course Aims/Description

This course is specially designed for actuarial science students who are interested in learning the software tools (R & Excel) frequently used by actuaries in the financial industry. The course uses various real-life examples for demonstration in order to give the students firsthand experience of how actuaries using the software tools in solving the problems faced by them in their day-to-day works.

This course is also designed with the aim to meet the requirements under the new syllabus offered by Institute and Faculty of Actuaries (IFoA), UK, in order to maintain the accreditation status with IFoA.

B) Intended Learning Outcomes (ILO)/Objectives

By the end of the course, you will be able to:

- ILO1: Assess the various functionalities of software such as R & Excel used by actuaries in carrying out their works.
- ILO2: Analyze and solve various actuarial, financial and insurance related issues with the use of software such as R & Excel.
- ILO3: Communicate model and model results to target audiences (i.e., customers, colleagues, supervisors and management) in an effective manner.

C) Course Content

The course covers the following key topics:

LEC1. CS1: Part 1

This chapter covers several topics under IFoA CS1 – Actuarial Statistics. The topics include discrete distributions, continuous distributions, conditional expectation, central limit theorem, sampling distributions and estimation.

LEC2. CS1: Part 2

This chapter covers several topics under IFoA CS1. The topics include confidence intervals, hypothesis tests and correlation.

LEC3. CS1: Part 3

This chapter covers several topics under IFoA CS1. The topics include linear models, credibility theory and empirical Bayes credibility theory.

LEC4. CS2: Part 1

This chapter covers several topics under IFoA CS2 – Risk Modelling and Survival Analysis. The topics include Poisson processes, Markov chains, Markov jump processes, estimating the lifetime distribution and proportional hazards models.

LEC5. CS2: Part 2

This chapter covers several topics under IFoA CS2. The topics include exposed to risk, graduation, survival models, mortality projection and time series.

LEC6. CS2: Part 3

This chapter covers several topics under IFoA CS2. The topics include loss distributions, extreme value theory, copulas, reinsurance, risk models and machine learning.

LEC7. CM1: General Topics

This chapter covers the general topics under IFoA CM1 – Actuarial Mathematics. In particular, it covers topics such as loan schedule, project appraisal, term structure of interest and asset valuation.

LEC8. CM1: Conventional Insurance Business (Pricing and Valuation)

This chapter covers pricing and valuation of conventional insurance business under IFoA CM1. Insurance products under both non-participating and participating basis are discussed in this chapter.

LEC9. CM1: Unit-Linked Insurance Business (Pricing and Valuation)

This chapter covers pricing and valuation of unit-linked insurance business under IFoA CM1. Insurance products under unit-linked basis are covered.

LEC10. CM2: General topics

This chapter covers the general topics under IFoA CM2 – Financial Engineering and Loss Reserving. In particular, it covers topics such as utility theory, measure of investment risks, portfolio theory, model of asset returns, asset pricing models, credit risk, ruin theory and run-off triangle.

LEC11. CM2: Stochastic Modeling

This chapter covers stochastic modeling related topics under IFoA CM2.

LEC12. CM2: Derivatives

This chapter covers derivatives related topics under IFoA CM2.

D) Assessment (includes both continuous and summative assessment)

Component	ILO Tested	NBS Learning Goal	Weightage	Team/ Individual	Assessment Rubrics (attach rubrics in Appendix 1)
1. Final Examination	ILO1 & ILO2	• Acquisition of knowledge • Problem solving & Decision Making	50%	Individual	N.A.
2. Mid-term Test	ILO1 & ILO2	• Acquisition of knowledge • Problem solving & Decision Making	30%	Individual	Mid-term Test Rubric
3. Individual Presentation	ILO3	• Oral Communication	10%	Individual	Individual Presentation /Class Participation Rubric
4. Class Participation	ILO3	• Oral Communication	10%	Individual	
Total			**100%**		

Please note that the final exam and mid-term test are computer-based examination.

E) Formative feedback

You will receive compulsory formative feedback through written responses to your mid-term test and verbal feedback through in-class discussion. In addition, customized advice will be given to you in order to help you to further strengthen your understanding about the course through face-to-face consultation.

F) Learning and Teaching approach

Seminars

The interactive seminar session where there are ample opportunities for open discussion on the conceptual questions and software related questions raised in the seminar allows you to think critically and share your ideas and concepts with the class. This also allows me to get the concepts clearly through the entire class by involving you and ensure that the targeted learning outcomes are being achieved.

G) Reading and References

1. **Main Readings: Handout**
2. Reading materials from Acted: CS1, CS2, CM1 and CM2 Core Readings and Paper B
3. Electronic sources from Internet.

H) Course Policies and Student Responsibilities

(1) General

You are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take the mid-term test. You are expected to take responsibility to follow up with course notes, tutorials and course-related announcements for seminar sessions you have missed. You are expected to participate in all seminar discussions and activities.

(2) Absenteeism

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

If you miss a seminar, you must inform the course instructor via email prior to the start of the class.

I) Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

J) Course Instructors

Instructor	Office Location	Email	Consultation Hours
Liew Min Liang	NA	mlliew@ntu.edu.sg	Flexible

K) Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
1	Lecture 01 – CS1: Part 1	ILO1 – ILO3	Handout
2	Lecture 02 – CS1: Part 2	ILO1 – ILO3	Handout
3	Lecture 03 – CS1: Part 3	ILO1 – ILO3	Handout
4	Lecture 04 – CS2: Part 1	ILO1 – ILO3	Handout
5	Lecture 05 – CS2: Part 2	ILO1 – ILO3	Handout
6	Lecture 06 – CS2: Part 3	ILO1 – ILO3	Handout
7	Lecture 07 – CM1: General Topics	ILO1 – ILO3	Handout
8	Recess		
9	Lecture 08 – CM1: Conventional Insurance Business	ILO1 – ILO3	Handout
10	Lecture 09 – CM1: Unit-Linked Insurance Business	ILO1 – ILO3	Handout
11	Lecture 10 – CM2: General topics	ILO1 – ILO3	Handout
12	Lecture 11 – CM2: Stochastic Modeling	ILO1 – ILO3	Handout
13	Lecture 12 – CM2: Derivatives	ILO1 – ILO3	Handout
14	Revision	ILO1 – ILO3	Handout

Appendix 1: Assessment Rubric

Assessment Rubric for Mid-term Test (Learning Goal: Acquisition of Knowledge and Problem Solving & Decision Making)

No	Learning Objective	Performance	
1	Discover and assess the various functionalities of R program.	**Not yet** Fail to demonstrate an understanding of the application of various R functions; functions used were incorrect.	**Substantially developed** Demonstrate good understanding of the application of various R functions; formulas used were correct.
		Evaluation: Not yet 1 2 3 4 5 6 7 8 9 10 Substantially developed	
2	Analyze and solve various actuarial, financial and insurance related issues with the use of R program.	**Not yet** Uses R program to perform quantitative analysis of data as the basis for tentative, basic judgements, although is uncertain about drawing conclusions from this work.	**Substantially developed** Uses R program to perform quantitative analysis of data as the basis for deep and thoughtful judgements, drawing insightful, carefully qualified conclusions from this work.
		Evaluation: Not yet 1 2 3 4 5 6 7 8 9 10 Substantially developed	

Assessment Rubric for Individual Presentation / Class Participation (Learning Goal: Oral Communication)

To assess the student's punctuality and contribution to the class discussion.

Traits	Performance		
	1	2	3
Engagement	Hardly focuses in class (e.g., using mobile phone, unnecessary chatting)	Occasionally engages in distracting activities (e.g., using mobile phone, unnecessary chatting) in class.	Engages fully in class
Contribution frequency	Does not speak up/contribute in class	Occasionally speaks up/contributes in class	Speaks up/contributes in all classes
Contribution quality	No contributions/Contributions lack substance	Contributions demonstrate knowledge of subject matter	Contributions are constructive and insightful