

# MA222-10 Metric Spaces

**24/25**

**Department**

Warwick Mathematics Institute

**Level**

Undergraduate Level 2

**Module leader**

Richard Sharp

**Credit value**

10

**Module duration**

10 weeks

**Assessment**

Multiple

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

The concepts of convergence, continuity, convergence and compactness are studied in the more general setting. This enables development of multi-dimensional and infinite-dimensional Analysis in consequent modules.

[Module web page](#)

### Module aims

To introduce the notions of Normed Space, Metric Space and Topological Space, and the fundamental properties of Compactness, Connectedness and Completeness that they may possess. Students will gain knowledge of definitions, theorems and calculations in:

Normed, Metric and Topological spaces Open and closed sets and their relation to continuity  
Notions of Compactness and relations to continuous maps Notions of Connectedness and relations  
to continuous maps Notions of Completeness and relations to previous topics in the module

### 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.

The module comprises the following chapters:

Normed Spaces Metric Spaces Open and closed sets Continuity Topological spaces Compactness  
Connectedness Completeness

## Learning outcomes

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

- Demonstrate understanding of the basic concepts, theorems and calculations of Normed, Metric and Topological Spaces.
- Demonstrate understanding of the open-set definition of continuity and its relation to previous notions of continuity, and applications to open or closed sets.
- Demonstrate understanding of the basic concepts, theorems and calculations of the concepts of Compactness, Connectedness and Completeness (CCC).
- Demonstrate understanding of the connections that arise between CCC, their relations under continuous maps, and simple applications.

## Indicative reading list

1. W A Sutherland, Introduction to Metric and Topological Spaces, OUP.
2. E T Copson, Metric Spaces, CUP.
3. W Rudin, Principles of Mathematical Analysis, McGraw Hill.
4. G W Simmons, Introduction to Topology and Modern Analysis, McGraw Hill. (More advanced, although it starts at the beginning; helpful for several third year and MMath modules in analysis).
5. A M Gleason, Fundamentals of Abstract Analysis, Jones and Bartlett.

## Subject specific skills

Familiarity with different ways of formulating convergence and continuity, and the relationship between them. Ability to use compactness and completeness arguments as part of larger proofs, frequently required in mathematical applications.

## Transferable skills

Analytical and problem-solving skills as for any module in abstract mathematics. Facility for independent study and self motivation.

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## Study

## Study time

Type	Required
Lectures	30 sessions of 1 hour (30%)
Seminars	9 sessions of 1 hour (9%)
Private study	61 hours (61%)
Total	100 hours

## Private study description

61 hours to review lectured material and work on set exercises.

## Costs

No further costs have been identified for this module.

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## Assessment

You do not need to pass all assessment components to pass the module.

### Assessment group D1

	Weighting	Study time	Eligible for self-certification
Assignments	15%		No
Examination	85%		No

- Answerbook Pink (12 page)

### Assessment group R1

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

- Answerbook Pink (12 page)

## Feedback on assessment

Marked assignments and exam feedback.

[Past exam papers for MA222](#)

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## Availability

## Courses

This module is Core for:

- Year 2 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 2 of UMAA-GV17 Undergraduate Mathematics and Philosophy
- Year 2 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations
- Year 2 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)

This module is Optional for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics

This module is Option list A for:

- Year 2 of USTA-G302 Undergraduate Data Science
- Year 2 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 2 of UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
  - Year 2 of GF13 Mathematics and Physics
  - Year 2 of FG31 Mathematics and Physics (MMathPhys)

This module is Option list B for:

- Year 2 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics