F79SP Stochastic Processes

**COURSE DETAILS**

**Course Code:** F79SP  
**Full Course Title:** Stochastic Processes  
**SCQF Level:** 9  
**SCAF Credits:** 15  
**Available as Elective:** No

**DELIVERY LEVEL**

| Undergraduate | Yes | Postgraduate Taught | Yes | Postgraduate Research | No |

**Additional Information:**

**COURSE AIMS**

To introduce fundamental stochastic processes which are useful in insurance, investment and stochastic modelling, and to develop techniques and methods for analysing the long term behaviour of these processes.

**LEARNING OUTCOMES – SUBJECT MASTERY**

After studying this course, students should be able to:

- Understand and use the Markov property
- Write down equations for the stationary distribution of a Markov chain and use, wherever possible, additional structure to solve them
- Write down first step equations and use them to compute the time to death, probability of absorption etc.
- Apply Markov chain modelling in several problems
- Understand long term behaviour and stationarity of a Markov chain
- Classify states in terms of the topological properties of the intercommunications graph and in terms of the actual transition probabilities.

**LEARNING OUTCOMES – PERSONAL ABILITIES**

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

- Demonstrate the ability to learn independently
- Manage time work to deadlines and prioritise workloads
- Present results in a way which demonstrates that they have understood the technical and broader issues of stochastic processes

**SYLLABUS**

- Review of independence
- Sequences of random variables and the Markov property
- Review of matrix algebra
- Review of summation notation and other useful concepts
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- Using the Markov property
- Absorbing Markov chains with finite state space
- First step (backwards) equations
- Basic examples
- Stationarity problem for finite state space chains
- Tricks for the computation of the stationary distribution
- State classification
- Periodicity
- Convergence to stationarity
- Frequencies
- Markov chains with infinite but countable state space
- Recurrence and transience
- Examples
- Basic relations between exponential, gamma, Poisson and uniform distributions
- Simple point processes, Poisson and compound Poisson processes
- Continuous time Markov processes
- Numerical solution of the Kolmogorov Forward Equations for a time-inhomogeneous Markov process
- Examples
- Simulation of Markov Chains, Markov Processes

### COURSE RELATIONSHIPS

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<th>Course Code</th>
<th>Level</th>
<th>Title</th>
<th>School</th>
<th>Type</th>
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<td>Probability and Statistics A</td>
<td>School of Math and Comp Sci.</td>
<td>Pre-Requisite</td>
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<td>Probability and Statistics B</td>
<td>School of Math and Comp Sci.</td>
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<td>Survival Models</td>
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### LOCATION AND ASSESSMENT METHODS

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