

## Applied Linear Algebra

### ECTS

5

### Prerequisites

Upper level mathematics equivalent to A-levels

### Main purpose

The purpose of the course is to equip the student with basic knowledge about linear algebra and its applications. This will enable the student to not only understand but also apply linear algebra in solving practical engineering problems. Skills in linear algebra are of high importance when dealing with scientific computing, image processing graphics, robot technology, algorithmics, coding theory, and more. As an example, the founders of Google have cited their course in linear algebra as the backbone of Google's PageRank feature (i.e. ordering web pages after importance). The course familiarizes students with scalars, vectors, matrices, determinants, operations on vectors and matrices, and systems of linear equations in matrix form. The course also presents applications of matrix theory to linear models, including examples from engineering.

### Knowledge

After successfully completing the course, the student will have gained knowledge about:

- What a vector space is, and
- How a linear representation of such spaces can be analyzed using matrix operations
- Application of linear algebra in engineering

### Skills

After successfully completing the course, the student will be able to:

- Apply techniques and results from linear algebra to solve problems in linear systems, matrices, vector space, orthogonality, eigen vectors, and eigenvalue
- Apply theory to analyze basic theoretic tasks within the below mentioned topics
- Express mathematically correct arguments
- Use mathematical terminology and symbol language

### Competences

After successfully completing the course, the student will have acquired competences in:

- Applying linear algebra to the study of various phenomena in engineering science
- Using matrices to solve concrete problems
- Using vector operations to solve concrete problems
- Applying methods and results from linear algebra in the solution of engineering problems

### Topics

- Systems of linear equations and their solutions
- Matrix algebra
- Determinants
- Vector spaces
- The eigenvalue problems
- Orthogonality
- Singular value decomposition

### Teaching methods and study activities

Approximately 150 hours. The course is a mixture of lectures, problem solving and computer/laboratory exercises with approximately 1/3 of the time devoted to each part.

### Resources

David C. Lay, 4. edition: Linear Algebra and its applications  
Matlab

### Evaluation

Grading will be done according to the 7-scale, using an internal examiner.

In order to qualify for the exam, the students must have the compulsory activity approved.

### **Examination**

The final exam is a 3 hour written exam and takes place at Campus Horsens. All supplementary materials and aids are allowed, e.g. using a computer as a reference work. Communication of any sort is not allowed during the exam and will lead to expulsion of all involved parties from the exam. Internet access is not allowed.

The re-exam may be held as an oral examination.

### **Grading criteria**

Grading is according to the 7-point grading scale.

Mark 12: Awarded to students who have shown excellent comprehension of the above-mentioned knowledge, skills, and competences. A few minor errors and shortfalls are acceptable.

Mark 02: Awarded to students for the just acceptable level of comprehension of the required knowledge, skills, and competences.

### **Additional information**

For more information, please contact Richard Brooks ([rib@via.dk](mailto:rib@via.dk)).

### **Responsible**

Richard Brooks

### **Valid from**

1.2.2017

### **Course type**

ICT Engineering;7. semester;Electives;