

MODULE DESCRIPTOR

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| MODULE TITLE | STOCHASTIC PROCESSES | | |
| MODULE CODE | MA3871 (L6) | CREDIT VALUE | 20 CREDITS (10 ECTS) |
| CAMPUS | UCLAN CYPRUS | | |
| SCHOOL | SCHOOL OF SCIENCE | | |

MODULE AIMS

This module aims to introduce students to basic concepts of stochastic processes and their applications to physics, engineering, biology and finance.

MODULE CONTENT

Introduction to stochastic processes: Basic terminology, Examples of stochastic processes, Definition of stochastic processes.

Markov Chains: Definitions, Examples of Markov Chains, Classification of States of a Markov Chain, Recurrence, Discrete Renewal Equation, Absorption Probabilities, Criteria of Recurrence, Queuing Example, Random Walk.

Continuous Time Markov Chains: Birth Processes and Poisson Processes, Birth and Death Processes.

Renewal Processes: Definition and Examples of Renewal Processes, Renewal Theorem and Applications.

Martingales: Definitions and Examples, Optional Sampling Theorem, Convergence Theorems.

Brownian Motion: Joint Probabilities for Brownian Motion, Continuity of paths and the Maximum Variables, Variations and Extensions.

Stationary Processes: Definitions and Examples, Mean Square Distance, Mean square error prediction, Prediction of Covariance Stationary Processes, Ergodic Theory and Applications, Gaussian Systems.

INTENDED LEARNING OUTCOMES

| On successful completion of this module a student will be able to: | |
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| 1. | Recognise and apply the concept of a stochastic process, and in particular a Markov process, a counting process and a random walk. |
| 2. | Classify a stochastic process according to whether it operates in continuous or discrete time and whether it has a continuous or a discrete state space, and give examples of each type process. |
| 3. | Describe and analyse birth and death processes in terms of Markov processes. |
| 4. | Derive basic properties of a Poisson process and a Brownian motion. |
| 5. | Recognise and apply general terms of the principles of stochastic modelling. |

TEACHING METHODS

The class contact will consist of teaching classes together with workshops. Teaching classes will introduce new material and provide examples. Tutorials have no new material introduced. Students

will attempt problems during the tutorials. Key elements of the learning strategy are regular sessions during which problems are attempted.

The module will be assessed principally by examination. However, to facilitate and monitor the formative learning process selected set exercises will be submitted for assessment. These will present regular opportunities for feedback and feedforward. At the end of the module, students will be expected to include a reflective component in this portfolio of work. This will make up the coursework component of the module.

ASSESSMENT METHODS

The module is assessed through a Portfolio of set exercises and a written examination.