Geometry with Applications

Programme course

6 credits

Geometri med tillämpningar

TATA49

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
G1X

Course offered for
- Mathematics

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
First courses in Linear algebra and Discrete mathematics (desirable)

Intended learning outcomes
The course presents methods and concepts in modern geometry, i.e. it is based on geometrical transformations. The course treats Euclidean and non-euclidean geometry, and real and finite projective geometry. By generalization of Euclidean transformation one obtains projective geometries. These geometries form the mathematical basis for computer graphics, latin squares and error-correcting codes. Students should be able to:
- use the concept of group to study different geometries
- classify and to determine the different (Euclidean) transformations of the plane.
- study frieze and wallpaper patterns with the help of transformations
- know of hyperbolic and elliptic geometry.
- work with the projective plane and its transformations: collineations and projectivities
- use collineations and projectivities to explain the foundations of computer graphics
- recognise finite projective geometries and their applications to coding theory and configurations.
- apply quaternions to computer animations

Course content
Groups: cyclic and dihedral groups. Quaternions. Stereographic projection. Euclidean plane geometry: isometries, reflections, direct and inverse isometries. Frieze and wallpaper patterns. Three-dimensional isometries. Hyperbolic and elliptic geometries. Projective plane: harmonic sets, perspectivity, projectivity, conics, cross ratios, collineations and polarity. Application in computer graphics Finite projective planes. Applications to error-correcting codes, configurations, design and latin squares.

Teaching and working methods
Lectures and tutorials.

Examination

UPG1	Hand-in assignments	6 credits	U, 3, 4, 5

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

Other information
Supplementary courses: Linear Algebra, honours course. Combinatorics

Department
Matematiska institutionen

Director of Studies or equivalent
Jesper Thorén

Examiner
Milagros Izquierdo Barrios

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

Education components
Preliminary scheduled hours: 56 h
Recommended self-study hours: 104 h

Course literature

Additional literature

Books

J. N. Cederberg, *A course in Modern Geometries (Undergraduate Texts in Mathematics)*

Compendia

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.