

THE UNIVERSITY OF
NEW SOUTH WALES



Australian School of Business
School of Actuarial Studies

ACTL5103
STOCHASTIC MODELLING FOR ACTUARIES

COURSE OUTLINE
SESSION 2, 2008

Dear Students

Welcome to ACTL5103 Stochastic Modelling for Actuaries. This course is one of eight courses covering the Core Technical subjects of the Institute of Actuaries offered in the Master of Actuarial Studies. Many of you will also be completing the courses ACTL5106 Insurance Risk Models and/or ACTL5109 Financial Economics for Insurance and Superannuation in this session. ACTL5103 is closely linked to these courses. In the early weeks of the courses you should take some time to note the links between these courses.

This course provides an introduction to the stochastic models used by actuaries to model both liabilities and assets and illustrates their applications in actuarial work. We hope that you will find the course challenging and interesting.

In this course outline, you will find the details of the course requirements, course aims and learning outcomes, content, teaching methods, assessment tasks, texts and readings, and expectations. Please read it carefully and thoroughly, as it will be assumed that you are familiar with the contents.

If you have any questions about the course at any time then please contact us.

We look forward to guiding your learning through the duration of the course.

Jinxia Zhu and Michael Sherris

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1. COURSE STAFF

The Course Coordinator of this course is Dr Jinxia Zhu:

Staff	E-mail	Room	Telephone
Jinxia Zhu	jinxia.zhu@unsw.edu.au	Quad 2084	9385 7385

She will be responsible for course administration, teaching and assessment of the course. Professor Sherris will be assisting with course development and the use of lecture recording technology for the course.

1.1 Communication with Staff

Questions about the material covered in lectures should be referred to the Course Coordinator. For administrative matters related to the course including enrolment, tutorial enrolment, assessment, special consideration, and the course web site, students should normally consult the School Administrator or the Course Coordinator.

2. INFORMATION ABOUT THE COURSE

2.1 Teaching times and Locations

Lectures

The lectures will be held:

Tuesday evening 6-9pm in ASB232

Exercises will be incorporated with the lectures. Students are highly encouraged to attend the lectures. Attendance counts towards meeting the requirements to pass the course.

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 WebCT Vista site.

Students should consult the WebCT Vista site on a regular basis, since assignment questions and other course materials will be placed there.

2.2 Units of Credit

6

2.3 Parallel teaching in the course

This course is offered only to students enrolled in the Master of Actuarial Studies or who are completing research programs in the actuarial studies program. ASB and School policy does not allow undergraduate attendance at postgraduate lectures.

2.4 Relationship of this course to other course offerings

This course provides an introduction to the stochastic models used by actuaries to model both liabilities and assets and illustrates their applications in actuarial work. It contributes to the actuarial professional subjects CT4 Models & CT6 Statistical Models of the Institute of Actuaries. CT4 exemption is determined by the average of ACTL5103 and ACTL5104 marks. CT6 exemption is determined by the average of ACTL5103 and ACTL5106 marks. This average will have to be 65% or higher in order to be recommended for exemptions.

Students are assumed to have knowledge of probability and statistics to the level covered in the course ACTL5101 Probability and Statistics for Actuaries (or equivalent courses in the School of Mathematics). They should also be proficient with calculus and linear algebra. Students need to be able to use a computer to analyse mathematical and statistical problems. You should be familiar with a word processing package (such as WORD), a spreadsheet (such as EXCEL) and a statistical package (such as Minitab or R). Students should use the computer programs they are most familiar with in doing assignments and other assigned tasks. Use of one of the matrix based computer program such as Maple, Matlab (<http://www.mathworks.com/products/matlab/>) or O-Matrix (<http://www.omatrix.com/>) may assist in completing assignment tasks. The R software is also considered by many statisticians and researchers to be a very versatile statistical package, and is an open-source software which is freely downloadable from the R-project website (<http://www.r-project.org>).

2.5 Approach to learning and teaching

The course textbooks, lectures and assessment tasks are designed to provide a framework for your learning. Every student has a different approach to learning. How much time you spend on reading in preparation for lectures, completing assessment tasks, reviewing course objectives, deepening your understanding and preparing for final examinations will depend on your learning approach. Lectures will generally cover the main concepts and issues and will not necessarily cover all the details of the course readings or texts. Students who are successful in this course take an active approach to learning.

3. COURSE AIMS AND OUTCOMES

3.1 Course Aims

Course Description

This course provides an introduction to the stochastic models used by actuaries to model both liabilities and assets and illustrates their applications in actuarial work. Topics covered include main features of a Markov chain and applications to experience rating; Markov process models and applications to insurance, survival, sickness and marriage models; simple time series models including random walk and auto-regressive models and their application to investment variables; properties of Brownian motion and applications to investment variables; methods for simulation of a stochastic process. Students will be expected to implement models using spreadsheets or programs in a numerical computer package.

Course Aims

The primary aim of this course is to provide students with an understanding of the mathematical concepts and techniques that are used by actuaries to model stochastic processes of both assets and liabilities. The course covers the aims of the Actuarial professional syllabus for topics in CT4 and CT6.

Course Aims of the Institute of Actuaries CT4/CT6 syllabus

1. Describe and explain the principles of actuarial modelling.
2. Describe and explain the main terminology of stochastic processes, including their classification into different types.
3. Define the key features and properties of a Markov Chain and use a Markov Chain to analyse insurance applications including a frequency based experience rating No Claim Discount (NCD) scheme.
4. Define the main features of a Markov Process and use simple Markov Processes to analyse insurance, survival, sickness and marriage models.
5. Define the main concepts underlying the analysis of time series models including simple non-stationary models and apply these models to actuarial models for investment returns and inflation.
6. Define and apply the main concepts of Gauss-Wiener processes.
7. Explain the concepts of 'Monte Carlo' simulation of a stochastic process using a series of pseudo-random numbers and apply simulation to simple actuarial problems.

3.2 Student Learning Outcomes

At the end of this course students should have:

1. Developed a capability to implement Markov Chains for a frequency-based experience rating No Claim Discount (NCD) scheme using data.
2. Developed an understanding of Markov processes that can be used for insurance, survival, sickness and financial modelling.
3. Developed an understanding of Poisson processes that can be used for insurance, credit and operational risk management.
4. Developed an understanding of Gauss-Wiener processes that can be used for asset and financial derivatives pricing and interest rate modelling.
5. Developed an understanding of the basic concepts underlying the analysis of time series model and a capability to apply basic concepts to data.
6. Developed an understanding of the main concepts of 'Monte Carlo' simulation of a stochastic process and a capability to carry out simple simulation procedures.

3.3 Teaching Strategies

Lectures will cover 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 what material students need to read and review. Students will need to review the prescribed readings for each lecture.

4. STUDENT RESPONSIBILITIES AND CONDUCT

4.1 Workload

It is expected that you will spend at least ten hours per week studying this course. This time should be made up of reading texts, completing exercises, working on assessment tasks, and attending classes. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment 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.

4.2 Attendance

Your regular and punctual attendance at lectures and seminars 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.

4.3 General Conduct and Behaviour

You are expected to conduct yourself with consideration and respect for the needs of your fellow students and teaching staff. Conduct that unduly disrupts or interferes with a class, such as ringing or talking on mobile phones, is not acceptable and students may be asked to leave the class. More information on student conduct is available at: www.my.unsw.edu.au.

4.4 Keeping informed

You should take note of all announcements made in lectures or on the course web site. From time to time, the University will send important announcements to your university e-mail address without providing you with a paper copy. You will be deemed to have received this information. It is also your responsibility to keep the University informed of all changes to your contact details.

5. LEARNING ASSESSMENT

5.1 Formal Requirements

In order to pass the course students must complete and submit all components of assessment on or before the due date. 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.

The following table gives the relative weighting of the assessment components:

Component	Percentage
Class Test 1	7.5%
Class Test 2	7.5%
Assignment	10%
Final Examination	75%
Total	100%

In order to pass the course student must perform satisfactorily in all course assessment components.

5.2 Assessment Details

Class Tests

Technical skills are important in practice and this course provides foundation technical skills that will be useful throughout your working life.

In order to assess your understanding of the technical skills covered in the course aims there will be two 55-minute class tests during the session. The tests will be administered during lectures. Each test will be worth 7.5% of the total assessment for the course. The test will be closed book. Students will only be allowed to bring the text "Formulae and Tables for Actuarial Examinations" into the tests. It must be must not be annotated with any writing.

Normal examination rules apply to the conduct of class tests. Calculators will be allowed in the class tests and the 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. Please note that the class test date, time and coverage may be subject to change, and that any alterations will be advised in lectures or on the Course WebCT.

Assignment

The practical application of the course concepts based on insurance and 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 major Assignment for this course involving the practical application of course concepts to an actuarial problem. This will provide students with an opportunity to also develop writing skills.

The assignments you submit must be your own work. Students who copy other student's assignment solutions will be penalised. The assignments will be assessed on technical accuracy, practical application and how well it is written and the quality of the assignment presentation.

Final Examination

The final examination will assess students understanding of the concepts covered in the entire course and their ability to apply them to practical problems.

The final examination will be a three-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. It must be must not be annotated with any writing.

5.3 Assignment Submission Procedure

Assignments must be placed in the box provided outside Quad 2059, Level 2 Quadrangle Building, near the Actuarial Studies office. A cover sheet must accompany these assignments. A copy of the cover sheet is available from the course WebCT site. Additional copies of the cover sheet can be obtained outside Quad 2059. **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.**

5.4 Late Submission

The School of 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. 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.

5.5 Special Consideration and Supplementary examinations

UNSW policy and process for Special Consideration applies (see <https://my.unsw.edu.au/student/atoz/SpecialConsideration.html>). Specifically:

- Applications for special consideration (including supplementary examinations) must go through UNSW Central administration (within 3 working days of the assessment to which it refers) – applications will **not** be accepted by teaching staff;
- Applying for special consideration does not automatically mean that you will be granted additional assessment or that you will be awarded an amended result;
- If you are making an application for special consideration (through UNSW Central Administration) please notify your Course Coordinator or Lecturer in Charge;
- Please note: a register of applications for Special Consideration is maintained. History of previous applications for Special Consideration is taken into account when considering each case.

ASB Policy and Process for Special Consideration and Supplementary Exams

In the ASB, requests for special consideration are determined by a Faculty wide panel that will advise the Lecturer in Charge of appropriate action.

If the Faculty panel (see above) grants a special consideration request, this may entitle the student to sit a supplementary examination. In such cases the following procedures will apply:

- Supplementary exams will be scheduled centrally and will be held approximately two weeks after the formal examination period. Actual date will be advised by mid-semester.
- Where a student is granted a supplementary examination as a result of a request for special consideration, the student's original exam (if completed) will not be marked and only the mark achieved in the supplementary examination will count towards the final grade.

Further information concerning supplementary examinations is available on the 'Policies and Guidelines for Current Students' page of the ASB website:

www.business.unsw.edu.au/currentstudents.

Supplementary Examination and Special Consideration

Students who believe that their performance in this course, either during session or in an examination, has been adversely affected by sickness, misadventure or other circumstances beyond their control may apply for special consideration for affected assessments. See the University web site for more details:

<http://www.student.unsw.edu.au/atoz/atoz-Special.shtml>

Students may be required to sit for an oral or written supplementary examination. Any supplementary examination date will be advised to students after the final examination. In general, a supplementary examination will only be offered to a student who has been prevented from taking the Final Examination, who has been placed at a serious disadvantage during the examination, and whose circumstances have improved considerably in the period since the relevant examination was held. Failure to attend a supplementary examination, if you have been granted one, will result in forfeiture of any additional assessment granted to you. Satisfactory performance in any course assessment is required in order to be granted a supplementary examination.

STUDENTS SHOULD NOTE THAT SPECIAL CONSIDERATION WILL NOT BE GRANTED UNLESS PERFORMANCE AND ATTENDANCE AT LECTURES IS SATISFACTORY. THIS WILL USUALLY MEAN THAT YOU WILL HAVE TO PASS ALL ASSESMENT TASKS IN ORDER FOR ANY SPECIAL CONSIDERATION TO BE GIVEN.

Consideration for Missed Assessments (other than final examination)

If you miss a test or are unable to submit your assignment by the due time & date, and you have a valid reason, you need to inform the Actuarial Studies office as soon as possible. You must provide written documentation requesting consideration to the Actuarial Studies office, in the form of a letter explaining your reasons with evidence attached, i.e. medical certificate, police report etc. You should note the course details, your student ID and contact details in your letter as well. As per University rules these considerations must be submitted within 3 working days of the assessment date. If no request is received or it is received after 3 working days you will be awarded a zero mark for that assessment.

Review of Results of Assessments (other than final examination)

As per University rules, if you wish a piece of course assessment to be re-checked, for addition error or incorrect marking, you need to contact the Actuarial Studies office within 15 working days of the assessment being available for collection. You will need to bring in the assessment and provide a note as to the error or reason for review to the Actuarial Studies office. The assessment will be passed onto the relevant academic for review. Students will be able to collect back the assessment from the Actuarial Studies office.

Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course coordinator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made. Equity and Diversity can be contacted at 9385 4734 or

<http://www.equity.unsw.edu.au/>

5.6 Assignment Format

Details of format for submission of assignments are included with the assignment and available from the course web site.

6. ACADEMIC HONESTY AND PLAGIARISM

The University regards plagiarism as a form of academic misconduct, and has very strict rules regarding plagiarism. For full information regarding policies, penalties and information to help you avoid plagiarism see:

<http://www.lc.unsw.edu.au/plagiarism/index.html>

Plagiarism is the presentation of the thoughts or work of another as one's own.* Examples include:

- Direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- Paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- Piecing together sections of the work of others into a new whole;
- Presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
- Claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- Correct referencing practices;
- Paraphrasing, summarising, essay writing, and time management;
- Appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle

† Adapted with kind permission from the University of Melbourne.

7. STUDENT RESOURCES

7.1 Course Resources

The textbooks for the course are:

Sheldon M. Ross, Introduction to Probability Models, 9th edition, Academic Press, 2007.

Ngai Hang Chan, Time Series: Applications to Finance, Wiley publications, 2002.

Other References

The following references also provide a detailed and comprehensive coverage of the topics covered in the Course.

The Actuarial Education Company (ActEd), CT4 and CT6 Course Notes – only the relevant sections related to ACTL5103 course which are Chapters 1 to 6 inclusive of CT4 and Chapters 12 to 14 inclusive of CT6.

Some topics in the course are also covered in the following textbooks and the students may find the following references also helpful reading materials:

Sheldon M. Ross, Stochastic Processes, 2nd edition, John Wiley, 1996

Chris Chatfield, The Analysis of Time Series: An Introduction, 6th edition, CRC Press, 2003.

Brockwell, P.J. and R.A. Davis, Introduction to Time Series and Forecasting, Springer, 2nd edition, 2002.

Formulae & Tables

Students will only be allowed to bring into the examinations for the Actuarial courses in the BCom 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 WebCT

This course will use WebCT Vista for communication with students.

The WebCT Vista site for this course will contain the course outline, lecture notes, homework and tutorial exercises, assessment information, and any notices relevant to this course. It is important that you visit the site regularly to see any notices posted there by the course coordinator. The site can be accessed from the WebCT Vista log-in page at: <http://vista.elearning.unsw.edu.au/>.

7.2 Other Resources, Support and Information

The University and the Faculty provide a wide range of support services for students, including:

Learning and study support

ASB Education Development Unit

The Education Development Unit (EDU) provides learning support and assistance to all students in the ASB, to enable them to enhance the quality of their learning. The EDU services are free, and tailored to meet the academic needs of students in the Australian School of Business.

The role of the EDU is to provide

- A range of support initiatives for students from the Australian School of Business in relation to their transition to university;
- Learning skills development, resources and activities for Business students
- Academic writing and skills workshops throughout the session;
- Printed and online study skills resources, such as referencing guides, report writing and exam preparation;
- A drop-in EDU Office containing books and resources that can be borrowed;
- A limited consultation service for students with individual or small group learning needs.

The EDU website <http://www.business.unsw.edu.au/edu> contains information, online resources and useful links as well as providing information and dates for workshops. More information about the EDU services including resources, workshop details and registration, and consultation request forms are available from the EDU Office.

EDU Contact Details

Location	Room GO7, Ground Floor, West Wing, Australian School of Business Building
Telephone:	02 9385 5584
Email:	Edu@unsw.edu.au
Website	www.business.unsw.edu.au/edu

UNSW Learning Centre (<http://www.lc.unsw.edu.au>)

In addition to the EDU services, the UNSW Learning Centre provides academic skills support services for all UNSW students. The Learning Centre is located on Level 2 of the Library and can be contacted by phone: 9385 3890 or through their website.

Technical support:

For any technical support issues (difficulty logging in to websites, problems downloading documents, etc) you can contact the UNSW IT Service Desk at (02) 9385 1333; Email: servicedesk@unsw.edu.au.

Counselling support - <http://www.counselling.unsw.edu.au/>

Students experiencing problems of a personal or academic nature are encouraged to contact the Counselling Service at UNSW. This consultation service is free and confidential and run by professional counsellors. The Counselling Service also conducts workshops on topics such as 'Coping With Stress' and 'Procrastination'. The Counselling Service is located on Level 2, Quadrangle East Wing, and can be contacted on 9385 5418.

Library training and support services - <http://info.library.unsw.edu.au>

Disability Support Services – Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the Course Coordinator or the Equity Officer (<http://www.studentequity.unsw.edu.au/>). Early notification is essential to enable any necessary adjustments to be made.

In addition, it is important that all students are familiar with University policies and procedures in relation to such issues as:

- **Examination procedures** and advice concerning illness or misadventure <https://my.unsw.edu.au/student/academiclife/assessment/examinations/examinationrules.html>
- **Occupational Health and Safety** policies and student responsibilities <https://my.unsw.edu.au/student/atoz/OccupationalHealth.html>

8. CONTINUAL COURSE IMPROVEMENT

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.

This is a course that should benefit immensely from the increased use of technology to deliver lecture material and the increased use of active learning in face-to-face classes. In s2 2008 it is planned to increasingly use recorded and annotated lectures and additional exercises to assist student learning. All of the course materials including lecture notes and exercises are to be reviewed as a result of the change to 12 week sessions.

9. COURSE SCHEDULE

Course structure, Session 2, 2008 - Summary

Week Number	Lecture (Tuesday)	Topics Covered	Assignment/Test
0	22 July	Students access course web site	
1	29 July	Introduction to Stochastic Processes Markov Chains	
2	5 August	Markov Chains Markov Processes	
3	12 August	Exponential Distribution Poisson Process Generalizations of the Poisson Process	
4	19 August	Continuous Time Markov Chains	Class TEST 1 6.05 pm (Tuesday, 19 August)
5	26 August	Actuarial applications	
6	2 September	Brownian motion	
7	9 September	Simulation	
8	16 September	Introduction to Time Series	Class TEST 2 6.05 pm (Tuesday, 16 September)
9	23 September	Time Series	
University Recess			
10	7 October	Time Series	Assignment due 5.55 pm (Tuesday, 7 October)
11	14 October	Time Series	
12	21 October	Time Series	
Exam Period	29 October		

Please note that changes to the timetable may occur and that any alterations will be advised in lectures or via the course web site. A more detailed lecture program is available on subsequent pages.

Lecture Program

Week	Lecture	Topics and Readings
1	<i>Tuesday 29 July</i> 6:00pm – 9:00pm ASB232	Topics Introduction to the course Principles of actuarial modelling Introduction to stochastic processes Introduction to Markov Chains Chapman-Kolmogorov equations Classification of states Readings Ross, 9th Edition, Chapter 2(2.8), Chapter 4 (4.1-4.3) Ross, 8th Edition, Chapter 2(2.8), Chapter 4 (4.1-4.3) Reference ACTED Chapter 1 and 2 CT4
2	<i>Tuesday 5 August</i> 6:00pm – 9:00pm ASB232	Topics Limiting Probabilities Mean time in transient states Gambler's ruin Branching processes Time reversible Markov chains Readings Ross, 9th Edition, Chapter 4 (4.4, 4.5.1, 4.6-4.8) Ross, 8th Edition, Chapter 4 (4.4, 4.5.1, 4.6-4.8) Reference ACTED Chapter 3 CT4

3	<i>Tuesday 12 August</i> 6:00pm – 9:00pm ASB232	Topics - Exponential distribution - Poisson process - Generalizations of the Poisson process Readings Ross, 9th Edition, Chapter 5 Ross, 8th Edition, Chapter 5 Reference ACTED Chapter 5 CT4
4	<i>Tuesday 19 August</i> 6:00pm – 9:00pm ASB232	Class Test 1 (Tuesday 19 August, 6:05pm-7:00pm) Topics - Continuous-Time Markov Chains - Birth and death processes - Transition probabilities - Kolmogorov equations - Limiting probabilities Readings Ross, 9th Edition, Chapter 6 (6.1-6.5) Ross, 8th Edition, Chapter 6 (6.1-6.5) Reference ACTED Chapter 5 CT4
5	<i>Tuesday 26 August</i> 6:00pm – 9:00pm ASB232	Topics - Actuarial applications - Mortality and sickness models Reference ACTED Chapter 4 and 6 CT4

6	<i>Tuesday 2 September</i> 6:00pm – 9:00pm ASB232	Topics - Introduction to Brownian motion - Hitting times, maximum - Brownian motion with drift - Geometric Brownian motion - White noise - Stationary and weakly stationary processes Readings Ross, 9th Edition, Chapter 10 (10.1-10.3, 10.5-10.7) Ross, 8th Edition, Chapter 10 (10.1-10.3, 10.5-10.7)
7	<i>Tuesday 9 September</i> 6:00pm – 9:00pm ASB232	Topics - Introduction to Simulation - Generating continuous random variables - Simulating discrete random variables - Stochastic Process Simulation - Multivariate normal - Variance Reduction Techniques - Number of runs Readings Ross, 9th Edition, Chapter 11 (11.1-11.5) Ross, 8th Edition, Chapter 11 (11.1-11.5) Reference ACTED Chapter 14 CT6

8	<i>Tuesday 16 September</i> 6:00pm – 9:00pm ASB232	Class Test 2 (Tuesday 16 September, 6:05pm-7:00pm) Topics - Introduction to time series - Properties of a univariate time series - Trends, seasonal cycles, transformation - Sample correlation functions - ACF and PACF Readings Chan, Chapters 1, 2 Reference ACTED Chapter 12 and 13 CT6
9	<i>Tuesday 23 September</i> 6:00pm – 9:00pm ASB232	Topics - Moving Average (MA) models - Autoregressive (AR) models - ARMA models - ARIMA models Readings Chan, Chapter 3 Reference ACTED Chapter 12 and 13 CT6
29 September – 3 October Session break		

10	<i>Tuesday 7 October</i> 6:00pm – 9:00pm ASB232	Assignment due (Tuesday 7 October, 5.55pm) Topics - Model parameter estimations - Partial ACF - Order selections - Residual analysis - Model building Readings Chan, Chapter 4 Reference ACTED Chapter 12 and 13 CT6
11	<i>Tuesday 14 October</i> 6:00pm – 9:00pm ASB232	Topics - Nonstationarity - Unit root test - Simulations Readings Chan, Chapter 8 Reference ACTED Chapter 12 and 13 CT6
12	<i>Tuesday 21 October</i> 6:00pm – 9:00pm ASB232	Topics - Introduction to forecasting - Simple forecasts - Box-Jenkins approach Readings Chan, Chapter 6

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