MA270-10 Analysis 3

23/24

Department
Warwick Mathematics Institute
Level
Undergraduate Level 2
Module leader
Jose Rodrigo
Credit value
10
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This is the third module in the series Analysis 1, 2, 3 that covers rigorous Analysis. It covers convergence of functions and its applications to Integration, Fourier Series and Complex Analysis.

Module web page

Module aims

1. Continuity, differentiability and integral of the limit of a uniformly convergent sequence of functions.
2. Fourier series and their convergence.
3. Foundations of Complex Analysis.

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.

- Uniform convergence of sequences and series of functions; Weierstrass M-test
- Application to integration: integrals of limits and series, differentiation under the integral sign

- Fourier series: convergence, Parseval, and Gibbs phenomenon (differentiability and rate of decay of coefficients)
- Complex power series and classical functions (exponential, logarithm, sine and cosine, including periodicity)
- Complex integration, contour integrals and Cauchy’s Theorem
- Applications of Cauchy’s formula to evaluate real integrals
- Laurent series, Calculus of residues

- Sequences and Series of Functions
    - Pointwise and uniform convergence
    - Series of functions
    - A continuous, nowhere differentiable function
    - Space filling curves
    - Absolute Continuity
- Complex Analysis
    - Review of basic facts about C
    - Power Series
    - The exponential and the circular functions
    - Argument and Log
    - Complex integration, contour integrals
    - Links with MA259
    - Consequences of Cauchy’s Theorem
    - Applications of Cauchy’s formula to evaluate integrals in R

Learning outcomes

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

- Understand uniform and pointwise convergence of functions together with properties of the limit function
- Learn the continuity, differentiability and integral of the limit of a uniformly convergent sequence of functions
- Develop working knowledge of complex differentiability (Cauchy-Riemann equations) and complex power series
- Learn how to compute contour integrals: Cauchy's integral formulas and applications
- Develop understanding of Fourier Series including Gibbs phenomenon

Indicative reading list

- Lecture notes will be provided for the module.
- The module webpage contains additional references that students may consult. Students registered for this module may access the relevant chapters of books scanned under copyright.

Subject specific skills

- Working knowledge of series and sequences, including the development of the notions of convergence and uniform converge for sequences and series of functions.
- Good understanding of Fourier series, including their convergence, Parseval's identity and Gibbs phenomenon.
- Working knowledge of Complex Analysis, including power series, exponential and circular maps, contour integration.
- Mastery of applications of Cauchy's formula to compute integrals in R

Transferable skills

- The students will be able to apply abstract notions in a variety of different contexts.
- Use a variety of techniques to compute complicated integrals or asymptotic expansions for functions/quantities arising from a wide range of applications in the physical sciences.
- Students will develop an ability to analyse and process complex information, triaging key concepts and effectively prepare plans for solving problems.

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (20%)
Tutorials	9 sessions of 1 hour (9%)
Private study	71 hours (71%)
Total	100 hours

Private study description

71 hours private study, revision for exams, and assignments

Costs

No further costs have been identified for this module.

Assessment

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

Assessment group D

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

- Answerbook Pink (12 page)

Assessment group R

	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 MA270

Availability

Courses

This module is Core for:

- Year 2 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- Year 2 of UMAA-G100 Undergraduate Mathematics (BSc)
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 2 of G100 Mathematics
  - Year 2 of G103 Mathematics (MMath)
- Year 2 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 2 of UMAA-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)
- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- Year 2 of UMAA-G101 Undergraduate Mathematics with Intercalated Year