

# MA947-15 Graduate Real Analysis

23/24

**Department**

Warwick Mathematics Institute

**Level**

Research Postgraduate Level

**Module leader**

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

100% exam

**Study location**

University of Warwick main campus, Coventry

---

## Description

### Introductory description

Introduce the fundamental concepts and results of measure theory and to present more advanced topics not usually covered in the undergraduate courses.

### Module aims

Measures, integration, basic properties and convergence theorems. Lebesgue measure.

Egorov, Lusin and Fubini theorems.

Riesz representation theorem and weak\* convergence.

Lebesgue density theorem, almost everywhere differentiation of monotone functions, Rademacher's theorem.

Hausdorff measure, rectifiable sets.

Selected topics in Geometric Measure Theory, for example, Sard's theorem, Frostman measures, Besicovitch projection theorem

### 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.

Measures, integration, basic properties and convergence theorems. Lebesgue measure.

Egorov, Lusin and Fubini theorems.

- Riesz representation theorem and weak\* convergence.
- Lebesgue density theorem,
- almost everywhere differentiation of monotone functions,
- Rademacher's theorem.
- Hausdorff measure, rectifiable sets.
- Selected topics in Geometric Measure Theory, for example, Sard's theorem, Frostman measures, Besicovitch projection theorem

## Learning outcomes

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

- Measures, integration, basic properties and convergence theorems. Lebesgue measure. Egorov, Lusin and Fubini theorems. Riesz representation theorem and weak\* convergence. Lebesgue density theorem, almost everywhere differentiation of monotone functions, Rademacher's theorem. Hausdorff measure, rectifiable sets. Selected topics in Geometric Measure Theory, for example, Sard's theorem, Frostman measures, Besicovitch projection theorem

## Indicative reading list

Rudin, W.: Real and Complex Analysis

Loeb, P.A: Real Analysis

Halmos, P. R.: Measure Theory

## Subject specific skills

Develop a deep understanding and applicability of the following topics:

- Measures,
- integration,
- basic properties and convergence theorems.
- Lebesgue measure.
- Egorov, Lusin and Fubini theorems.
- Riesz representation theorem and weak\* convergence.
- Lebesgue density theorem,
- almost everywhere differentiation of monotone functions,
- Rademacher's theorem.
- Hausdorff measure, rectifiable sets.
- Sard's theorem, Frostman measures, Besicovitch projection theorem

## Transferable skills

- sourcing research material
- prioritising and summarising relevant information
- absorbing and organizing information
- presentation skills (both oral and written)

---

## Study

### Study time

Type	Required
Lectures	30 sessions of 1 hour (100%)
Total	30 hours

### Private study description

Review lectured material.

Work on supplementary reading material.

Source, organise and prioritise material for additional reading.

### Costs

No further costs have been identified for this module.

---

## Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

### Assessment group A

	Weighting	Study time
Oral Exam	100%	
An oral exam involving a presentation by the student, followed by questions from the panel (2 members of the department)		

### Feedback on assessment

Students will receive feedback from the course instructor after the oral exam, to cover also areas like presentation skills and use of technologies (or blackboard)

[Past exam papers for MA947](#)

---

## Availability

There is currently no information about the courses for which this module is core or optional.