



The University of Southern Queensland

## Course Specification

### Description: Stochastic Process Modelling

Subject	Cat-Nbr	Class	Term	Mode	Units	Campus
STA	4303	10372	1, 2002	ONC	1.00	TWMBA

<b>Academic Group:</b>	FOSCI
<b>Academic Org:</b>	FOS003
<b>HECS 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. Topics covered include Poisson processes, Markov processes, renewal processes, random walks and diffusion processes.

### OBJECTIVES

On completion of this course students will 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 stationary processes, Poisson processes, Markovian processes, random walks, branching processes, renewal processes, queueing processes, semi-Markov processes and diffusion 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; renewal-reward processes; stationary and transient processes; stochastic convergence; delayed renewal processes; discrete renewal processes; regenerative processes.	20.00
4. Discrete-time Markov chains. Classification of states; random walks; ergodicity and periodicity; absorbing chains; Markov renewal processes; reversible chains.	15.00
5. Continuous-time Markov chains. Birth-death processes; Kolmogorov forward and backward equations; absorbing chains; phase-type distributions; uniformization; introduction to Markov renewal and semi-regenerative processes.	20.00
6. Diffusion processes. Brownian motion; Wiener processes.	5.00

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

Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at <http://bookshop.usq.edu.au> by entering the author or title of the text.

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.

## ASSESSMENT DETAILS

Description	Marks Out of	Wtg(%)	Required	Due Date
ASSIGNMENT 1	10.00	10.00	Y	04 Mar 2002 (see note 1)
ASSIGNMENT 2	10.00	10.00	Y	04 Mar 2002 (see note 2)
ASSIGNMENT 3	10.00	10.00	Y	04 Mar 2002 (see note 3)
ASSIGNMENT 4	10.00	10.00	Y	04 Mar 2002 (see note 4)
ASSIGNMENT 5	10.00	10.00	Y	04 Mar 2002 (see note 5)
EXAM - 3 HOUR RESTRICTED	50.00	50.00	Y	END S1 (see note 6)

### NOTES:

1. Further details about the due dates are detailed in the assessment section of the Course Specifications.
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3. Further details about the due dates are detailed in the assessment section of the Course Specifications.
4. Further details about the due dates are detailed in the assessment section of the Course Specifications.
5. Further details about the due dates are detailed in the assessment section of the Course Specifications.
6. Examination dates will be available during the Semester. Please refer to Examination timetable when published.

## OTHER REQUIREMENTS

- 1 Attendance: It is the student's responsibility to attend classes and activities to ensure that they have the best chance to meet the objectives of the course and be well informed of course- related activities and administration.
- 2 Minimum Requirements to Pass the Course: To be certain of obtaining a passing grade in this course, students must gain at least 50% of the marks available for each assessment item.
- 3 Supplementary and Deferred Examinations: Any supplementary or deferred examinations for this course will be held at a time to be decided by mutual agreement between the examiner and student.
- 4 Assignments: The due date for assessments is the date by which the student must dispatch an assignment to USQ. The onus is on the student to provide proof of the dispatch date, if required by the examiner. Students must retain a copy of any assignment submitted. This must be produced within 48 hours if required by the examiner. In accordance with University's Policy on Assignments (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an

assignment in extenuating circumstances. This policy may be found in the USQ Handbook, the Distance Education Student Guide and the Faculty of Sciences' Orientation Handbook for new on-campus students. All students are advised to study and follow the guidelines associated with this policy. Assignments submitted after the due date will be penalised 10% for each working day late unless the student can convince the examiner that such a penalty is not warranted.

- 5 Examinations: Restricted Examination - a restricted examination is an examination where only those materials specified in the examination paper are permitted during the examination. The only materials that students may bring into the examination room and use in the restricted examination are: (a) writing materials (non-electronic and free from materials which could give the student an unfair advantage in the examination); (b) calculators which cannot hold textual information (students must indicate on their exam paper the make and model of any calculator(s) they use during the examination). These details can be checked by the invigilator of the examination.
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