UNSW Course Outline

ACTL3151 Actuarial Mathematics for Insurance and Superannuation - 2024

Published on the 28 Jan 2024

General Course Information

Course Code : ACTL3151
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : UNSW Business School
Academic Unit : School of Risk and Actuarial Studies
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Long-term contingent cashflow valuation is fundamental for actuarial work, especially for life-,

disability- and health insurance, pensions and superannuation. They are also increasingly applied in broader areas in social protection and policy. This course introduces models and techniques from actuarial mathematics combining the present value principles with stochastic modelling, in order to derive the value of contingent cashflows for pricing, reserving, projections and profit testing purposes. The course also covers contemporary management issues in life, health and superannuation products such as longevity, premium rating, selection and capital management. Spreadsheets will be used to perform computations.

Course Aims

This course is to provide students with the mathematical and computational techniques model and value cashflows dependent on death, survival, or other uncertain risks for application in life insurance and superannuation particularly. Further, students develop an understanding of contemporary issues facing life insurance companies and ways to address these issues.

Relationship to Other Courses

This course covers the mathematical foundations of life insurance and superannuation models. The assumed knowledge for this course are the courses in the actuarial major including ACTL1101, ACTL2102, ACTL2111 and ACTL2131. Students enrolled in the combined Bachelor of Actuarial Studies / Bachelor of Science program should have completed the statistics/ mathematics courses in place of ACTL2131. The course should normally be taken at the same time as ACTL3141.

Students should have a solid background in mathematics and are assumed to be able to use a computer to analyse financial and/or statistics problems. You should be able to use a word processing package (such as WORD) and a spreadsheet (such as EXCEL).

Course Learning Outcomes

Course Learning Outcomes	Program learning outcomes
CLO1 : Explain and apply the fundamental techniques used to value cash flows involving death, survival and other similar contingent events.	• PLO1 : Business Knowledge
CLO2 : Assess risk inherent in cash flows resulting from these contingent events.	• PLO1 : Business Knowledge
CLO3 : Describe the life insurance and life annuity products that may be available in the market.	• PLO1 : Business Knowledge
CLO4 : Explain the basic valuation and funding of superannuation benefits.	• PLO1 : Business Knowledge
CLO5 : State and apply contingent valuation concepts to practical situations.	• PLO1 : Business Knowledge • PLO2 : Problem Solving
CLO6 : Assess calculations of premiums and policy values of financial contingent products for reasonableness.	• PLO1 : Business Knowledge
CLO7 : Integrate and apply these technical skills to practical valuation problems in the life insurance and annuity markets.	• PLO2 : Problem Solving
CLO8 : Present orally and explain Life insurance and superannuation problems in simple terms.	
CLO9 : Participate collaboratively and responsibly in teams, and reflect on their own teamwork, and on the team's processes and ability to achieve outcomes	

Course Learning Outcomes	Assessment Item
CLO1 : Explain and apply the fundamental techniques used to value cash flows involving death, survival and other similar contingent events.	• Storywall Discussion • Final Exam • Assignment
CLO2 : Assess risk inherent in cash flows resulting from these contingent events.	• Storywall Discussion • Final Exam • Assignment
CLO3 : Describe the life insurance and life annuity products that may be available in the market.	• Storywall Discussion • Final Exam • Assignment
CLO4 : Explain the basic valuation and funding of superannuation benefits.	• Storywall Discussion • Final Exam
CLO5 : State and apply contingent valuation concepts to practical situations.	• Assignment • Storywall Discussion • Final Exam
CLO6 : Assess calculations of premiums and policy values of financial contingent products for reasonableness.	• Assignment • Storywall Discussion • Final Exam
CLO7 : Integrate and apply these technical skills to practical valuation problems in the life insurance and annuity markets.	• Assignment • Final Exam
CLO8 : Present orally and explain Life insurance and superannuation problems in simple terms.	• Quiz
CLO9 : Participate collaboratively and responsibly in teams, and reflect on their own teamwork, and on the team's processes and ability to achieve outcomes	• Assignment

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

The approach adopted in this course is one of assisted self-study. The approach adopted in this course is called flipped and blended classroom. The main rationale for this flipped and blended structure is twofold. First, it frees up class time which can now be used to do inclass exercises and learning-by-doing activities, which aim at enhancing students long-lasting (deep) learning. Second, it brings a significant portion of the face-to-face time later in the learning process, when students are more comfortable with the materials, and more likely to interact and ask questions.

In this flipped and blended approach, the first conceptual encounter with the materials of a given module happens at home when students watch video lectures. These video lectures are accompanied by online discussion forums which provide the students with an immediate

opportunity for asking questions on their understanding of the material. Consultation is also available. Then, everyone gathers in the lecture room for a lectorial. The word combines lectures because they are run by the lecturer, and with the whole group, and tutorial because their goal is not to lecture students. By contrast, in this lectorial, the lecturer first provides a high level summary of the key concepts of the module and then moves on to other activities (such as discussions, advanced exercises, guest lectures, real life applications) that aim to cement students learning. Finally, the students move on to practicing their knowledge with tutorial exercises. Tutorial sessions aim to provide some additional face-to-face and personalised help. In summary, students are responsible for engaging in learning activities in the following order:

1. Watch video lectures available on the course website.
2. Attend live lectorials as scheduled in the class timetable.
3. Attend tutorials and attempt tutorial exercises with solutions.

It is expected the students will take a pro-active approach to learning. It is recommended to have watched the associated videos prior to the associated modules' lectorial in order to complete the module by the end of the lectorial.

It is expected that you will spend at least ten hours per week studying this course. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment (to extra-curricular activities) has been a cause of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities. In the past, students have found the amount of contents particularly challenging. Dont allow yourself to fall behind the schedule!

Other Professional Outcomes

Course learning outcomes 8 and 9 are no longer assessed in this course for 2024.

Additional Course Information

Note: There won't be any team exercise in this course for 2024.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Program learning outcomes
Storywall Discussion Assessment Format: Individual	5%		• PLO1 : Business Knowledge
Final Exam Assessment Format: Individual	60%		• PLO1 : Business Knowledge • PLO2 : Problem Solving
Assignment Assessment Format: Individual	20%		• PLO1 : Business Knowledge • PLO2 : Problem Solving
Quiz Assessment Format: Individual	15%		• PLO1 : Business Knowledge

Assessment Details

Storywall Discussion

Assessment Overview

Discussions to practice the concepts you have learned. The discussions will reinforce your learning and help you identify the areas you need to focus on.

Course Learning Outcomes

- CLO1 : Explain and apply the fundamental techniques used to value cash flows involving death, survival and other similar contingent events.
- CLO2 : Assess risk inherent in cash flows resulting from these contingent events.
- CLO3 : Describe the life insurance and life annuity products that may be available in the market.
- CLO4 : Explain the basic valuation and funding of superannuation benefits.
- CLO5 : State and apply contingent valuation concepts to practical situations.
- CLO6 : Assess calculations of premiums and policy values of financial contingent products for reasonableness.

Detailed Assessment Description

The course offers discussions to practice the concepts you have learned. The discussions will reinforce your learning and help you identify the areas you need to focus on. Please see more information about the discussion questions on the course Moodle page.

Final Exam

Assessment Overview

To assess student learning

Course Learning Outcomes

- CLO1 : Explain and apply the fundamental techniques used to value cash flows involving death, survival and other similar contingent events.
- CLO2 : Assess risk inherent in cash flows resulting from these contingent events.
- CLO3 : Describe the life insurance and life annuity products that may be available in the market.
- CLO4 : Explain the basic valuation and funding of superannuation benefits.
- CLO5 : State and apply contingent valuation concepts to practical situations.
- CLO6 : Assess calculations of premiums and policy values of financial contingent products for reasonableness.
- CLO7 : Integrate and apply these technical skills to practical valuation problems in the life insurance and annuity markets.

Detailed Assessment Description

The final examination will assess students understanding of the concepts covered in the course and readings and their ability to apply them to practical problems. Details on the final examination will be posted on the course website.

Assignment

Assessment Overview

The practical application of the course concepts based on actual financial market problems is an important graduate attribute that employers require, and this course aims to provide at least some introductory exposure to this.

Course Learning Outcomes

- CLO1 : Explain and apply the fundamental techniques used to value cash flows involving death, survival and other similar contingent events.
- CLO2 : Assess risk inherent in cash flows resulting from these contingent events.
- CLO3 : Describe the life insurance and life annuity products that may be available in the market.
- CLO5 : State and apply contingent valuation concepts to practical situations.
- CLO6 : Assess calculations of premiums and policy values of financial contingent products for reasonableness.
- CLO7 : Integrate and apply these technical skills to practical valuation problems in the life insurance and annuity markets.
- CLO9 : Participate collaboratively and responsibly in teams, and reflect on their own teamwork, and on the team's processes and ability to achieve outcomes

Detailed Assessment Description

The practical application of the course concepts based on actual financial market problems is an important graduate attribute that employers require and this course aims to provide at least some introductory exposure to this. Writing skills for technical material are also important. There

will be one Assignment for this course. The assignment will involve the practical application of course concepts to actuarial problems. The assignment offers students an opportunity to engage in critical analysis and problem solving, as well as to demonstrate their understanding of the concepts and perspectives that are central to actuarial studies. The assignment report will be assessed on technical accuracy and how well it is written. The assignment questions, together with the marks allocated to all components of the assignment, will be made available to students on the course website.

Assessment information

Note: Teamwork is no longer assessed in the assignment for 2024.

Quiz

Assessment Overview

To assess student learning.

Course Learning Outcomes

- CLO8 : Present orally and explain Life insurance and superannuation problems in simple terms.

Detailed Assessment Description

In order to provide progressive feedback on student progress in an examination-style setting, with primary focus on assessment for learning, a quiz will run in Week 4. The quiz will assess the main course concepts to date.

Assessment information

Note: Quiz assesses the following course learning outcomes:

Explain and apply the fundamental techniques used to value cash flows involving death, survival and other similar contingent events

Describe the life insurance and life annuity products that may be available in the market

General Assessment Information

Grading Basis

Standard

Requirements to pass course

In order to pass this course, you must:

- achieve a composite mark of at least 50 out of 100;
- meet any additional requirements described in the Assessment Summary section.

Course Schedule

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

Week 0:

Video Lecture: M0 Life table & M1 Life insurances benefits (single life)

Week 1:

Lectorial and Tutorial: M1 Life insurances benefits (single life)

Video Lecture: M2 Life annuities (single life)

Week 2:

Lectorial and Tutorial: M2 Life annuities

Video Lecture: M3 Net Premium Valuation & M4 Premium Reserves and Policy Values-I

Assessment: Storywall Discussion Question 1: due on Saturday

Week 3:

Lectorial and Tutorial: M3 Net Premium Valuation &

M4 Premium Reserves and Policy Values-I

Video Lecture: M4 Premium Reserves and Policy Values-II

Assessment: Storywall Discussion Question 2 due on Saturday

Week 4:

Lectorial and Tutorial: M4 Premium Reserves and Policy Values-II

Video Lecture: M5 Gross Premiums and Reserves

Assessment: Quiz

Week 5:

Lectorial and Tutorial: M5 Gross Premiums and Reserves

Video Lecture: M6 Profit Testing

Week 6: Flebility week. No classes.

Week 7:

Lectorial and Tutorial: M6 Profit Testing

Video Lecture: M7 Multiple Decrement Models & M8 Multiple State Models

Assessment: Storywall Discussion Question 3 due on Tuesday

Week 8:

Lectorial and Tutorial: M7 Multiple Decrement Models & M8 Multiple State Models

Video Lecture: M9 Insurance and Annuities for Multiple

Assessment: Storywall Discussion Question 4 due on Saturday

Week 9:

Lectorial and Tutorial: M9 Insurance and Annuities for Multiple

Video Lecture: M10 Pension funds

Assessment: Assignment Due on Saturday

Week 10:

Lectoiral and Tutorial: M10 Pension Funds

Assessment: Storywall Discussion Question 5 due on Saturday

Course Resources

Prescribed Resources

The prescribed textbook for the course is:

- D. C. M. Dickson, M. R. Hardy and H. R. Waters, 2nd edition, (2013), "**Actuarial Mathematics for Life Contingent Risks**", Cambridge University Press [A solutions manual is available for purchase. The Solutions manual is strongly encouraged, as solutions to problems assigned from the textbook for tutorials will not be provided.]
- "**Formulae and Tables for Actuarial Examinations**". All students in the actuarial courses should purchase a copy of this text if they wish to use it in tutorials, the quiz and the final examinations. The text is available from the UNSW Bookstore, the UK Institute of Actuaries or from ActEd. This is the only text students are allowed to bring into the examinations for the actuarial course. It must not be annotated.

Course website

The course Moodle website is available from the UNSW TELT platform:

To access the Moodle online support site for students, follow the links from that website to UNSW Moodle Support/Support for Students. Additional technical support can be obtained from itservicecentre@unsw.edu.au (02 9385 1333). All course contents will be available from the

course website. It is essential that you visit the site regularly (at least weekly) to see any notices posted there by the course coordinator.

Recommended Resources

Additional, recommended references are:

- Life insurance mathematics. Gerber, H. U. 3rd ed. Springer; Swiss Association of Actuaries, 1997. 217 pages
- Actuarial mathematics. Bowers, N. L.; Gerber, H. U.; Hickman, J. C. et al. 2nd ed. Society of Actuaries, 1997. 753 pages.
- Core Reading for Subject CT5 Contingencies published by The Institute of Actuaries
- ActEd Course Notes for Subject CT5 Contingencies.

The course draws on and further develops concepts covered in ACTL2111 (Financial Mathematics) and ACTL2102 (Markov Chains). Students should review these concepts as required early in the course.

Course Evaluation and Development

Feedback is regularly sought from students and continual improvements are made based on this feedback. At the end of this course, you will be asked to complete the myExperience survey , which provides a key source of student evaluative feedback. Your input into this quality enhancement process is extremely valuable in assisting us to meet the needs of our students and provide an effective and enriching learning experience. The results of all surveys are carefully considered and do lead to action towards enhancing educational quality.

Since a few years ago, the structure of the course and its learning and teaching strategy have changed radically. The main rationale for this change is the exceptional success of the lecture video recordings introduced in other courses, as well as the recurrent student request for additional coverage of exercises during contact hours. As the essentially unilateral lecturing is moved home with the help of video recordings, additional time is available during the lectures to work through exercises, wrap up topics, answer the residual questions students might have and invite guest lecturers. Furthermore, more digital resources have been added to the course including online videos and online quizzes.

Moreover, in response to recent feedback from course participants, significant changes have been implemented in the course assessment structure. The teamwork component has been removed to place a greater emphasis on knowledge acquisition and problem-solving skills. Taking into account input from students, oral presentations have been discontinued in tutorial

classes to free up more time for discussions and exercises. Furthermore, the reintroduction of in-session quiz is underway, and the weighting of the final exam has been reduced.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Jinxia Zhu			02 90658253		No	Yes

Other Useful Information

Academic Information

COURSE POLICIES AND SUPPORT

The Business School expects that you are familiar with the contents of this course outline and the UNSW and Business School learning expectations, rules, policies and support services as listed below:

- Program Learning Outcomes
- Academic Integrity and Plagiarism
- Student Responsibilities and Conduct
- Special Consideration
- Protocol for Viewing Final Exam Scripts
- Student Learning Support Services

Further information is provided on the key policies and support page.

Students may not circulate or post online any course materials such as handouts, exams, syllabi or similar resources from their courses without the written permission of their instructor.

STUDENT LEARNING OUTCOMES

The Course Learning Outcomes (CLOs) – under the Outcomes tab – are what you should be able to demonstrate by the end of this course, if you participate fully in learning activities and successfully complete the assessment items.

CLOs also contribute to your achievement of the Program Learning Outcomes (PLOs), which are developed across the duration of a program. PLOs are, in turn, directly linked to UNSW graduate capabilities. More information on Coursework PLOs is available on the key policies and

support page. For PG Research PLOs, including MPDBS, please refer to the UNSW HDR Learning Outcomes.

Academic Honesty and Plagarism

As a student at UNSW you are expected to display academic integrity in your work and interactions. Where a student breaches the UNSW Student Code with respect to academic integrity, the University may take disciplinary action under the Student Misconduct Procedure. To assure academic integrity, you may be required to demonstrate reasoning, research and the process of constructing work submitted for assessment.

To assist you in understanding what academic integrity means, and how to ensure that you do comply with the UNSW Student Code, it is strongly recommended that you complete the Working with Academic Integrity module before submitting your first assessment task. It is a free, online self-paced Moodle module that should take about one hour to complete.

Submission of Assessment Tasks

SPECIAL CONSIDERATION

You can apply for special consideration when illness or other circumstances beyond your control interfere with your performance in a specific assessment task or tasks, including online exams. Students studying remotely who have exams scheduled between 10pm and 7am local time, are also able to apply for special consideration to sit a supplementary exam at a time outside of these hours.

Special consideration is primarily intended to provide you with an extra opportunity to demonstrate the level of performance of which you are capable. To apply, and for further information, see Special Consideration on the UNSW Current Students page.

Special consideration applications will be assessed centrally by the Case Review Team, who will update the online application with the outcome and add any relevant comments. The change to the status of the application immediately sends an email to the student and to the assessor with the outcome of the application.

Please note the following:

1. Applications can only be made through Online Services in myUNSW (see the UNSW Current

Students page). Applications will not be accepted by teaching staff. The lecturer-in-charge/ course coordinator will be automatically notified when your application is processed.
2. Applying for special consideration does not automatically mean that you will be granted a supplementary exam or other concession.
3. If you experience illness or misadventure in the lead up to an exam or assessment, you must submit an application for special consideration, either prior to the examination taking place, or prior to the assessment submission deadline, except where illness or misadventure prevent you from doing so.
4. If your circumstances stop you from applying before your exam or assessment due date, you must apply within 3 working days of the assessment or the period covered by your supporting documentation.
5. Under the UNSW Fit To Sit/Submit rule, if you sit the exam/submit an assignment, you are declaring yourself well enough to do so and are cannot subsequently apply for special consideration.
6. If you become unwell on the day of – or during – an exam, you must stop working on your exam, advise your course coordinator or tutor and provide a medical certificate dated within 24 hours of the exam, with your special consideration application. For online exams, you must contact your course coordinator or tutor immediately via email, Moodle or chat and advise them you are unwell and submit screenshots of your conversation along with your medical certificate and application.
7. Special consideration requests do not allow the awarding of additional marks to students.

Further information on Business School policy and procedure can be found under “Special Consideration” on the key policies and support page.

LATE SUBMISSION PENALTIES

For assessments other than examinations, late submission will incur a penalty of 5% per day or part thereof (including weekends) from the due date and time. An assessment will not be accepted after 5 days (120 hours) of the original deadline unless special consideration has been approved. An assignment is considered late if the requested format, such as hard copy or electronic copy, has not been submitted on time or where the ‘wrong’ assignment has been submitted.

For assessments which account for 10% or less of the overall course grade, and where answers are immediately discussed or debriefed, the LIC may stipulate a different penalty. Details of such late penalties will be available on the course Moodle page.

FEEDBACK ON YOUR ASSESSMENT TASK PERFORMANCE

Feedback on student performance from formative and summative assessment tasks will be

provided to students in a timely manner. Assessment tasks completed within the teaching period of a course, other than a final assessment, will be assessed and students provided with feedback, with or without a provisional result, within 10 working days of submission, under normal circumstances. Feedback on continuous assessment tasks (e.g. laboratory and studio-based, workplace-based, weekly quizzes) will be provided prior to the midpoint of the course.

Faculty-specific Information

PROTOCOL FOR VIEWING FINAL EXAM SCRIPTS

UNSW students have the right to view their final exam scripts, subject to a small number of very specific exemptions. The UNSW Business School has set a protocol under which students may view their final exam script. Individual schools within the Faculty may also set up additional local processes for viewing final exam scripts, so it is important that you check with your School.

If you are completing courses from the following schools, please note the additional school-specific information:

- Students in the **School of Accounting, Auditing & Taxation** who wish to view their final examination script should also refer to this page.
- Students in the **School of Banking & Finance** should also refer to this page.
- Students in the **School of Information Systems & Technology Management** should also refer to this page.

COURSE EVALUATION AND DEVELOPMENT

Feedback is regularly sought from students and continual improvements are made based on this feedback. At the end of this course, you will be asked to complete the myExperience survey, which provides a key source of student evaluative feedback. Your input into this quality enhancement process is extremely valuable in assisting us to meet the needs of our students and provide an effective and enriching learning experience. The results of all surveys are carefully considered and do lead to action towards enhancing educational quality.

QUALITY ASSURANCE

The Business School is actively monitoring student learning and quality of the student experience in all its programs. A random selection of completed assessment tasks may be used for quality assurance, such as to determine the extent to which program learning goals are being achieved. The information is required for accreditation purposes, and aggregated findings will be

used to inform changes aimed at improving the quality of Business School programs. All material used for such processes will be treated as confidential.

TEACHING TIMES AND LOCATIONS

Please note that teaching times and locations are subject to change. Students are strongly advised to refer to the Class Timetable website for the most up-to-date teaching times and locations.