

## Differential Geometry (C004420)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 6.0**

**Study time 165 h**

**Course offerings and teaching methods in academic year 2024-2025**

A (semester 2)

Dutch

Gent

lecture

seminar

**Lecturers in academic year 2024-2025**

Broucke, Frederik

WE16

lecturer-in-charge

**Offered in the following programmes in 2024-2025**

[Bachelor of Arts in Moral Sciences](#)

6

A

[Bachelor of Arts in Philosophy](#)

6

A

[Bachelor of Science in Mathematics](#)

6

A

**Teaching languages**

Dutch

**Keywords**

Classical differential geometry, curves and surfaces, differentiable manifolds, Riemannian geometry.

**Position of the course**

In the first two chapters we treat the classical differential geometry of curves and surfaces in  $\mathbb{R}^3$ . In the third chapter we give an introduction to modern differential geometry, and to the theory of differentiable manifolds and Riemannian manifolds.

**Contents**

*1. Curves*

Curves in 3-dimensional Euclidean space. Arclength, curvature and torsion, the canonical representation of a curve. The fundamental theorem.

*2. Surfaces*

Surfaces in 3-dimensional Euclidean space. Tangent plane. The first fundamental form. Isometries. Normal and geodesic curvature. Weingarten map, Gaussian curvature, mean curvature, principal curvatures. Christoffel symbols, geodesic lines, Riemann curvature tensor. Theorema Egregium.

*3. Differentiable manifolds*

Generalities about differentiable manifolds. Examples: matrix groups and surfaces in  $\mathbb{R}^3$ . Tangent spaces of a manifold. Riemannian manifolds.

**Initial competences**

Final competences of the courses Analysis I, Analysis II and Linear Algebra and Geometry I. Some preknowledge of classical mechanics is advisable.

**Final competences**

- 1 To have insight in all structures and concepts that were introduced in this course.
- 2 To recognize these structures in other branches of mathematics and mathematical physics.

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Seminar, Lecture

**Extra information on the teaching methods**

Theory: ex cathedra. Guided exercise classes.

**Study material**

Type: Syllabus

Name: Differentiaalmeetkunde

Indicative price: Free or paid by faculty

Optional: no

Language : Dutch

Number of Pages : 148

Oldest Usable Edition : 2022-2023

Available on Ufora : Yes

Online Available : Yes

Available in the Library : No

Available through Student Association : No

Additional information: Course notes written by Tom Mestdag. A pdf version is made available on Ufora which the students can download and print.

**References**

M.P. Do Carmo, Differential Geometry of Curves and Surfaces, Prentice Hall (1976)

T.J. Willmore: Riemannian Geometry, Clarendon Press (Oxford) (1993).

S. Sternberg, Curvature in Mathematics and Physics, Dover Publications (2012)

**Course content-related study coaching**

Consultations with the teachers are always possible.

**Assessment moments**

end-of-term assessment

**Examination methods in case of periodic assessment during the first examination period**

Written assessment with open-ended questions

**Examination methods in case of periodic assessment during the second examination period**

Written assessment with open-ended questions

**Examination methods in case of permanent assessment**

**Possibilities of retake in case of permanent assessment**

not applicable

**Extra information on the examination methods**

Theory: written exam. Exercises: open book exam.

**Calculation of the examination mark**

100% periodic evaluation. 10 points for theory, 10 points for exercises.