



## UNSW Course Outline

# ACTL3182 Asset-Liability and Derivative Models - 2024

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## General Course Information

Course Code : ACTL3182

Year : 2024

Term : Term 3

Teaching Period : T3

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

This course is to provide students with an appreciation of the mathematical and economic models of investment markets and highlight their application (and shortcomings) in asset-liability management for insurance, superannuation and funds management and in the pricing of

derivatives.

Topics covered include; risk and utility; risk measures; mean variance models; factor models; asset liability models using portfolio selection models; equilibrium and arbitrage-free valuation; valuation of derivatives; term structure models; credit risk models and actuarial stochastic investment models and their application. The topics will be illustrated with applications to the valuation and risk management of insurance and superannuation contracts especially those with embedded options and financial guarantees - with a particular focus on the inadequacies of the models for investment risk management. The course will include case studies on investment and derivative disasters.

## Course Aims

This course is to provide students with an appreciation of the issues involved in pricing derivatives and modelling returns on assets typically used by financial institutions

## Relationship to Other Courses

The aims of this course are to provide students with an understanding of:

- The application of utility theory and quantitative risk measurement as a tool to aid decision-making.
- Mean-variance analysis and its applications to optimal asset-liability management.
- The assumptions, theory and application of the principal asset pricing models including statistical, arbitrage, and equilibrium approaches.
- Contingent-claims pricing techniques and their actuarial applications.
- Actuarial stochastic investment models, and asset-liability modelling.

Students taking this course are assumed to have mastery over all areas of financial mathematics covered in ACTL2111 and stochastic modelling techniques covered in ACTL2102. Concepts covered in this course are useful for advanced quantitative risk management as covered in ACTL3301.

# Course Learning Outcomes

Course Learning Outcomes	Program learning outcomes
CLO1 : Apply methods for risk measurement and decision-making under uncertainty, using techniques frp, financial economics and actuarial science.	<ul style="list-style-type: none"> <li>• PL01 : Business Knowledge</li> <li>• PL02 : Problem Solving</li> </ul>
CLO2 : Utilise mean-variance criteria to optimise asset allocation for long-term investors such as insurers and superannuation funds.	<ul style="list-style-type: none"> <li>• PL01 : Business Knowledge</li> <li>• PL02 : Problem Solving</li> <li>• PL03 : Business Communication</li> </ul>
CLO3 : Explain key asset-pricing models and their implications for actuarial practice.	<ul style="list-style-type: none"> <li>• PL01 : Business Knowledge</li> <li>• PL02 : Problem Solving</li> <li>• PL03 : Business Communication</li> </ul>
CLO4 : Use contingent-claim pricing methods to assess the risks associated with options and guarantees.	<ul style="list-style-type: none"> <li>• PL01 : Business Knowledge</li> <li>• PL02 : Problem Solving</li> <li>• PL03 : Business Communication</li> </ul>
CLO5 : Describe stochastic investment models in actuarial contexts and their use in asset-liability management.	<ul style="list-style-type: none"> <li>• PL01 : Business Knowledge</li> <li>• PL02 : Problem Solving</li> <li>• PL03 : Business Communication</li> </ul>
CLO6 : Enhance skills in communication, discussion, and report writing.	<ul style="list-style-type: none"> <li>• PL01 : Business Knowledge</li> <li>• PL03 : Business Communication</li> <li>• PL04 : Teamwork</li> </ul>

Course Learning Outcomes	Assessment Item
CLO1 : Apply methods for risk measurement and decision-making under uncertainty, using techniques frp, financial economics and actuarial science.	<ul style="list-style-type: none"> <li>• Online Discussion Questions</li> <li>• Assignment</li> <li>• Examination</li> </ul>
CLO2 : Utilise mean-variance criteria to optimise asset allocation for long-term investors such as insurers and superannuation funds.	<ul style="list-style-type: none"> <li>• Online Discussion Questions</li> <li>• Assignment</li> <li>• Examination</li> </ul>
CLO3 : Explain key asset-pricing models and their implications for actuarial practice.	<ul style="list-style-type: none"> <li>• Online Discussion Questions</li> <li>• Assignment</li> <li>• Examination</li> </ul>
CLO4 : Use contingent-claim pricing methods to assess the risks associated with options and guarantees.	<ul style="list-style-type: none"> <li>• Online Discussion Questions</li> <li>• Assignment</li> <li>• Examination</li> </ul>
CLO5 : Describe stochastic investment models in actuarial contexts and their use in asset-liability management.	<ul style="list-style-type: none"> <li>• Online Discussion Questions</li> <li>• Assignment</li> <li>• Examination</li> </ul>
CLO6 : Enhance skills in communication, discussion, and report writing.	<ul style="list-style-type: none"> <li>• Assignment</li> </ul>

# Learning and Teaching Technologies

Echo 360 | Moodle - Learning Management System | EdStem

## Assessments

### Assessment Structure

Assessment Item	Weight	Relevant Dates	Program learning outcomes
Online Discussion Questions Assessment Format: Individual Short Extension: Yes (1 day)	10%	Start Date: Fortnightly Due Date: 1 week from release date	• PL02 : Problem Solving • PL03 : Business Communication • PL01 : Business Knowledge
Assignment Assessment Format: Individual Short Extension: Yes (3 days)	30%	Start Date: TBA Due Date: Week 9	• PL02 : Problem Solving • PL03 : Business Communication • PL01 : Research Excellence • PL02 : Academic Excellence
Examination Assessment Format: Individual	60%	Start Date: Not Applicable Due Date: Exam period	• PL01 : Business Knowledge • PL02 : Problem Solving • PL03 : Business Communication • PL02 : Academic Excellence

## Assessment Details

### Online Discussion Questions

#### Assessment Overview

The course offers discussions to practice the concepts you have learned each week. This is a formative assessment initiative aimed at reinforcing your learning and help you in identifying the areas you need to focus on in enhancing your understanding of the course content.

#### Course Learning Outcomes

- CL01 : Apply methods for risk measurement and decision-making under uncertainty, using techniques frp, financial economics and actuarial science.
- CL02 : Utilise mean-variance criteria to optimise asset allocation for long-term investors such as insurers and superannuation funds.
- CL03 : Explain key asset-pricing models and their implications for actuarial practice.
- CL04 : Use contingent-claim pricing methods to assess the risks associated with options and guarantees.

- CLO5 : Describe stochastic investment models in actuarial contexts and their use in asset-liability management.

### **Detailed Assessment Description**

These are weekly exercises, a one day soft extension is permitted.

### **Assessment Length**

To be uploaded on Moodle StoryWall

### **Assessment information**

The course offers discussions to practice the concepts you have learned each week. This is a formative assessment initiative aimed at reinforcing your learning and help you in identifying the areas you need to focus on in enhancing your understanding of the course content.

### **Generative AI Permission Level**

#### **Simple Editing Assistance**

In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.

If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.

For more information on Generative AI and permitted use please see [here](#).

## **Assignment**

### **Assessment Overview**

The assignment is intended to develop critical thinking skills and the ability to concisely and coherently apply concepts from lecture content.

### **Course Learning Outcomes**

- CLO1 : Apply methods for risk measurement and decision-making under uncertainty, using techniques frp, financial economics and actuarial science.
- CLO2 : Utilise mean-variance criteria to optimise asset allocation for long-term investors such as insurers and superannuation funds.
- CLO3 : Explain key asset-pricing models and their implications for actuarial practice.
- CLO4 : Use contingent-claim pricing methods to assess the risks associated with options and guarantees.

- CLO5 : Describe stochastic investment models in actuarial contexts and their use in asset-liability management.
- CLO6 : Enhance skills in communication, discussion, and report writing.

#### **Detailed Assessment Description**

The assignment is intended to develop critical thinking skills and the ability to concisely and coherently apply concepts from lecture content.

The assignment is intended to develop your skills in research and your ability to concisely and coherently present your ideas. It is intended to be part of achieving the Learning Outcomes.

The assignment will allow students the opportunity to develop their understanding of the issues involved in applying/extending the techniques discussed in the course to a practical actuarial business problem, and to develop writing and communication skills. The assignment will be posted on the course website. Assignments are to be submitted via Moodle.

Students are reminded that the work they submit must be based on work by themselves. While we have no problem with students working together (and in fact, it is encouraged to interact with your peers to enhance your learning) on the assignment problems, the material students submit for assessment must be their own. This means that: (i) the mathematical solutions you present are written up by you, without reference to any other student's work; (ii) Any analysis and program you use and present is done using your own code, which you yourself wrote and ran, without reference to any other student's work.

#### **Assignment submission Turnitin type**

Not Applicable

#### **Generative AI Permission Level**

##### **Simple Editing Assistance**

In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.

If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.

For more information on Generative AI and permitted use please see [here](#).

# Examination

## Assessment Overview

The examination will assess critical analysis and problem-solving skills as well as written communication skills, and correspond to the learning outcomes.

## Course Learning Outcomes

- CL01 : Apply methods for risk measurement and decision-making under uncertainty, using techniques frp, financial economics and actuarial science.
- CL02 : Utilise mean-variance criteria to optimise asset allocation for long-term investors such as insurers and superannuation funds.
- CL03 : Explain key asset-pricing models and their implications for actuarial practice.
- CL04 : Use contingent-claim pricing methods to assess the risks associated with options and guarantees.
- CL05 : Describe stochastic investment models in actuarial contexts and their use in asset-liability management.

## Detailed Assessment Description

The examination will assess critical analysis and problem-solving skills as well as written communication skills, and correspond to the learning outcomes.

## Assessment information

This course will have a two-hour invigilated exam held on UNSW's Kensington campus. The examination will assess the achievement of the learning outcomes of the course including the course aims. The examination will assess critical analysis and problem solving skills as well as written communication skills, and correspond to the Learning Outcomes.

## Generative AI Permission Level

### **Not Applicable**

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

## **General Assessment Information**

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.

## Grading Basis

### Standard

#### 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.

You are required to attempt all assessment requirements in the course.

# Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Utility Theory; Risk Measures, Mean-Variance Analysis - Module 1 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 2 : 16 September - 22 September	Lecture	Mean-Variance Analysis continued - Module 1 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 3 : 23 September - 29 September	Lecture	Capital Asset Pricing Model, Factor Models, Arbitrage Pricing Theory, Data and Statistics, Efficient Markets - Module 2 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 4 : 30 September - 6 October	Lecture	Introduction to Derivatives, Contingent Claim Valuation - Discrete - Module 3 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 5 : 7 October - 13 October	Lecture	Continuous Time Modelling Techniques - Module 4 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 6 : 14 October - 20 October	Other	Flexibility week
Week 7 : 21 October - 27 October	Lecture	Contingent Claim Valuation - Continuous Time (1) - Module 4 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 8 : 28 October - 3 November	Lecture	Contingent Claim Valuation - Continuous Time (2) - Module 4 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 9 : 4 November - 10 November	Lecture	Interest Rate Modelling and Actuarial Stochastic Investment Models; Applications - Module 5 Lecture Slides & Videos via Moodle StoryWall Discussions
Week 10 : 11 November - 17 November	Lecture	Guest Presentation - Note that the timing of guest lecture may change as this is yet to be finalised. StoryWall Discussions



# Attendance Requirements

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

## General Schedule Information

Refer to the time table

# Course Resources

## Prescribed Resources

There are many books of relevance to the course topics. The following books will be the main text references for a substantial part of the course:

- Baxter, M. and A. Rennie "Financial Calculus: An Introduction to Derivative Pricing", Cambridge University Press, 1996.
- Luenberger, D.G. "Investment Science", 2nd Edition. Oxford University Press, 2013.
- Recorded Lightboard videos

### Other References

Other texts that are useful references for the course coverage are:

- Cairns, A. "Interest Rate Models", Princeton University Press, 2004.
- Elton, E., M. Gruber, S. Brown and W. Goetzmann "Modern Portfolio Theory and Investment Analysis", Wiley 2002 (6th Edition).

### Course Website

The course website is available from the [UNSW TELT platform](#).

It is essential that you visit the site regularly to see any notices posted there by the course coordinator, as it will be assumed that they are known to you within a reasonable time.

### Actuaries Institute

The Actuaries Institute allows students to become University Subscribers free of charge. Full time undergraduates studying at an Institute accredited university who are members of a university student actuarial society are eligible.

## 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, opens in a new window](#), 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.

Each year feedback is sought from students and other stakeholders about the courses offered in the School and continual improvements are made based on this feedback. UNSW's Course and Teaching Evaluation and Improvement (myExperience) Process is one of the ways in which student evaluative feedback is gathered. In this course, we will seek your feedback during the course of the term (via Moodle based surveys) and end of session myExperience.

As a result of feedback from previous offerings in the course, significant changes and improvements were introduced in recent years with significant positive feedback from students as a result. In 2024, we will improve the course material by incorporating additional illustrative examples to further enhance student understanding. In addition, all lectures will be available via the lecture recording system in order to facilitate students' flexible learning strategies. These recordings become available via the Moodle course webpage.

## Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Jonathan Ziveyi					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 [Policies and Guidelines](#) 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 [Policies and Guidelines](#) page. For PG Research PLOs, including MPDBS, please refer to [UNSW HDR learning outcomes](#).

## Academic Honesty and Plagiarism

As a student at UNSW you are expected to display [academic integrity](#) in your work and interactions. Where a student breaches the [UNSW Code of Conduct](#) with respect to academic integrity, the University may take disciplinary action. 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 Code of Conduct, 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

## SHORT EXTENSIONS

Short Extension is a new process that allows you to apply for an extended deadline on your assessment without the need to provide supporting documentation, offering immediate approval during brief, life-disrupting events. Requests are automatically approved once submitted.

Short extensions are ONLY available for some assessments. Check your course outline or Moodle to see if this is offered for your assessments. Where a short extension exists, all students enrolled in that course in that term are eligible to apply. Further details are available the UNSW [Current Students](#) page.

## **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. Special consideration is primarily intended to provide you with an extra opportunity to demonstrate the level of performance of which you are capable.

Applications can only be made online and will NOT be accepted by teaching staff. 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. The majority of applications will be processed within 3-5 working days.

For further information, and to apply, see Special Consideration on the UNSW [Current Students](#) page.

## **LATE SUBMISSION PENALTIES**

### **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. In the case of an approved Equitable Learning Plan (ELP) provision, special consideration or short extension, the late penalty applies from the date of approved time extension. After five days from the extended deadline, the assessment cannot be submitted.

An assessment is considered late if the requested format, such as hard copy or electronic copy, has not been submitted on time or where the 'wrong' assessment 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.