Differential Geometry

Programme course

6 credits

Differentialgeometri

TATA74

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical
Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Mathematics, Applied Mathematics

Course level
First cycle

Advancement level
G2F

Course offered for
- Mathematics, Master's Programme
- Mathematics

Specific information
The course is only offered every second year. It will be offered during 2015

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Linear algebra, Calculus in several variables, Vector calculus.

Intended learning outcomes

The aim of the course is to provide knowledge of the geometry of curves and surfaces. The course integrates concepts from different parts of mathematics, such as linear algebra, calculus and differential equations. It also provides intuitive examples for many concepts in linear algebra, calculus and differential equations. These examples are fundamental to physics and mechanics: they play a role in our understanding of the movements of particles and the theory of relativity. After completing this course, students should be able to:

- Determine and calculate curvature of curves in different coordinate systems.
- Parametrise surfaces and use the metric tensor. Calculate isometries.
- Treat geodesic curves and parallel translation
- Calculate and analyse curvature of surfaces in different settings.
- Know the concept of tensor and recognise tensors that are used in mechanics, image processing and theory of relativity.
- Apply geometry of curves and surfaces to computer aided graphics

Course content

Curves: tangents, curvature and torsion. Contact. Different types of curves.
Regular surfaces: tangent plane. The first fundamental form: normal and geodesic curvature. Geodesics and parallel transport. Gauss' formulae.
The second fundamental form: Weingarten's equation, principal, Gauss and mean curvature. Minimal and developable surfaces. Riemann's and Ricci's tensors, Codazzi-Mainardi's equations. Gauss' "Theorema Egregium". Isometrical and conformal mappings. Gauss-Bonnet theorem.
Applications to CAD.

Teaching and working methods

Lectures and tutorials.
The course runs over the entire autumn semester.

Examination

UPG1	Assignments	6 credits	U, 3, 4, 5
TEN1	Written Examination	6 credits	U, 3, 4, 5

A written exam will be offered in August for those who did not pass the assignments. Examination is either by hand-in assignments or TEN1. Ten 1 can only give the grade 3.

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department
Matematiska institutionen

Director of Studies or equivalent
Jesper Thorén

Examiner
Milagros Izquirdo Barrios

Course website and other links
http://www.mai.liu.se/und/kurser/index-amne-tm.html

Education components
Preliminary scheduled hours: 48 h
Recommended self-study hours: 112 h

Course literature

Additional literature

Books

A. Pressley, (2001) *Elementary Differential Geometry* Springer-Verlag

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.