



The University of Southern Queensland

## Course specification

### Description: Stochastic Process Modelling

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
STA	4303	30335	1, 2004	ONC	1.00	TWMBBA

<b>Academic group:</b>	FOSCI
<b>Academic org:</b>	FOS003
<b>Student contribution band:</b>	2
<b>ASCED code:</b>	010101

### STAFFING

Examiner: Ashley Plank

Moderator: Ron Addie

### RATIONALE

Stochastic modelling finds application in diverse fields such as reliability theory, insurance, manpower planning, computer networking, traffic management, epidemiology, and many others. Knowledge of the techniques of stochastic modelling is particularly useful to statisticians and applied mathematicians, as well as technologists, engineers and management scientists.

### SYNOPSIS

This course consists of techniques and applications of stochastic modelling. A prerequisite level of mastery of statistical theory to that covered in STA2301 Distribution Theory (or equivalent) is required and it is desirable that students should also have covered the stochastic modelling module of MAT3102 Advanced Engineering Mathematics A or equivalent. Topics covered include branching processes, Poisson processes, Markov processes, renewal processes and random walks. This course is normally offered only in odd years.

### OBJECTIVES

On completion of this course students should be able to:

- recognise the relevance of the mathematical techniques presented in this course to real-world problems;
- demonstrate the ability to apply these techniques to some real-world processes;
- demonstrate a knowledge and understanding of a range of random processes including Poisson processes, Markovian processes, random walks, branching processes and renewal processes;
- be familiar with various computational methods used in probability theory.

## TOPICS

Description	Weighting (%)
1. Introduction. Generating functions; Laplace transforms and moment generating functions; Fourier transform and characteristic function; Riemann Stieltjes integration; random sums; branching processes; indicator variables.	25.00
2. Poisson processes. Properties; decomposition and addition; nonhomogeneous Poisson processes; compound Poisson processes; PASTA.	15.00
3. Renewal processes. Properties; renewal equation; forward and backward recurrence times; stopping times; renewal-reward processes; stationary and transient processes; stochastic convergence; delayed renewal processes; discrete renewal processes; regenerative processes.	25.00
4. Discrete-time Markov chains. Classification of states; random walks; ergodicity and periodicity; absorbing chains; embedded Markov chains; M/G/1 queue.	25.00
5. Continuous-time Markov chains. Birth-death processes; Kolmogorov forward and backward equations; absorbing chains.	10.00

### **TEXT and MATERIALS required to be PURCHASED or ACCESSED:**

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at <http://bookshop.usq.edu.au> click 'Semester', then enter your 'Course Code' (no spaces).

Kao, E 1997, *Introduction to Stochastic Processes*, Duxbury, Belmont, Calif.

### **REFERENCE MATERIALS:**

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

A number of suitable reference and textbooks are available from the USQ library and elsewhere and will be advised by the lecturer.

## STUDENT WORKLOAD REQUIREMENTS:

ACTIVITY	HOURS
Assessment	30.00
Assignments	30.00
Examinations	3.00
Lectures	39.00
Private Study	60.00
Tutorial	13.00

## ASSESSMENT DETAILS

Description	Marks out of	Wtg(%)	Due date
ASSIGNMENT 1	10.00	10.00	12 Mar 2004
ASSIGNMENT 2	10.00	10.00	26 Mar 2004
ASSIGNMENT 3	10.00	10.00	08 Apr 2004
ASSIGNMENT 4	10.00	10.00	07 May 2004
ASSIGNMENT 5	10.00	10.00	21 May 2004
EXAM - 3 HOUR RESTRICTED	50.00	50.00	END S1 (see note 1)

### NOTES:

1. Examination dates will be available during the Semester. Please refer to Examination timetable when published.

## IMPORTANT ASSESSMENT INFORMATION

- 1 Attendance requirements:  
It is the students' responsibility to attend and participate appropriately in all activities (such as lectures, tutorials, laboratories and practical work) scheduled for them, and to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.
- 2 Requirements for students to complete each assessment item satisfactorily:  
To complete each of the assessment items satisfactorily, students must obtain at least 50% of the marks available for each assessment item.
- 3 Penalties for late submission of required work:  
If students submit assignments after the due date without prior approval then a penalty of 10% of the total marks gained by the student for the assignment will apply for each working day late.
- 4 Requirements for student to be awarded a passing grade in the course:

To be assured of a passing grade, students must demonstrate, via the summative assessment items, that they have achieved the required minimum standards in relation to the objectives of the course by satisfactorily completing all summative assessment items (the examination and assignments).

- 5 Method used to combine assessment results to attain final grade:  
The final grades for students will be assigned on the basis of the weighted aggregate of the marks obtained for each of the summative assessment items in the course.
- 6 Examination information:  
The only materials that candidates may use in the restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); calculators which cannot hold textual information (students must indicate on their examination paper the make and model of any calculator(s) they use during the examination. With the Examiner's approval, candidates may take an appropriate non- electronic translation dictionary into the examination. This will be subject to perusal and, if it is found to contain annotations or markings that could give the candidate an unfair advantage, it may be removed from the candidate's possession until the appropriate disciplinary action is completed.
- 7 Examination period when Deferred/Supplementary examinations will be held:  
Any Deferred or Supplementary examinations for this course will be held during the next examination period.
- 8 University Regulations:  
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL <http://www.usq.edu.au/corporateservices/calendar/part5.htm> or in the current USQ Handbook.

## **ASSESSMENT NOTES**

- 9 Students must retain a copy of each item submitted for assessment. This must be despatched to USQ within 24 hours of receipt of request to do so by the Examiner.