



The University of Southern Queensland

Course specification

The current and official versions of the course specifications are available on the web at <http://www.usq.edu.au/coursespecification/current>.
Please consult the web for updates that may occur during the year.

Description: Stochastic Process Modelling

| Subject | Cat-nbr | Class | Term | Mode | Units | Campus |
|---------|---------|-------|---------|------|-------|-----------|
| STA | 8103 | 74223 | 1, 2008 | ONC | 1.00 | Toowoomba |

| | |
|-----------------------------------|--------|
| Academic group: | FOSCI |
| Academic org: | FOS003 |
| Student contribution band: | 2 |
| ASCED code: | 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:

1. recognise the relevance of the mathematical techniques presented in this course to real-world problems (Assignments 1 to 5);
2. demonstrate the ability to apply these techniques to some real-world processes (Assignments 1 to 5);
3. demonstrate a knowledge and understanding of a range of random processes including Poisson processes, Markovian processes, random walks, branching processes and renewal processes (Assignments 1 to 5);
4. be familiar with various computational methods used in probability theory (Assignments 1 to 5).

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 |
|---------------|-------|
| Assessments | 30.00 |
| Assignments | 30.00 |
| Lectures | 39.00 |
| Private Study | 60.00 |
| Test | 2.00 |
| Tutorials | 13.00 |

ASSESSMENT DETAILS

| Description | Marks out of | Wtg (%) | Due date |
|------------------------|--------------|---------|-----------------------------|
| ASSIGNMENT 1 | 10.00 | 10.00 | 03 Mar 2008 (see note 1) |
| ASSIGNMENT 2 | 10.00 | 10.00 | 03 Mar 2008 |
| ASSIGNMENT 3 | 10.00 | 10.00 | 03 Mar 2008 |
| ASSIGNMENT 4 | 10.00 | 10.00 | 03 Mar 2008 |
| ASSIGNMENT 5 | 10.00 | 10.00 | 03 Mar 2008 |
| TEST 2 HOUR RESTRICTED | 50.00 | 50.00 | 03 Mar 2008 (see note 2) |

NOTES

1. Assignment due dates will be provided by the Examiner at the commencement of semester.
2. Date of end of semester test will be provided by the Examiner during the semester.

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 5% 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 receiving a passing grade a student must achieve at least 50% of the total weighted marks available for the course.
- 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:
There is no examination in this course.
- 7 Examination period when Deferred/Supplementary examinations will be held:
Not applicable.
- 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.