MA263-10 Multivariable Analysis

23/24

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

Description

Introductory description

Mathematical Analysis is the heart of modern Mathematics. This module is the final in a series of modules where the subject of Analysis is rigorously developed in many dimensional setting.

Module aims

extend the analysis of one variable from the first year to the multivariable context.

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.

- Different notions of continuity of functions of several variables
- Quantitative Linear Algebra in terms of norms
- Different notions of differentiability of functions of several variables
- Chain rule, (generalised) mean value inequality and other properties of differentiable functions
- Inverse Function Theorem and Implicit Function Theorem, with applications to regular curves and hypersurfaces
- Vector Fields and the theorems of Green, Gauss and Stokes, with some applications to

PDEs.
- Maxima, minima and saddles and constrained critical points.

Learning outcomes

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

- learn the basic concepts, theorems and calculations of multivariable analysis
- understand the Implicit and Inverse Function Theorems and their applications
- acquire a working knowledge of vector fields and the Integral Theorems of Vector Calculus
- learn how to analyse and classify critical points using Taylor expansions

Indicative reading list

J. E. Marsden and A. Tromba. Vector Calculus. Macmillan Higher Education, sixth edition, 2011.
J. J. Duistermaat, J. A. C. Kolk. Multidimensional Real Analysis I : Differentiation, CUP, 2004 [available online via Warwick's library]
R. Coleman. Calculus on normed vector spaces, Springer 2012. [available online via Warwick's library]
W. Rudin. Principles of Mathematical Analysis. International Series in Pure and Applied Mathematics. McGraw-Hill Book Co., New York-Auckland-Düsseldorf, third edition, 1976.
T. M. Apostol. Mathematical Analysis. Addison-Wesley Publishing Co., Reading, Mass.-London-Don Mills, Ont., second edition, 1974.
T. W. Körner. A Companion to Analysis: A Second First and First Second Course in Analysis, volume 62 of Graduate Studies in Mathematics. American Mathematical Society, Providence, RI, 2004.

Subject specific skills

Multivariable Analysis gives students tools to do rigorous Analysis in higher dimensional spaces. Students will learn definitions, theorems and calculations with vector-valued functions of many variables, for instance, Inverse and Implicit Function Theorems, vector fields, maxima, minima and saddles.

Transferable skills

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

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (20%)
Online learning (independent)	9 sessions of 1 hour (9%)
Private study	13 hours (13%)
Assessment	58 hours (58%)
Total	100 hours

Private study description

Working on assignments, going over lecture notes, text books, exam revision.

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
Assignments	15%	20 hours
Examination	85%	38 hours

- Answerbook Pink (12 page)

Assessment group R

	Weighting	Study time
In-person Examination - Resit	100%	

Feedback on assessment

Marked homework (both assessed and formative) is returned and discussed in smaller classes. Exam feedback is given.

Past exam papers for MA263

Availability

Courses

This module is Core for:

- Year 2 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- UMAA-G103 Undergraduate Mathematics (MMath)
    - Year 2 of G103 Mathematics (MMath)
    - Year 2 of G103 Mathematics (MMath)

This module is Core optional for:

- UMAA-G100 Undergraduate Mathematics (BSc)
    - Year 2 of G100 Mathematics
    - Year 2 of G100 Mathematics
    - Year 2 of G100 Mathematics
- Year 2 of UMAA-G103 Undergraduate 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-G101 Undergraduate Mathematics with Intercalated Year

This module is Option list A for:

- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
    - Year 2 of GF13 Mathematics and Physics
    - Year 2 of GF13 Mathematics and Physics
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
    - Year 2 of FG31 Mathematics and Physics (MMathPhys)
    - Year 2 of FG31 Mathematics and Physics (MMathPhys)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
    - Year 2 of GG14 Mathematics and Statistics
    - Year 2 of GG14 Mathematics and Statistics

This module is Option list B for:

- UCSA-G4G1 Undergraduate Discrete Mathematics
    - Year 2 of G4G1 Discrete Mathematics
    - Year 2 of G4G1 Discrete Mathematics
- Year 2 of UCSA-G4G3 Undergraduate Discrete Mathematics
- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics