

ACTL3182

Asset-Liability and Derivative Models

Course Outline

Semester 2, 2017

Course-Specific Information

The Business School expects that you are familiar with the contents of this course outline. You must also be familiar with the Course Outlines Policies webpage which contains key information on:

- Program Learning Goals and Outcomes
- Academic Integrity and Plagiarism
- Student Responsibilities and Conduct
- Special Consideration
- Student Support and Resources

This webpage can be found on the Business School website:
<https://www.business.unsw.edu.au/degrees-courses/course-outlines/policies>

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COURSE-SPECIFIC INFORMATION

1 STAFF CONTACT DETAILS

The Course Coordinator and Lecturer in Charge is Jonathan Ziveyi:

Staff	E-mail	Room	Telephone
Jonathan Ziveyi	j.ziveyi@unsw.edu.au	Business School 648	9385 8006

Jonathan is responsible for course administration, final assessment of the course and delivering lectures related to teaching and learning. He is available on Thursdays 2pm-3pm for student consultation during the teaching session.

The Tutors for the course are:

Staff	E-mail
Anh Vu	p.vu@unsw.edu.au
Igor Balnozan	i.balnozan@unsw.edu.au
Hayden Lau	kawai.lau@unsw.edu.au

The tutors will hold consultation at the front of the School of Risk and Actuarial Studies office (UNSW Business School Building, Level 6) in the week before any in-session assessment. The consultation times will be advertised on the course website.

2 COURSE DETAILS

2.1 Teaching Times and Locations

This Course consists of:

- Weekly 2+1 hour lectures (weeks 1 - 12) – see below;
- Weekly 1 hour tutorials (weeks 2 to 13) – see below;
- Weekly optional live streaming online tutorials – see below.
- Video recordings of the summarised lecture material.

Lectures

Face-to-face lectures will be held on **Mondays from 10am-12pm and Thursdays 10am-11am** in the **Chemical Science M17 Theatre**.

Timetables and locations are correct at time of editing. A full timetable of lectures and topics is provided later in this Course Outline. Any alterations to the lecture times or locations will be advised in lectures and via the Course website.

Tutorials

Tutorials will be held from week 2 to week 13. They will cover topics presented in the previous week's lecture. Scheduled Tutorial Session times and locations are as follows:

Section	Day	Time	Venue	Tutor
H09A	Thursday	9am-10am	Law G17	Anh Vu
H11A	Thursday	11am-12pm	Squarehouse 114	Anh Vu
H12A	Thursday	12pm-1pm	Squarehouse 114	Anh Vu
M09A	Monday	9am-10am	Law G17	Hayden Lau
T09A	Tuesday	9am-10am	Squarehouse 114	Igor Balnozan
T10A	Tuesday	10am-11am	Squarehouse 115	Igor Balnozan
T11A	Tuesday	11am-12pm	Squarehouse 115	Hayden Lau
T12A	Tuesday	12pm-1pm	Squarehouse 115	Hayden Lau

Students must attend the tutorial for which they are enrolled. Attendance will be recorded and counts towards meeting the requirements to pass the course; for more information, see Part B of the Course Outline. If you wish to change your tutorial then you must lodge an application to change your tutorial time with the Business School Student Centre.

In tutorials, we will implement interactive learning where participation is highly encouraged. To get the most out of the tutorials, students should cover the modules' contents and complete assigned homework problems in advance of the tutorial.

Live-streaming sessions

From Week 2 – 13, we will introduce additional online tutorial/consultation sessions which will be live-streamed via Moodle. Each session will be recorded and posted on the course site on Moodle. A link will be made available each week before the session. Students will be expected to suggest material to cover during these sessions and post on associated forums which will be created for each week.

2.2 Units of Credit

The course is worth 6 units of credit.

2.3 Summary of Course

This course introduces the mathematical and economic models of financial economics, and highlights their application to asset-liability management for insurance, superannuation and funds management. Particular focus will be placed on the development of quantitative models to solve practical actuarial problems.

Topics covered include: risk and utility; risk measures; mean-variance models; factor models; asset-liability models; equilibrium and arbitrage-free valuation; valuation of derivatives and embedded guarantees; stochastic interest rate modeling; actuarial stochastic investment models. 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.

Students need to be able to use a word processing package (such as WORD) and a spread-sheet package (such as EXCEL).

2.4 Course Aims and Relationship to Other Courses

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

- A. The application of utility theory and quantitative risk measurement as a tool to aid decision-making.
- B. Mean-variance analysis and its applications to optimal asset-liability management.
- C. The assumptions, theory and application of the principal asset pricing models – including statistical, arbitrage, and equilibrium approaches.
- D. Contingent-claims pricing techniques and their actuarial applications.
- E. 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 ACTL5301 and ACTL5302.

This material covered in this course is further continued/ complemented in ACTL4303 and ACTL5303, which focuses on the knowledge, skills and judgment necessary to understand investment and asset liability modeling with an emphasis on practical issues.

2.5 Student Learning Outcomes

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

- 1. Describe and apply methods for quantitative risk measurement and decision-making under uncertainty by effectively combining techniques from financial economics and actuarial science. [LO1]
- 2. Apply mean-variance criteria to determine the optimal asset allocation for long term investors, including insurers and superannuation funds. [LO2]
- 3. Explain and apply the assumptions, theory, and results of the principal asset-pricing models – including statistical, arbitrage, and equilibrium approaches - as well as their applications to actuarial work. [LO3]
- 4. Apply contingent-claim pricing techniques to value and manage the risks of embedded options and guarantees. [LO4]
- 5. Describe actuarial stochastic investment models, and their applications to asset-liability management. [LO5]
- 6. Apply effective communication, discussion and report writing skills. [LO6]

The Learning Outcomes in this course also help you to achieve some of the overall Program Learning Goals and Outcomes for all undergraduate students in the Business School. Program Learning Goals are what we want you to BE or HAVE by the time you successfully complete your degree (e.g. 'be an effective team player'). You demonstrate this by achieving specific Program Learning Outcomes - what you are able to DO by the end of your degree (e.g. 'participate collaboratively and responsibly in teams').

For more information on Program Learning Goals and Outcomes, see the School's Course Outlines Policies webpage available at <https://www.business.unsw.edu.au/degrees-courses/course-outlines/policies>

The following table shows how your Course Learning Outcomes relate to the overall Program Learning Goals and Outcomes, and indicates where these are assessed (they may also be developed in tutorials and other activities):

Program Learning Goals and Outcomes		Course Learning Outcomes	Course Assessment Item
<i>This course helps you to achieve the following learning goals for all UNSW Business School undergraduate coursework students:</i>		<i>On successful completion of the course, you should be able to:</i>	<i>This learning outcome will be assessed in the following items:</i>
1	Knowledge	All	<ul style="list-style-type: none"> • Assignment • Mid-term Exam • Final Exam
2	Critical thinking and problem solving	All	<ul style="list-style-type: none"> • Assignment • Mid-term Exam • Final Exam
3a	Written communication	All	<ul style="list-style-type: none"> • Assignment
3b	Oral communication	n/a	
4	Teamwork	n/a	
5a.	Ethical, environmental and sustainability responsibility	n/a	
5b.	Social and cultural awareness	n/a	

3 LEARNING AND TEACHING ACTIVITIES

3.1 Approach to Learning and Teaching in the Course

Lectures will review the main topics and provide coverage of the course concepts. They are an opportunity for students to develop an understanding of the main topics covered in the course and the level of knowledge expected. They provide a guide to the course of study during the session and the material students need to read and review. Students should read the prescribed readings prior to the lecture.

Tutorials and in-class activities are for students to ask questions on aspects of the course that need further clarification, and to interact with other students in the course. Students need to attempt the homework problems alone first and identify problems that require

closer review. Students are strongly encouraged to work in teams as it is an opportunity to learn from other students and to develop team skills.

3.2 Learning Activities and Teaching Strategies

It is expected the students will take a pro-active approach to learning. The course is organised into learning activities given in the following table. The Course Aims and Program Learning Goals they should develop are also indicated.

Activity	A	B	C	D	E	1	2	3	4	5
Required readings	X	X	X	X	X	X	X			
Lectures and in-class activities	X	X	X	X	X	X	X	X	X	X
In-class discussion of homework problems	X	X	X	X	X	X	X	X		
Optional readings	X	X	X	X	X	X				X
Optional exercises	X	X	X	X	X	X	X			

The aims A to E are developed during all activities. By nature, the actuarial program develops problem-solving and professional skills (Program Goals 1 and 2), and all activities contribute to that development.

Students are expected to perform these activities in the following time frame (for the outcomes of week k):

Week $k-1$	Week k	Week $k+1$
Required readings Have a first look at the homework problems (if possible, in a team)	Attend lecture Attempt homework problems (if possible, in a team), and prepare questions Review lecture notes, and seek help if needed	Attend tutorials, ask questions and review solutions Review relevant past quizzes and final exam questions Optional readings and exercises

Thus, you should, in a given week, work on these three different stages for their corresponding three different course weeks. Note that thanks to the 12-weeks-in-13 model, homework problems are discussed in Week $k+1$.

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 content particularly challenging. **Don't allow yourself to fall behind the schedule!**

4 ASSESSMENTS

4.1 Assessment Format

In order to pass the course students **must complete and submit all components of assessment at or before the due times**. Late assessment submissions will not be marked. It is important that students be punctual and reliable when submitting assessment. This is an important workplace requirement and students need to ensure they meet deadlines.

Your regular and punctual attendance at lectures and tutorials is expected in this course. **University regulations indicate that if students attend less than eighty per cent of scheduled classes they may be refused final assessment.**

In order to pass the course students must perform satisfactorily in all course assessment components. Students who have an overall performance at the Credit level (65% and above) are eligible for exemption of the Actuaries Institute CT8 examination.

Assessment of your performance in the course will be done through a number of tasks, whose list you will find in the following table with relevant details.

Assessment Task	Weight	LO ¹	Length	Due Date
Mid-term exam	25%	Module 1-2: A1, A2, A3	60 mins	21/08/2017, 10am-12pm
Assignment	15%	C1	N/A	11/10/2017 11:59pm
Final examination	60%	A, B and C	2 hours	TBA

Mid-term exam

There will be one written answer mid-term exam in weeks 5 of 60 minutes duration. **The mid-term exam will take place on Monday the 21st of August 2017, between 10am to 12pm.** Its venue will be advertised later. The mid-term exam will be closed book. Students will only be allowed to bring the text "Formulae and Tables for Actuarial Examinations".

Normal examination rules apply to the conduct of mid-term exams. Calculators will be allowed in the mid-term and final examination but a clear indication of all of the steps involved in your calculations must be shown. The University will not supply calculators to students for use in examinations where the provision of calculators has not been requested by the course examiner. It is the student's responsibility to be familiar with the rules governing the conduct of examinations.

The course exams require written responses, with students earning marks for correct mathematical working as well as part marks for incorrect responses with correct method and reasoning. They test not only their knowledge of the material, but also the depth of their understanding of it.

¹ Course Learning Outcome that is assessed

Assignment

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 Learning Outcomes LO1-LO6.

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 web site on or before 6pm, on the 1st of September, 2017, and are due at 11.59pm on 11th of October, 2017. Assignments are to be submitted via the course webpage.

Students are reminded that the work they submit must be their original work. 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.

Final Examination

The final examination will assess students' understanding of the concepts covered in the course and their ability to apply them to financial market problems. A deeper grasp of materials is expected from students at the final exam level than at the tutorial level.

The final examination will be a two hour written paper. The final examination will be closed book. Students will only be allowed to bring the text "Formulae and Tables for Actuarial Examinations" into the exam. This must not be annotated.

4.2 Assignment Submission Procedure

Assignment reports must be submitted via the Turnitin submission box that will be made available on the course website. Turnitin reports on any similarities between their own cohort's assignments, and also with regard to other sources (such as the internet or all assignments submitted all around the world via Turnitin). More information is available at:

http://elearning.unsw.edu.au/turnitin/content/TurnItIn_Student_Support.cfm?ss=0

Please read this page, as we will assume that its content is familiar to you. You will be able to make multiple submissions and have access to the originality reports.

4.3 Special Consideration, Late Submission and Penalties

For information on Special Consideration please refer to the Business School's [Course Outlines Policies webpage](#)

<https://www.business.unsw.edu.au/degrees-courses/course-outlines/policies>

Special consideration and assessments other than the Final Exam in undergraduate and postgraduate courses:

For courses offered by the School of Risk and Actuarial Studies, the weight of the assessment items for which special consideration is granted is re-allocated to the Final

Exam. Alternatively, in exceptional cases and only for assessment items with a submission deadline, a delayed deadline may be granted. This may be no more than 5 business days after the initial deadline, and must be before feedback is provided to students.

Special consideration **does not** entitle students to a supplementary opportunity to complete the assessment item.

Late submission of assessment items

When an assessment item had to be submitted by a pre-specified submission date and time and was submitted late, the School of Risk and Actuarial Studies will apply the following policy.

The School of Risk and Actuarial Studies' policy on late assignment submission is that a penalty of 25% of the mark the student would otherwise have obtained, for each full (or part) day of lateness (e.g., 0 day 1 minute = 25% penalty, 2 days 21 hours = 75% penalty). Students who are late must submit their assignment to the lecture-in-charge (LIC) via e-mail. The LIC will then upload documents to the relevant submission boxes. The date and time of reception of the e-mail determines the submission time for the purposes of calculating the penalty.

4.4 Protocol for viewing final exam scripts

The UNSW Business School has set a protocol under which students may view their final exam script. Please check the protocol [here](https://www.business.unsw.edu.au/students/resources/student-centre/student-resources/policies-and-guidelines/protocol-for-viewing-final-exam-scripts)

<https://www.business.unsw.edu.au/students/resources/student-centre/student-resources/policies-and-guidelines/protocol-for-viewing-final-exam-scripts>

Individual Schools within the Faculty may set up a local process providing it is in keeping with the Faculty protocol. The School of Risk and Actuarial Studies implements the abovementioned faculty guidelines in the following way:

1. There will be only one viewing.
2. Students must register (that is, lodge a request to view their final exam script) to rasadmin@unsw.edu.au after results are released, but no later than COB on Wednesday 6 December 2017.
3. The viewing will take place on Monday 11 December 2017, at a time and location to be announced to registered students by COB on Friday 8 December 2017. Student **MUST** remain available for the **WHOLE** of 11 December 2017 until the time of their viewing is communicated.

Note that students must make a separate, subsequent appointment with the LIC, should they wish to lodge a formal application for re-assessment

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.

5 COURSE 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.

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 Moodle website is available from the UNSW TELT platform:

<http://moodle.telt.unsw.edu.au>

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 externalteltsupport@unsw.edu.au (02 9385 3331).

All course contents will be available from the course website. 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.

6 COURSE EVALUATION AND DEVELOPMENT

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 at the end of session and we encourage you to share your views on 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 2017 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 Echo360 lecture recording system in order to facilitate students' flexible learning strategies. We have also developed lecture summaries with the aid of Light board technology which we hope will assist in improving the student learning experience.

7 COURSE SCHEDULE

This timetable may be altered. Students will be advised of any changes in lectures and via the course web site.

Week	Week beginning	Topic
1	24-Jul	Utility Theory; Risk Measures
2	31-Jul	Mean-Variance Analysis
3	7-Aug	Capital Asset Pricing Model
4	14-Aug	Factor Models, Arbitrage Pricing Theory, Data and Statistics; Efficient Markets
5	21-Aug	Mid Semester Exam, Introduction to Derivatives
6	28-Aug	Introduction to Derivatives, Contingent Claim Valuation - Discrete Time
7	4-Sep	Continuous Time Modelling Techniques
8	11-Sep	Continuous Time Modelling Techniques
9	18-Sep	Contingent Claim Valuation - Continuous Time (1)
Mid-semester break: 23 September – 2 October inclusive (2 Oct = Labour Day Public Holiday)		
10	3-Oct	Contingent Claim Valuation - Continuous Time (2)
11	9-Oct	Interest Rate Modelling
12	16-Oct	Actuarial Stochastic Investment Models; Applications

8 COVERAGE OF ACTUARIES INSTITUTE SYLLABUS

The following table indicates the Actuaries' Institute Learning Outcomes and the corresponding learning outcomes / lecture in this course:

Actuaries Institute CT8 Aim	Learning Outcome(s)	Lecture Topic(s)
(i) - Utility Theory	1	Module 1
(ii) - Risk Measures	1	Module 1
(iii) - Mean-variance Analysis	2	Module 1
(iv) - Factor Models	3	Module 2
(v) - Asset Pricing Models	3	Module 2
(vi) - Efficient Markets	3	Module 2
(vii) - Stochastic Models	5	Modules 3 & 4
(viii) - Brownian Motion	4	Modules 3 & 4
(ix) - Option Pricing	4	Modules 3 & 4
(x) Term Structure	4	Module 5