

# MA933-15 Stochastic Modelling and Random Processes

21/22

**Department**

Warwick Mathematics Institute

**Level**

Taught Postgraduate Level

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

20% coursework, 80% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

N/A

[Module web page](#)

### Module aims

The main aims are to provide a broad background in theory and applications of complex networks and random processes, and related practical and computational skills to use these techniques in applied mathematical research and modelling. Students will become familiar with basic network theoretic definitions, commonly used network statistics, probabilistic foundations of random processes, some commonly studied Markov processes/chains, and the links between these topics through random graph theory.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Review of important concepts from Probability  
Discrete-time Markov chains

Continuous-time Markov chains

Stochastic models of interacting processes (including population dynamics, epidemics)

Basic network definitions and statistics

The Erdos-Renyi random graph and connection to percolation

Heterogeneous network models

Random processes on networks

## **Learning outcomes**

By the end of the module, students should be able to:

- Recall and apply standard network statistics such as degree distribution and clustering coefficient.
- Understand the probabilistic and combinatorial foundations of random processes and network theory, respectively.
- Work with standard stochastic models of population dynamics and epidemiology, such as branching and contact processes
- Mathematical modelling: Building a quantitative probabilistic model from a phenomenological description
- Work with popular random graph models such as Erdos-Renyi, Configuration Model and Preferential Attachment.
- Understand and implement simple algorithms to simulate random processes and networks

## **Indicative reading list**

Handbook of Stochastic Methods, CW Gardiner, Springer 2004.

Networks: An Introduction, MEJ Newman, OUP 2010.

Probability and Random Processes (3rd ed.), G Grimmett and D Stirzakek, OUP 2001.

Random Graph Dynamics, R Durrett, CUP 2007.

[View reading list on Talis Aspire](#)

## **Subject specific skills**

See learning outcomes.

## **Transferable skills**

Students will acquire key reasoning and problem solving skills which will empower them to address new problems with confidence.

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## **Study**

## **Study time**

Type	Required
Lectures	10 sessions of 3 hours (20%)
Tutorials	10 sessions of 1 hour (7%)
Private study	110 hours (73%)
Total	150 hours

### Private study description

Review lectured material and work on set exercises.

### Costs

No further costs have been identified for this module.

### Assessment

You must pass all assessment components to pass the module.

#### Assessment group D

	Weighting	Study time
Problem sets	20%	
Problem sheets set and marked by module leader		
Locally timetabled examination	80%	
Class examination set by module leader. Not centrally timetabled.		

### Feedback on assessment

Marked script and opportunity for verbal feedback

[Past exam papers for MA933](#)

### Availability

### Courses

This module is Core for:

- RMAA-G1PG Postgraduate Research Mathematics of Systems
  - Year 1 of G1PG Mathematics of Systems
  - Year 1 of G1PG Mathematics of Systems

- TMAA-G1PF Postgraduate Taught Mathematics of Systems
  - Year 1 of G1PF Mathematics of Systems
  - Year 1 of G1PF Mathematics of Systems

This module is Optional for:

- Year 2 of TPXA-F345 Postgraduate Taught Modelling of Heterogeneous Systems (PGDip)

This module is Option list B for:

- Year 1 of TPXA-F345 Postgraduate Taught Modelling of Heterogeneous Systems (PGDip)