

# SF1684 ALGEBRA AND GEOMETRY

AUTUMN 2017

The course covers basics of vector spaces, linear transformations, operations on vectors and matrices

## Literature:

"SF1624 Algebra and Geometry, Introduction to Linear Algebra for Science and Engineering" by Daniel Norman and Dan Wolczuk, third edition.

## Course plan

**Week 44** Modul 1: systems of linear equations

*Lecture 1.* Vector spaces:  $\mathbb{R}^2$ ,  $\mathbb{R}^3$  and  $\mathbb{R}^n$ : Chapters 1.1 and 1.2

*Lecture 2.* Systems of linear equations and Gauss elimination: Chapter 2.1

*Lecture 3.* Reduced row echelon form, rank and homogeneous systems: Chapter 2.2

**Week 45** Modul 2: geometry

*Lecture 4.* Lines in the space and their parametric form: Chapter 1.1, Lines, planes, and general subspaces, parametric form, and as a solution of a system of equations: Chapters 1.3 and 2.1.

*Lecture 5.* Length, distance, dot product: Chapter 1.3, projection and minimal distance: Chapter 1.4.

*Lecture 6.* Cross product and volume: Chapter 1.5.

**Week 46** Modul 3: basis, abstract vector spaces and dimension

*Lecture 7.* Linear independence, basis: Chapters 1.2, 2.3

*Lecture 8.* Vector spaces: Chapter 4.2, basis and dimension: Chapter 4.3

*Lecture 9.* Coordinates with respect to a basis: Chapter 4.4.

**Week 47** Modul 4: linear mappings and matrices.

*Lecture 10.* Matrices: Chapter 3.1, linear mappings and their matrices: Chapter 3.2

*Lecture 11.* Rotations and reflections: Chapter 3.3, solution space, nullspace, column space, range: Chapter 3.4

*Lecture 12.* Inverse matrices and inverse mappings: Chapter 3.5, General linear mappings and their matrices: Chapters 4.5-4.6

**Week 48** Modul 5: determinants and eigenvectors

*Lecture 13.* Determinant of a matrix: Chapter 5.1, row and column operations: Chapter 5.2, Determinants and volume: Chapter 5.4

*Lecture 14.* Eigenvalues and eigenvectors: Chapter 6.1, Diagonalization: Chapter 6.2

**Week 49** Modul 6: Orthonormal bases, method of least squares and quadratic forms

*Lecture 15.* Orthonormal basis and orthogonal matrices: Chapter 7.1, projections and Gram-Schmidt orthogonalisation: Chapter 7.2, Method of least squares: Chapter 8.1

*Lecture 16.* Symmetric matrices and diagonalization: Chapter 8.1, Quadratic forms: Chapter 8.2

**Week 50**

*Lecture 17.* Review

*Lecture 18.* Review

**Seminars**

There are 6 seminars, each starts with a 20 min written exam. After that the seminar continues with active work with seminar assignments. If you come on time, solve the written seminar task and participate in the rest of the seminar, you will get a pass for that seminar. If you are late for the seminar you will not get a pass for the seminar. Students with special needs can get a 10-minute extended written seminar exam time. Please show certificate to the assistant. Note that this is NOT organized by FUNKA.

Each seminar you pass gives one bonus point to the exam. A maximum of 6 such bonus points can be obtained. From Part A on the exam you can get a maximum of 12 points, including the bonus points. For example, if you received 4 bonus points from seminars, and you receive 10 points on the Part A assignments of the exam, then you receive 12 points on Part A.

**Week 45** Monday 8-10

**Week 46** Monday 8-10

**Week 47** Monday 8-10

**Week 48** Monday 10-12

**Week 49** Wednesday 8-10

**Exam**

Wednesday January 10, 2018 from 8-11. Please do not forget to register for the exam in advance.