MA259-12 Multivariable Calculus

23/24

Department
Warwick Mathematics Institute
Level
Undergraduate Level 2
Module leader
Mario Micallef
Credit value
12
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

N/A

Module web page

Module aims

To 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.

- Continuous Vector-Valued Functions
- Some Linear Algebra
- Differentiable Functions
- Inverse Function Theorem and Implicit Function Theorem
- Vector Fields, Green’s Theorem in the Plane and the Divergence Theorem in R3
- Maxima, minima and saddles

Learning outcomes

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

- Demonstrate understanding of the basic concepts, theorems and calculations of multivariate analysis.
- Demonstrate understanding of the Implicit and Inverse Function Theorems and their applications.
- Demonstrate understanding of vector fields and Green’s Theorem and the Divergence Theorem.
- Demonstrate the ability to analyse and classify critical points using Taylor expansions.

Indicative reading list

1. R. Abraham, J. E. Marsden, T. Ratiu. Manifolds, Tensor Analysis, and Applications. Springer, second edition, 1988.
2. T. M. Apostol. Mathematical Analysis. Addison-Wesley Publishing Co., Reading, Mass.-London-Don Mills, Ont., second edition, 1974.
3. R. Coleman. Calculus on normed vector spaces, Springer 2012. [available online via Warwick's library]
4. J. J. Duistermaat, J. A. C. Kolk. Multidimensional Real Analysis I : Differentiation, CUP, 2004 [available online via Warwick's library]
5. 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.
6. J. E. Marsden and A. Tromba. Vector Calculus. Macmillan Higher Education, sixth edition, 2011.
7. J. R. Munkres. Analysis on Manifolds. Addison-Wesley Publishing Company, Advanced Book Program, Redwood City, CA, 1991.
8. W. Rudin. Principles of Mathematical Analysis. International Series in Pure and Applied Mathematics. McGraw-Hill Book Co., New York-Auckland-Düsseldorf, third edition, 1976.
9. M. Spivak. Calculus on Manifolds. A Modern Approach to Classical Theorems of Advanced Calculus. W. A. Benjamin, Inc., New York-Amsterdam, 1965.

Subject specific skills

Students will gain knowledge of definitions, theorems and calculations in
-Continuous vector-valued functions
-Differentiable functions
-Inverse and Implicit Function Theorems
-Vector fields
-Maxima, minima and saddles

Transferable skills

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

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (67%)
Seminars	5 sessions of 1 hour (11%)
Other activity	10 hours (22%)
Total	45 hours

Private study description

85 self-working: reviewing lectured material and accompanying supplementary materials; working on both summative and formative coursework; revising for exams.

Other activity description

Collaborative project

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 D2

	Weighting	Study time
Assignments	15%	
Project	10%	
Examination	75%	

- Answerbook Pink (12 page)

Assessment group R

	Weighting	Study time
In-person Examination - Resit	100%	

	Weighting	Study time

- Answerbook Pink (12 page)

Assessment group S

	Weighting	Study time
Assignments	15%	
In-person Examination	85%	

- Answerbook Pink (12 page)

Feedback on assessment

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

Past exam papers for MA259

Availability

Courses

This module is Core for:

- Year 2 of UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe

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

This module is Option list B for:

- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
  - Year 3 of GG14 Mathematics and Statistics
  - Year 3 of GG14 Mathematics and Statistics
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)

- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
    - Year 3 of Y602 Mathematics,Operational Research,Stats,Economics
    - Year 3 of Y602 Mathematics,Operational Research,Stats,Economics

This module is Option list E for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
    - Year 3 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
    - Year 4 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)