MATH20132

General Information

- Title:Calculculus of Several Variables
- Unit code: MATH20132
- Credit rating:10
- Level: 2
- Pre-requisite units:MT1121 or MT1131, MT1202 or MT1212, MATH21101 or MATH2111
- Co-requisite units:
- School responsible: Mathematics
- Member of staff responsible:Alexander Odesskii

Unit specification

Aims

The programme unit aims to:

Brief description

Functions of several variables were briefly considered in first year calculus. Although there are some similarities with the familiar theory of one real variable, the theory for functions of several variables is far richer. For example, for functions of several variables, the critical points might be maxima, minima or saddle points (which are minima in one direction and are maxima in another direction). A key idea is to generalize the definition of the derivative to the case of maps f:R^n -> R^m . This is the Fréchet derivative, which is a linear map Df: R^n -> R^m (often represented by a matrix) which gives the best approximation to the function. This course deals with a number of very elegant and useful results, including the Inverse Function Theorem, the Implicit Function Theorem and a study of the critical points of functions of several variables.

Intended learning outcomes

On completion of this unit successful students will be able to:

-

Future topics requiring this course unit

The ideas in this course are used in many areas of pure and applied mathematics. A natural follow on course unit is the level 3 *Calculus on Manifolds*.

Syllabus

1. The differential of a map R^n -> R^m.
2. An example-application: hydrodynamic interpretation of a vector field on Euclidean space; decomposition of its differential into symmetric ('deformation') and antisymmetric ('rotation') parts, and the geometric meaning of divergence and curl.
3. Differentials and partial derivatives; Taylor series.
4. Chain rule; Inverse and Implicit Function Theorems.
5. Critical points and values.
6. Saard's Theorem and its applications.

7. Study of critical points; the Hessian matrix.
8. Conditional extremum and Lagrange multipliers.

Textbooks

M.J. Field, Differential Calculus and its Applications, Van Nostrand, 1976.

W. Fleming, Functions of Several Variables, Addison-Wesley 1965.

J. and B. Hubbard, Vector Calculus, Linear Algebra, and Differential Forms. Prentice Hall , 1998.

Learning and teaching processes

Assessment

Coursework Weighting within unit 10%

2 hours end of semester examination; Weighting within unit 90%

Arrangements