UNSW Business School

School of Risk and Actuarial Studies

ACTL2111
FINANCIAL MATHEMATICS FOR ACTUARIES

Course Outline
Semester 1, 2017

Part A: Course-Specific Information

Please consult Part B for key information on Business School policies (including those on plagiarism and special consideration), student responsibilities and student support services.

Table of Contents

PART A: COURSE-SPECIFIC INFORMATION

1 STAFF CONTACT DETAILS

The Course Coordinator and Lecturer in Charge is:

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

He is responsible for course administration, final assessment of the course and responsible for the lectures and related teaching and learning. His consultation times are on Wednesday, 2:00pm to 3:00pm until the 31st of May 2017. Additional exam preparation consultation times in the week starting 5th of June 2017 will be advertised later.

The Tutors for the course are:

Staff	E-mail	Consultation
Ridhi Dave		TBA
Mingda Xu		TBA
Sam Luo		TBA
Yang Hu		TBA
Johnny Wong		TBA
Vivian Zhang		TBA
Josephine Ngan		TBA
Grant Lian		TBA

They are responsible for running the tutorials as well as marking the quiz and the assignment. They will hold consultations for the assignment, quiz and final exam at dates and venue to be advised. All tutors are available to all students, so please do not hesitate to visit them at your most convenient time.

Who should you contact?

- Questions about the lectures or tutorial questions: apart from the course forums, firstly Tutors, secondly Jonathan (during tutorials, consultation times or by e-mail);
- Administrative enquiries about the course: Jonathan, during his consultation times or by e-mail;
- Enquiries about undergraduate coursework programs in Actuarial Studies should be directed to Dr Jinxia Zhu, jinxia.zhu@unsw.edu.au
- Enquiries about postgraduate coursework programs in Actuarial Studies should be directed to Associate Professor Anthony Asher, a.asher@unsw.edu.au
- Enrolment: The Business School Student Centre

2 COURSE DETAILS

2.1 Teaching Times and Locations

This Course consists of:

- Weekly 2 hour lectures (weeks 1 to 12) – see below;
- Weekly 1 hour tutorials (weeks 2 to 13) – see below;
- Weekly 1 hour excel tutorials (weeks 2 to 13) – see below;
- Self-study video recordings available on the course Moodle website;
- Video recordings of advanced exercises available on the course Moodle website.

Lectures

Lectures will be held on **Wednesdays from 9am to 11am in the Science Theatre (K-F13-G09)** from week 1 to week 12.

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

Tutorials

Tutorials will be held from week 2 to week 13. They will cover topics covered in the previous week's lecture. A maximum of 13 tutorials classes are planned for the course. Scheduled Tutorial Session times and locations are as follows:

Section	Day	Time	Venue	Tutor
F09A	Friday	09:00 - 10:00	Colombo LG02	
F10A	Friday	10:00 - 11:00	Colombo LG02	
F11A	Friday	11:00 - 12:00	Goldstein G03	
F12A	Friday	12:00 - 13:00	Goldstein G01	
H12A	Thursday	12:00 - 13:00	Morven Brown G5	
H13A	Thursday	13:00 - 14:00	Colombo LG01	
H14A	Thursday	14:00 - 15:00	Colombo LG01	
W11A	Wednesday	11:00 - 12:00	Blockhouse G13	
W11B	Wednesday	11:00 - 12:00	Blockhouse G15	
W12A	Wednesday	12:00 - 13:00	Blockhouse G13	
W12B	Wednesday	12:00 - 13:00	Blockhouse G15	
W13A	Wednesday	13:00 - 14:00	Blockhouse G13	
W13B	Wednesday	13:00 - 14:00	Blockhouse G15	

Excel Tutorials

There will be excel laboratory sessions from week 2 to week 13. These sessions are meant to equip students with the necessary skills and will be assessed through mini-assignments throughout the semester. A maximum of 13 laboratory classes are planned for the course. Scheduled Tutorial Session times and locations are as follows:

Section	Day	Time	Venue	Tutor

H09B	Thursday	09:00 - 10:00	Law G17	
H10A	Thursday	10:00 - 11:00	Law G17	
T09A	Tuesday	09:00 - 10:00	Law G17	
T10A	Tuesday	10:00 - 11:00	Law G17	
T13A	Tuesday	13:00 - 14:00	Law 111	
T16A	Tuesday	16:00 - 17:00	Law G17	
T16B	Tuesday	16:00 - 17:00	Law 111	
T17A	Tuesday	17:00 - 18:00	Law G17	
W15A	Wednesday	15:00 - 16:00	Law G17	
W16A	Wednesday	16:00 - 17:00	Law G17	
W16B	Wednesday	16:00 - 17:00	Law 111	
W17A	Wednesday	17:00 - 18:00	Law G17	
W17B	Wednesday	17:00 - 18:00	Law 111	

Students must attend the tutorial for which they are enrolled. Attendance will be recorded and counts towards meeting the requirements to pass the course. If you wish to change your tutorial then you must lodge an application to change your tutorial time with the Actuarial Studies Administration Officer.

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.

2.2 Units of Credit

The course is worth 6 units of credit.

2.3 Summary of Course

This course develops the financial mathematics required for the analysis of financial and insurance transactions. Topics covered include: mathematics of compound interest; valuation of cash flows of simple insurance contracts; analysis and valuation of annuities, bonds, loans and other securities; yield curves and immunisation; introduction to stochastic interest rate models and actuarial applications.

2.4 Course Aims and Relationship to Other Courses

At the end of the course students should be able to:

A. Explain how to evaluate, and assign a single value to a series of contingent cash flows under different assumption on the time value of money (interest);
B. Understand and assess the principles underlying the evaluation of the main securities that are available in the financial markets;
C. Demonstrate their ability to apply the technical skills related to the course in a practical context.

This course covers financial mathematics at an introductory level. The assumed knowledge of the course is a good understanding of mathematics as covered in a full year undergraduate program in Calculus and Linear Algebra. The main mathematical topics are covered in a series of lectures by Randell Heyman that are available on Moodle on the ACTL students common website (section "Back to Basics: Basic

Mathematical Tools for Actuarial Students"). Students should review these lectures at the very latest by the end of the first week.

ACTL2111 Financial Mathematics for Actuaries builds on the basic concepts of financial mathematics. Parts of the course will apply some of the concepts covered in ACTL2131 Probability and Mathematical Statistics. More advanced models are covered in Session 2 in ACTL2102- Foundations of Actuarial Models. The course is necessary knowledge for the more advanced coverage in ACTL3182 Asset-Liability and Derivative Models and is an introduction to the more extensive coverage in ACTL3151 Life Contingences.

Furthermore, students should be able to use a word processing package (such as WORD) and a spreadsheet (such as EXCEL). Knowledge of and computational software (such as R, MATLAB, or MAPLE) is also recommended.

2.5 Student Learning Outcomes

The aims of Section 2.4 (A to C) have been unpacked in the following learning outcomes. At the end of the course students should be able to:

A1. Understand the concept of time value of money;
A2. Explain and compare different types of interest: simple vs compound interest, discount interest, nominal vs effective interest rates, rate vs force of interest, real vs money interest rates, the term structure of interest, as well as simple stochastic interest models;
A3. Understand the relation between a present value, a set of cash flows and interest, as well as understand the interest rate risk (duration, immunisation);
A4. Explain how to modify a simple valuation problem by taking into account tax and transaction costs;
A5. Assess financial calculations for reasonableness and criticise their assumptions;
B1. Describe, compare and value the following securities: bonds, shares, loans, forwards and futures contracts, options, annuities and life insurance contracts;
B2. Describe the basic market conventions in the securities and money markets for the instruments introduced during the course;
B3. Develop formulae for the expected value and variance of the present values of simple insurance and annuity contracts, assuming constant deterministic interest;
C1. Integrate financial valuation concepts to practical situations such as in investment project appraisals or in financial markets;
C2. Explain difficult concepts in simple terms and in an effective way, both in oral and written forms;

The course covers the syllabus of the Institute of Actuaries CT1 Financial Mathematics examination. The course's Learning Outcomes relate to the aims of Actuaries Institute of Australia aims in the following way:

Course Learning Outcomes	Actuaries Institute aims
A1	CT1: 2
A2	CT1: 3, 4, 13, 14
A3	Not included in The Institute Aims
A4	CT1: 1, 5, 6, 7, 8, 11

A5	CT1: 11
B1	(CT2: v.3)
B2	CT1: 10, 12
B3	(CT5: introduction)
C1	(CT2: x.1)
C2	Not included in The Institute Aims

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 the Undergraduate Program Learning Goals and Outcomes, see Part B of the course outline.

Business Undergraduate Program Learning Goals and Outcomes

1. Knowledge: **Our graduates will have in-depth disciplinary knowledge applicable in local and global contexts.**
You should be able to select and apply disciplinary knowledge to business situations in a local and global environment**.**

2. Critical thinking and problem solving: Our graduates will be critical thinkers and effective problem solvers.
You should be able to identify and research issues in business situations, analyse the issues, and propose appropriate and well-justified solutions.

3. Communication: Our graduates will be effective professional communicators.
You should be able to:

- **a.** Prepare written documents that are clear and concise, using appropriate style and presentation for the intended audience, purpose and context, and
- **b.** Prepare and deliver oral presentations that are clear, focused, well-structured, and delivered in a professional manner.

4. Teamwork: Our graduates will be effective team participants.
You should be able to participate collaboratively and responsibly in teams, and reflect on your own teamwork, and on the team's processes and ability to achieve outcomes.

5. Ethical, social and environmental responsibility: Our graduates will have a sound awareness of the ethical, social, cultural and environmental implications of business practice.
You should be able to:

a. Identify and assess ethical, environmental and/or sustainability considerations in business decision-making and practice, and
b. Identify social and cultural implications of business situations.

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

This course helps you to achieve the following learning goals for all Business undergraduate students:		*On successful completion of the course, you should be able to:*	*This learning outcome will be assessed in the following items:*
1	Knowledge	Learning Outcomes A1 – C2	• Tutorial Problems • Mid-session exam • Assignment • Final Exam
2	Critical thinking and problem solving	Learning Outcomes A1 – C2	• Tutorial Problems • Assignment • Mid-session exam • Final Exam
3a	Written communication	Learning Outcomes C1 – C2	• Assignment
3b	Oral communication	Learning Outcomes A2 & C2	• Tutorial Presentations
4	Teamwork	Learning Outcome C2	• Not specifically assessed in this course
5a.	Ethical, social and environmental responsibility	Not specifically addressed in this course	• Not specifically assessed in this course
5b.	Social and cultural awareness	Not specifically addressed in this course	• Not specifically assessed in this course

3 LEARNING AND TEACHING ACTIVITIES

3.1 Approach to Learning and Teaching in the Course

The approach adopted in this course is one of assisted self-study—while reading this subsection, please refer to the schedule given in Section 11.

Course materials are organised in 6 modules. They consist of:

- Prescribed books (and recommended books for additional support)
- Topic video lectures available on the course website
- Exercises with solutions
- All past quizzes and exams for advanced exercises (with solutions)
- Videos of the solutions of selected past quizzes and exams questions

Given the substantial amount of course on-line support, lectures will focus on providing the intuition and the big picture rather than repeating the details that are available on the videos. Students should have read the prescribed books, watched the videos and attempted the tutorial exercises **prior to the lectures**. An ideal lecture would be one consisting essentially of answers to the students' questions. Students are encouraged

to prepare questions and communicate them to the lecturer in advance on the course website's forums (although this is not required).

Tutorials 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 tutorial exercises prior to the tutorial classes and identify problems that require closer review during tutorials. They are an opportunity to learn from other students and to develop team skills by working on problems with other students.

3.2 Learning Activities and Teaching Strategies

It is expected the students will take a pro-active approach to learning. The course is organised in the learning activities given in the following table. The Course Aims (A-C) students should develop are also indicated.

Activity	**A**	**B**	**C**	**1**	**2**	**3**	**4**	**5**	**6**
Self-study (readings, videos, exercises)	X	X	X	X				X	X
Lectures	X	X	X	X	X			X	X
Tutorials	X	X		X		X			X
Optional readings	X	X		X				X	X
Optional exercises	X	X		X				X	X

The aims A and B are developed during all activities. The broader aim C is developed in the assignment. By nature, the actuarial program develops problem-solving and professional skills and all activities contribute to that development.

A detailed mapping of the tutorial exercises to the modules' contents is provided on the course website. Exercises are organised in an increasing level of difficulty and it is recommended to complete all the exercises of a subsection before attempting the exercises of the following subsection.

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

4 ASSESSMENT

4.1 Formal Requirements

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 Institute of Actuaries CT1 examination.

ACTUARIES INSTITUTE OF AUSTRALIA
The Actuaries Institute of Australia (IAAust) allows students to become IAAust 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. To sign up, go to
http://www.actuaries.asn.au/Membership/MembershipoftheInstitute/Subscriber.aspx
THE UNIVERSITY SUBSCRIBER OFFER IS NOT A MEMBERSHIP OF THE IAAUST BUT A SUBSCRIPTION TO RECEIVE INFORMATION ON CAREER OPPORTUNITIES, INVITATIONS TO SELECTED IAAUST EVENTS AND ONLINE PUBLICATIONS. YOU MIGHT ALSO CONSIDER JOINING THE IAAUST – THERE ARE ADVANTAGES IN DOING SO WHILE A FULL-TIME STUDENT. FOR MEMBERSHIP INFORMATION, GO TO
http://www.actuaries.asn.au/Membership/MembershipoftheInstitute.aspx

4.2 Assessment Details

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	15%	Module 1-2: A1, A2, A3	60 mins	12/04/2017, 9am-11am
Assignment	15%	C1	N/A	Mini assignments due at 5pm on: 24/03/2017 07/04/2017 28/04/2017 12/05/2017
Final examination	70%	A, B and C	2 hours	TBA

Mid-term exam
There will be one written answer mid-term exam in weeks 7 of 60 minutes duration. **The mid-term exam will take place on Wednesday the 12th April 2017, from 9am to 11am.** 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".

[1] Course Learning Outcome that is assessed

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.

Assignment
The practical application of the course concepts based on actual financial 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 several mini-assignments throughout the semesters assessing application of excel concepts to solving real life financial mathematics problems. This will provide students with an opportunity to develop writing skills.

The assignment offers students the opportunity to engage in independent research, 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.

Each mini-assignment will be made available at least two weeks before the due date. Full information about the assignment will be released early in the session.

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.

4.3 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.

4.4 Late Submission

Please note that it is School policy that late assignments, even by one minute, will not be marked. Assignments MUST be submitted prior to the due time and date. The School of Risk and Actuarial Studies has a policy of grading late assignments with a zero mark.

Punctual submission of work is required in order to satisfy the requirements of the course. Turnitin will not accept any late submission. The assignment may be marked at the discretion of the course co-ordinator if there is a valid reason for late submission and used in cases where your final overall results are marginal.

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

Textbooks

The required textbooks for the course are:

- Broverman, S.A. (2015), Mathematics of Investment and Credit, 6th Edition, ACTEX Publications. [A solutions manual is available for purchase. **The 6th Edition is largely similar to the 5th Edition, so it is possible to learn with the 5th Edition as well;** the references at the end of this course outline are valid for both editions**. However, the 4th, 3rd and 2nd Editions are *not* recommended.**]
- Sherris, M. (1996), Money and Capital Markets, Pricing, Yields and Analysis, 2nd Edition, Allen & Unwin.

Additional (optional) readings are:

- The Actuarial Education Company, Course CT1 Study Guide. [A subset of the course, which has the advantage of showing exactly what the Institute of Actuaries expects from students at CT1 exam, should you need to take the exam later]
- Daniel, J. W. and Vaaler, L. J. F. (2007), Mathematical Interest Theory, Pearson, Prentice Hall. [A book similar to Broverman's, useful as a second reference if a second, different explanation is necessary. It also has the advantage of discussing the use of modern calculators and explaining how to use them]
- Boyle, P.P., Cox, S.H., Dufresne, D., Gerber, H.U., Mueller, H.H., Pedersen, H.W., Pliska, S.R., Sherris, M., Shiu, E.S., Tan, K.S. (2001) Financial Economics: With Applications to Investments, Insurance and Pensions, Harry H. Panjer Ed., The Actuarial Foundation, Schaumburg, Illinois. [An advanced textbook, too advanced for the level of the course. However, chapter 3, a required reading, is available for download from the library in the MyCourse page of the course. Useful as an optional reading for the learning outcomes B1 and B2 (see website)]
- Gerber, H.U. (1997), Life Insurance Mathematics, Springer-Verlag, 3rd Edition. [The absolute classic in Life Insurance Mathematics. Useful as an extremely concise optional reading for the learning outcomes A1, A2, A3, B1 and B3. It was a required textbook for ACTL3002 in 2011; a new edition is not likely to appear in a near future]
- Bowers, N.L. Gerber, H.U., Hickman, J.C., Jones, D.A. and Nesbitt, C.J. (1997), Actuarial Mathematics, Society of Actuaries, 2nd Edition [Another classic, useful as a reference for the learning outcomes A3 and B3. It was a required textbook for ACTL3002 in 2011; a new edition is not likely to appear in a near future]

All these books are available from the library, some of them with copies in the reserve. Should the quantity available be insufficient, please inform the course coordinator, who will forward this information to the library.

Formulae & Tables
Students will only be allowed to bring into the examinations for the Actuarial courses in the Bachelor of Actuarial programme the text "Formulae and Tables for Actuarial Examinations". This text must not be annotated. All students in the actuarial courses should purchase a copy of this text if they wish to use this in the final examinations for this course. The text is available from the UNSW Bookshop, the UK Institute of Actuaries or from ActEd Australia. Visit the ActEd website at http://www.acted.com.au.

Course website
The course Moodle website is available from the UNSW TELT platform:
http://elearning.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 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 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 course in actuarial studies at UNSW is reviewed each session by the course co-ordinator using student evaluative feedback from UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process. Student feedback is taken seriously, and continual improvements are made to the course based on such feedback. Significant changes to the course are communicated to students taking the course. Your input into improving future offerings of the course is highly valued.

In the last few years, the structure of the course and its learning and teaching strategy was changed radically. The main rationale for this change was the exceptional success of the lecture video recordings that were provided to the students in 2009, as well as the salient need for additional coverage of exercises during contact hours.

In 2011-15, the following additional developments were effected:

- Video recordings of a selection of past quizzes and exams problems for each module;
- The organisation of formative self-assessments throughout the session;
- Corrections of typos in the exercises and improvement of the solutions;
- A higher weight for the assignment in the final grade.

We repeat that we take students' feedback *extremely* seriously and we count on your cooperation when seeking feedback that will help us identify the strengths and weaknesses of the course contents and learning and teaching strategies. We guarantee that the process is entirely anonymous and that your feedback will *not* have any impact on your final results.

7 COURSE SCHEDULE

Time	Topic
Week 1, 1 March 2017	Module 1
Week 2, 8 March 2017	Module 1
Week 3, 15 March 2017	Module 1
Week 4, 22 March 2017	Module 2
Week 5, 29 March 2017	Module 3
Week 6, 5 April 2017	Module 3
Week 7, 12 April 2017	Module 4
12 April 2017, 9am-11am	***Mid-term Exam (Modules 1-3)***
University Recess	**14 – 23 April 2017**
Week 8, 26 April 2017	Module 4
Week 9, 3 May 2017	Module 5
Week 10, 10 May 2017	Module 5
Week 11, 17 May 2017	Module 6
Week 12, 24 May 2017	Module 6
Week 13 -	Tutorials Only
Week 13 / Study period	***Self-assessment week***

Module	LO	Topics	IAAust CT1	Broverman (5)	Sherris	Fin Econ	LIM	Actuarial Mathematics
1	-	**Time Value of Money and Valuation of Cash Flows**		**1-2**				
	A3	**Cash Flow Models**		-				
		Introduction	1.1	1.0				
		Describe situation using a model	1.2	1.0				
		Concept of valuing at a particular point in time	1.1, 9.1	1.2				
	A1	**A mathematical Model of Interest**	2.4	1.1.5				
	A2	**Simple and Compound Interest**						
		Simple interest	2.1	1.1.3-1.1.4	p. 1-10		App. B	
		Compound interest	2.1, 9.1	1.1.2	p. 27-30		1.2	
	A2	**Discount Interest**	2.3, 3.1	1.5.2	p. 8-9		1.5	
	A2	**Nominal Interest**	-	-	p. 30-32		-	
		Nominal interest rates	3.2, 3.3	1.4	p. 30-32		1.3	
		Nominal discount rates	3.2, 3.3	1.5	p. 30-32		1.5	
	A2	**Force of Interest**	3.2, 3.4	1.6			1.4-1.5	
	A2	**Real and Money Interest**	4, 5.1	1.7				
	A3, B1	**Relation between Cash Flow, Interest and Present Value**						
		Equation of value (NPV = 0)	2.2, 7.1	1.3				
		Newton-Raphson method						
	A3, B3	**Annuities: introduction**						
		Description of annuities	1.2	2.1-2.3	p. 32-34		1.6-1.7	
		Notation	6.1-6.3	2.1-2.3	p. 32-34		1.6-1.7	
		Perpetuity	5.1-5.2, 6.1	2.1.2.4			1.6	
	A3, B1	**Term annuities**						
		Term annuity	5.1-5.2, 6.1	2.1.1-2.1.3	p. 32-34		1.7	
		Deferred annuity	5.1-5.2, 6.2	2.1.2.1				
		Payments more frequent than a year	5.1-5.2, 6.1-6.2	2.2.1-2.2.2			1.7	
	A3, B1	**Non-Level Annuities**	-	-			-	
		Increasing annuity (AP)	5.1-5.2, 6.3	2.3.2.1			1.7	
		Increasing annuity (GP)	5.1-5.2, 11.5-11.6	2.3.1				
		Increasing annuity (p payments p.a.)	5.1-5.2, 6.3				1.7	

		Decreasing annuity	5.1-5.2, 6.3	2.3.2.2			1.7	
	A3, B1	**Continuous annuities**						
		Continuous annuity	5.1-5.2, 6.1	2.2.3				
		Increasing continuous annuity	5.1-5.2, 6.3					
		Continuously increasing continuous annuity	5.1-5.2, 6.3	2.3.2.3				
	A3	**Relations and recursive formulas between annuities**	6.1-6.3	2.5				
Module	**LO**	**Topics**	**IAAust CT2**	**Broverman (4)**	**Sherris**	**Fin Econ**	**LIM**	**Actuarial Mathematics**
2		**Valuation of Contingent Cash Flows**	-				**2-4**	**3.1-3.2, 3.7, 4.1-4.3, 5.1-5.3**
	B3	**Survival Analysis**	-				-	-
		Survival probabilities, force of mortality, etc.					2.1-2.2	3.2
		Analytical distributions of T(x)					2.3	3.7
		Discrete time (curtate lifetime)					2.4	3.2.3
	B3	**Life Insurance and Annuities**	-				-	-
		Whole life insurance	1.1, 7.2				3.2.1	4.3
		Term life insurance	1.1, 7.2				3.2.1	4.3
		Continuous whole life insurance	1.1, 7.2				3.3	4.2
		Pure endowment	1.1, 7.2				3.2.2	4.3
		Endowment	1.1, 7.2				3.2.3	4.3
		Whole life annuity	1.1, 7.2				4.2	5.3
		Term life annuity	1.1, 7.2				4.2	5.3
		Relations and recursive formulas					4.6	3.2, 4.2-4.3, 5.3
3		**Modelling Loans and Repayments**	-	**3-5**				
		Loan Repayments (I)	-	-				
	A3	Recursive approach	1.2, 7.1, 8.1	3.1.1				
	B1, C3	Loan schedule	8.2	3.1.2, 3.2				
	B1	Flat rate of interest	8.1					
	B1	Principal outstanding	8.2	3.1.3-3.1.4			1.8	
	C3	Spreadsheet modelling	8.2					
		Loan Repayments (II)	-	-				
	A3	Sinking funds		3.3				
	A4	Allowing for costs and taxation	11.7-11.8		p. 22-26			
		Fixed Interest Securities (Investments)	-	-				

	B1	Definitions and notation	1.2, 10	4.0-4.1, 8.4	p. 11-14, 32-39	1.3-1.4		
	B1	Pricing	7.1, 7.3, 11.1	4.0-4.1	p. 11-14, 32-39	1.3-1.4		
	A4	Allowing for costs and taxation	11.7-11.8		p. 58-73			
	B1	Redemption date	11.2-11.3	4.3.1				
	B1	Indexed bonds	11.5-11.6		p. 40-43			
	A2	Yield rates and reinvestment rates	9.2, 11.3	2.4.1, 5.1	p. 45-55		1.9	
	A2	Reinvestment rates (MIRR)		2.4.1, 2.2.5, 5.1				
	A2	Multiple solutions to IRR		5.1.2			1.9	
	B1	- Shares	10, 11.4					
	B1	Property	10, 11.4					
	C1	- **Project Appraisal Techniques**	-	-				
		Net present value	9.1	5.1.3				
		Payback and discounted payback	9.4	5.1.4.2				
		Internal rate of return	9.2	5.1.1				
		Modified IRR		5.1.4.3				
		Time/money weighted rate of return	9.5	5.2				
Module	**LO**	**Topics**	**IAAust CT2**	**Broverman (4)**	**Sherris**	**Fin Econ**	**LIM**	**Actuarial Mathematics**
4		**<u>Interest Rate Risk</u>**	-	**6-7**				
	A2	**Term Structure of Interest Rates**	13	-	-			21.5-21.5.1
		Theories of term structure	13.1					
		Spot rates	13.2, 13.3	6.1-6.2	p. 95-103	1.6		21.5-21.5.1
		Forward rates	13.3	6.3	p. 95-103	1.6		21.5-21.5.1
	A2, A3	**Price Sensitivity**	-	-	-	-		*21.1
		Duration	13.4-13.5	7.1	p. 74-88, 126-129	3.5		
		Convexity	13.4-13.5	7.2	p. 74-88, 126-129	3.5		
		Numerical approximation (Taylor series)			p. 74-88, 126-129	3.5		
		Fisher-Weil						
	A2, A3	**Immunisation**	-	-	-	-		*21.6.1
		Motivation and discussion	13.6	7.2	p. 89-94	3.3-3.4		
		Immunisation	13.6	7.2	p. 89-94	3.3-3.4		
		Barbell strategy						

Module	LO	Topics	IAAust CT2	Broverman (4)	Sherris	Fin Econ	LIM	Actuarial Mathematics
5		**Derivatives**	-	**9**				
	B1, B2	**- Introduction**						
		No-arbitrage pricing	12.1					
		Introduction to derivatives	10, 12.3	9.0		2.1		
	B1, B2	**Forwards and Futures**	10, 12.2, 12.4	9.1	p. 103-126, 129-137	2.2-2.3		
	B1, B2	**Swaps**	-	-	-	-		
		Interest swaps	10	6.4.3	p. 140-148	2.5.1-2.5.2		
		Foreign exchange swaps	10		p. 137-139			
		Cross currency swaps	10	9.1.10	p. 149-150	2.5.3		
	B1, B2	**Options**	-	-	-	-		
		Definitions	10	9.2	p. 151-154	2.4.0-2.4.1		
		Put-Call parity		9.3.3	p. 177	2.4.2		
		Pricing (Binomial model)		9.3.5	p. 155-174	2.4.3		
		Hedging strategies		9.3.1, 9.3.4				
Module	**LO**	**Topics**	**IAAust CT2**	**Broverman (4)**	**Sherris**	**Fin Econ**	**LIM**	**Actuarial Mathematics**
6		**Stochastic Returns**	-					
	A2	**Introduction to stochastic returns**	-					*21.1.1
		Deterministic vs stochastic	14.1					
		Discrete vs continuous						
		Stochastic processes						
	A2, A3	**IID Returns**	-					*21.3
		Specification	14.2-14.3					
		Distribution of accumulated value	14.2-14.3, 14.5					
	A2, A3	**Lognormal Returns**	-					*21.3
		Specification	14.4					
		Distribution of accumulated value	14.4-14.5					

	A2, A3	**Further Concepts** Accumulation of annuities (uses recursive formulas) Mean Reverting Model for Returns Binomial Model for Returns	-		p. 186-193			*21.4

** Only briefly covers the corresponding material/concepts in our course*