# TU/enable

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

*Dear prospective student,*

This is a brochure of TU/enable, an initiative of Eindhoven University of Technology. TU/enable is aimed at students with a refugee background who are currently waiting for their status or have recently received their status. Do you have an academic background and are you seeking to actively maintain and develop your current knowledge and skills in preparation for a smooth integration in the Dutch education- and labour market? TU/enable offers newcomers in the province of Noord-Brabant a chance to participate in a selection of regular undergraduate courses for free, providing you with your first experience with a Dutch university. Upon successful completion of the course a testimonium can be obtained, with except of some courses.

**What is required for me to participate in one of the courses on offer?**

In order for you to participate in one of the courses on offer, you are required to understand and speak (academic) English (at least level B2/C1). Participants are expected to have a level of education which is equivalent to at least the Dutch 'VWO-diploma' (secondary school) or to have prior academic experience. Moreover, availability and intrinsic motivation are also prerequisites. You are also required to live within one hour away from Eindhoven, because you need to travel to the university at least twice a week and we can not cover any travel costs. If you live too far away, please visit the websites of similar programs in The Netherlands that can be found at the bottom of the page

**How do I apply for one of the courses on offer?**

Simply download and fill in our intake form (see Downloads), and send it to TUenable@tue.nl, together with your CV. We will then get back to you as soon as possible. If you are not sure if TU/enable is something for you, you can also send an e-mail asking for more information or an exploratory meeting.

**How much time will each course take me?**

Each course is taught over a time period of eight weeks. These eight weeks consist of lectures and assignments (if applicable), after which an exam is conducted in the two weeks after that. Each course is expected to cost you approximately 140 hours throughout those 8-10 weeks, consisting of lectures, time spent on assignments (if applicable) and preparation time for the exam. This means that you are roughly 14 hours a week busy with a course.

**Which courses are on offer?**

In the table below you can find TU/Eindhoven courses that are open for refugee students. These courses are taught in a specific quartile in the academic year*. All offered courses are regular undergraduate courses of the Industrial Engineering faculty, the Electrical Engineering faculty or the Industrial Design faculty of which the lecturers have agreed to open their courses to students with a refugee background.

** A course is taught in a specific quartile of the academic year. This means that you can only participate in this course during that particular quartile. Thus, a course is bound to a specific quartile.*

**Can TU/enable support me with books or travelling expenses?**

TU/enable will try to make sure that students have access to the necessary study material. However, for some courses, the study material is provided by the responsible lecturer. Thus, books are not always necessary. Unfortunately, TU/enable is not able to provide support regarding travelling expenses.

# Courses on offer

Below you can find all the courses that we offer this academic year. The courses are listed per quartile, which is the period in which you can participate in a specific course. There is a possibility of participating in a more advanced course, in case of very well completing a course listed below. This will be in careful consultation with us.

## Quartile 1

Faculty: Industrial Engineering & Innovation Sciences

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 1JP00 | Fundamentals of Work & Organizational Psychology | Dr.ir. P.A.M. Kleingeld | 5 |
| 2WAB0 | Calculus variant A | Dr. F.G.M.T. Cuypers | 5 |
| 2WBB0 | Calculus variant B | Dr. F.G.M.T. Cuypers | 5 |
| 0LEUA0 | Decisions under Risk and Uncertainty | Dr. D.A. Martin | 6 |

Faculty: Mathematics

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 2IT60 | Logic and set theory | Dr. S.P. Luttik | 6 |

## Quartile 2

Faculty: Industrial Engineering & Innovation Sciences

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 1ZEUB0* | Introduction to Technology Entrepreneurship | Prof.dr.ir. M.L.A.M. Bogers | 7 |
| 1CV10 | Fundamentals of financial and management accounting | Dr. L. Tan | 7 |
| 0HV30 | Social Psychology and Consumer Behavior | Dr. Ir. P.A.M. Ruijten | 8 |

* No participation in group work; no testimonium can be obtained

Faculty: Electrical Engineering

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 5XCA0 | Fundamentals of electronics | Dr. V. Vidojkovic | 8 |

Faculty: Built environment

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 7T2X0 | Building Technology | ir. H. Schilperoort | 9 |

Faculty: Chemical Engineering and Chemistry

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 6A3X0* | Advanced calculus for CEC | G. Skantzaris | 9 |

* Prerequisite: the course 2WAB0 or 2WBB0. If you have acquired sufficient knowledge about Calculus in another way, this will be verified.

Faculty: Industrial Design

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| DAB150 | Introduction to Business Design | J.J.H. Steenbakkers | 10 |

## Quartile 3

Faculty: Industrial Engineering & Innovation Sciences

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 1BV00 | Fundamentals of business information systems | Dr.ir. H. Eshuis | 11 |
| 0HV00* | Behavioral Research Methods | Dr. G. Rooks | 11 |

* No participation in group work; no testimonium can be obtained

Faculty: Mathematics

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 2DE20* | Mathematics 1 | dr. J.C.M. Keijsper | 11 |

*Prerequisite: the course 2WAB0 or 2WBB0. If you have acquired sufficient knowledge about Calculus in another way, this will be verified.

Faculty: Built environment

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 7W9X0 | Transportation engineering | Dr.ing. P.J.H.J. van der Waerden | 11 |

## Quartile 4

Faculty: Industrial Engineering & Innovation Sciences

| Course code | Course name | Responsible lecturer | Page number |
|---|---|---|---|
| 1JK00 | Management of human behaviour in organizations (Non IE) | Dr. L. van der Meij | 13 |
| 1CK40* | Intermediate finance and accounting | Dr.ir. L.P.J. Schlicher | 13 |

| | | | |
|---|---|---|---|
| 0SV20 | Industrial Ecology to cradle-to-cradle: mass flow based concepts | Dr.ir. L.G. Wesselink | 13 |

* Admission depended on motivation letter, interested students have to write a motivation letter to the responsible lecturer

Faculty: Mathematics and Computer Science

| **Course code** | **Course name** | **Responsible lecturer** | **Page number** |
|---|---|---|---|
| 2DBI00 | Linear algebra and applications | Dr. M.E. Hochstenbach | 14 |
| 2IS50* | Software Development for Engineers | Dr.ir. T. Verhoeff | 15 |

*Prerequisites: the course 2WAB0 or 2WBB0 + knowledge about the basics of the programming language Python. If you have acquired sufficient knowledge about Calculus in another way, this will be verified.

## Quartile 1

**1JP00 – Work & Organization Psychology**

Competent, motivated and productive employees are a crucial asset for many organizations. Therefore, insight into the human factor in organizational processes is highly relevant for Industrial Engineering, Innovation Management, and Operations Management students. In this course, students will acquire knowledge of 1) important concepts and findings from personnel, work- and organizational psychology, 2) common research methods that are used in the domain of work- and organizational psychology, and 3) basic descriptive and inferential statistics. Below the major topics covered:

Block 1

- Methods and techniques in W&O psychology
- Individual differences and personnel selection
- Work performance, job analysis, and performance evaluation
- Training and development, work motivation

Block 2

- Attitudes, emotions, stress, and health
- Leadership and decision-making
- Teams and diversity

Block 3

- Organizational structure & Digitization at work
- Organizational culture
- Organizational change

**2WAB0/2WBB0 – Calculus variant A and B**

Technical science uses mathematics as a language to describe phenomena and to solve problems. With trigonometry one can describe waves. In many problems an optimal setting of parameters should be found. This can be done with mathematical techniques such as differentiation. Integral calculus is needed for the calculation of a centre of gravity. Many models use differential equations. In this course you will learn these and other basic techniques with applications.

This course is offered in two variants: a regular variant A and a more advanced variant B.

Topics in this course include:

- Algebraic Skills, Functions: Recapitulation of elementary algebra and high school mathematics with emphasis on algebraic skills (such solving inequalities), Cartesian coordinates, and functions; in particular, algebraic manipulation of trigonometric, exponential and logarithmic functions;

- Limits: The conceptual definition of limits; computation of various types of limits; the concept of continuity;
- Differentiation: The notion of differentiable functions; interpretation of derivatives in terms of tangent line; computation of derivatives using the product, quotient, and chain rules; implicit differentiation. Linear approximations of functions; l'Hôpital's rule for computing limits;
- Transcendental functions: Inverse functions of one-to-one (injective) functions; in particular, the main properties of the natural logarithm (as inverse of the exponential function) and of the inverse trigonometric functions;
- Integration: Definite and improper integrals; integration by substitution and integration by parts; sums and Sigma notation, Riemann sums. Application of integration;
- First-Order Differential Equations: First-order differential equations (separable differential equations);
- Vectors in the Plane and in Space: Equations and parametric (vector) equations for lines in the plane and in space, for planes in space; dot products and cross products; lengths of vectors, distances and angles between vectors.

**0LEUA0 - Decisions under risk and uncertainty**

Virtually all technologies confront enterprises, citizens and societies with opportunities and risks. For instance, citizens enjoy the efficiency and convenience of Internet hosting of their data, but major security breaches cast doubt on the government's ability to ensure data security. The USE learning line Decisions Under Risk and Uncertainty focuses on questions about how different actors (citizens, enterprises, governments) deal with these dangers:

1. In an engineering context, how are risks created or averted, and who is involved?
2. How can we analyze and quantify risks, and make decisions based on this analysis?

Student groups will meet with one or more of the project coordinators weekly during the term.

*Additional test information:*
*The student group reformulates a problem from the stakeholder in such a way that:*

- The problem is researchable.
- The problem has been explained in a way that is acceptable to stakeholders.
- The relevance of theories of safety, risk, and decision-making is clear and integral to the problem.
- The student has shown an ability to find and evaluate relevant scientific evidence, making use of contemporary concepts of scientific evidence, scientific objectivity, and values in science, in the reformulation.
- The student takes a standpoint on a scientific argument regarding the USE aspects of the problem.

Students will be assessed individually on how they have contributed to the satisfaction of these criteria.

**2IT60 – Logic and set theory**

Subjects: Propositions, truth tables, equivalence, logical consequence, tautology, contradiction, contingency. Predicates, quantifiers, variable binding. Logical derivation, reasoning with propositions and predicates, conclusion, assumption, context, validity. Set, subset, intersection and union, complement, difference, the empty set, powerset, cartesian product. Relation, equivalence relation, class, partition. Mapping (function), image and source, injection, surjection, bijection, inverse function, composition of relations and functions. Partial ordering, linear ordering, Hasse diagram, maximal and minimal elements. Induction, strong induction, inductive definition.

## Quartile 2

**1ZEUB0 – Introduction to Technology Entrepreneurship***

This course introduces the students to the topic of entrepreneurship for high-tech products and services. It concentrates on creating and evaluating a portfolio of entrepreneurial opportunities, and on designing a business model for a selected entrepreneurial opportunity, thereby recognizing the main challenges surrounding new business development for high-tech products and services. The course will be taught via a blend of interactive (guest) lectures, class discussions and assignments.

The topics covered in the course include creating and evaluating entrepreneurial opportunities from the viewpoint of effectual entrepreneurship. Special attention will be given to fostering creativity for new business development. Furthermore, the design of a business model will be discussed, thereby also focusing on challenges surrounding new business development, like entrepreneurial marketing and entrepreneurial finance.

The aims of this course are:

*To create knowledge and understanding of:*

- Entrepreneurial opportunity creation and evaluation;
- The components of a business model;
- Main issues surrounding new business development for high-tech products and services.

*To create skills to enable students to:*

- Create entrepreneurial opportunities;
- Evaluate entrepreneurial opportunities;
- Design a business model for an entrepreneurial opportunity.

Together these two learning goals contribute to creating an entrepreneurial mindset.

* No participation in group work; no testimonium can be obtained

**1CV10 - Introduction to financial and management accounting**

Focus of this course is on companies in terms of goods and cash flows. Goods flow through a company from suppliers to customers. These goods flows cause cash flows in the opposite direction, from customers to suppliers of production resources. The success of a company is measured, amongst others, by the amount of profit gained by the activities. Important topics are consequently: (relevant) costs, cost calculations, revenues, and financial performance and position.

This course deals with basic and more advanced theoretical economic concepts in the areas of financial accounting and management accounting. At the end of the course students should be able to:

- Explain and discuss basic financial statements and conventions;
- Explain and discuss management accounting concepts;
- Create basic financial statements;
- Use economic concepts to solve financial and management accounting problems.

The following topics will be covered in the course:

1. *Financial Accounting topics:* Double entry bookkeeping, Balance sheet and Income statement, Accounting conventions.

2. *Management Accounting topics*: Cost terms, concepts, classifications, and estimation, Cost behaviour and Cost-volume-profit analysis, Activity-Based Costing and Activity-Based Management, Job and order costing, influence of costing system on profit, Joint products and process costing, Service department costing, Decision making (short term, relevant costs), Decision making (long term, cost-cash relation), Profit planning and budgeting, Segment reporting, decentralization, transfer pricing.

**0HV30 – Social Psychology and Consumer Behavior**

Social psychology studies how thoughts, feelings, and behaviors of individuals are influenced by the actual, imagined or the implied presence of others. Social psychologists seek to understand the social performance of individuals rather than behaviors of groups of people, such as societies or communities. When trying to find explanations, social psychologists commonly stress the significance of social and individual influences whereas personality psychologists preferably focus on personal traits, skills, capabilities and their individual differences. Not surprisingly, if the goal is a more applied one, such as better understanding implementation problems of new technologies or changing people's energy consumption, social psychology theories are the ones that are commonly adopted.

One of the most important application domains of this fundamental knowledge is for understanding consumer behavior. That is, technology is made for people. Through understanding social psychology, you will gain understanding of one of the most fundamental building blocks of the psychology of technology, closely related to a crucial application domain: understanding the consumer of technology.

This course aims at a better understanding of people's social nature based on the theories and explanations that represent the state-of-the-art social psychology knowledge. Students will become acquainted with approaches that deal with social perception, self-presentation, attitude formation and change, social pressure and prejudices, as well as moral and group behavior. Students are expected to bridge the gap between theory and potential applications within the frame of Human-Technology Interaction through presentations of a technological application.

**5XCA0 – Fundamentals of electronics**

After following the course, the student can: analyze generic linear circuits in DC and sinusoidal regime; describe the frequency behavior of linear circuits and plot Bode diagrams; analyze and build circuits using operational amplfiers; describe the non-linear beaviour of a MOSFET transistor and analyze simple circuits based on MOSFETs; describe the difference between combinatorial and sequential electronics; analyze, simplify and syntetyze simple combinatorial circuits; analyze, simplify and syntetyze simple sequential circuits.

Following the course Fundamentals of Electronics you will learn the basics of analog and digital electronics, with emphasis on how to create electronics to make measurements. You will get acquainted with elementary circuit theory, that will help you to analyze and understand the behavior of circuits.
Circuits typically allow to process information, which can be expressed in several possible representations. Their inputs can for example be connected to sensors, which transform physical quantities to voltages or currents; and their outputs can be linked to actuators that do the reverse. The circuit itself can be for instance a frequency selective filter, or an amplifier with transistors or 'op-

amps' (analog circuits), or can perform a logic operation (digital circuit). Several examples of analog circuits will be discussed. In order to understand their principles, the fundaments of semiconductors, transistors and operational amplifiers are explained. Besides analog electronics, also digital electronics will be treated, both combinatorial logic as well as sequential circuits like memory registers, shift registers and counters. Apart from theory, you will also do a short practical training where you will design, build and measure a small circuit. After having followed this course, you will be able to recognize, understand and use some of the most important principles of modern electronics and its applications.

**7T2X0 – Building Technology**

Introduction to Building Technology: What are the most common solutions for building components and why do we build that way? Which technical requirements do the building components have to fulfill? And how do they do that? We will discuss the properties, performances, application, composition and making of the most common types of substructures, structures, floors, roofs, facades, facade openings and interior systems. And basic design criteria from the fields of structural design, building physics and construction. But before we discuss those subjects, we spend one week on reading and "writing" technical drawings.

After successful completion of this course:

- you know the basic properties, performances and applications of the most common solutions for building components (substructures, structures, floors, roofs, facades, interior systems).
- you know what the most common solutions for building components (substructures, structures, floors, roofs, facades, interior systems) are made of (products, systems, materials) and how they are made.
- you know and understand the basic design criteria for building components (substructures, structures, floors, roofs, facades, interior systems) from the fields of structural design, building physics and construction; and you are able to apply them in a qualitative evaluation of a design.
- you are familiar with standards for technical drawing and you can use/apply this knowledge both for reading and making technical drawings.

**6A3X0 – Advanced calculus for CEC***

Learning objectives:

- Mastering the methods to solve second order linear homogeneous and inhomogeneous differential equations with constant coefficients.
- Being able to compute with the different representations of complex numbers.
- The ability to analyse functions of more than one variable using: Level curves, partial derivatives, the gradient, linear approximations and the tangent plane, Taylor series.
- The ability to compute and work with double and triple integrals, by reducing them to repeated integrals with special attention to Cartesian, polar and spherical coordinates.
- Knowledge of the notion vector field, and the ability to integrate vector fields along curves and through surfaces.

Contents: Second-order differential equations. Complex numbers. Functions of two real variables, planes, lines, vectors, distance, partial derivatives, the chain rule(s), linear approximations, gradient, directional derivative. Optimisation: Find and classify extrema by examining critical, singular and boundary points (with or without side conditions), using the Lagrange multipliers method. Double integrals in cartesian and polar coordinates. Triple integrals using cylindrical and spherical coordinates. Vector fields: vector-valued functions, curves and fields, conservative fields and line integrals, surfaces and surface integrals, in particular for parametrized surfaces.

* Prerequisite: the course 2WAB0 or 2WBB0. If you have acquired sufficient knowledge about Calculus in another way, this will be verified.

**DAB150 – Introduction to Business Design**

This course is facilitated by the Systemic Change group. As a future industrial designer, one of your dreams could be to turn innovative concepts into successful businesses in the market. In this course we will introduce the basics of realizing that dream.

We will do this by covering four fundamental aspects of business design:

1. User and Market
2. Design, Technology and Intellectual Property (IP)
3. Design and Branding
4. Finance and organization

In this course you will learn the basic components that are of importance to make business of your design ideas. You will gain insight and experience in the four fields that are relevant in the business & entrepreneurship area of expertise.

- What is the relationship between business and design?
- How to turn a design into successful business?
- What are the important components you need to take in account when designing for a market implementation?

Many of our students consider business as a downstream design activity and it only starts after you have a solid concept. We are going to show you how business and design can be intertwined.

## Quartile 3

**1BV00 – Fundamentals of business information systems**

Modern organisations need business information systems to support their internal operations and their interactions with external parties (suppliers, customers, competitors, government, etc). As such, basic knowledge on the concepts of business information system development and management is essential. Business processes and information systems are interwoven: changing a business process results in changing the information systems supporting it and vice versa. It is therefore also important that students are able to model the complex relation between business processes and information systems. In this relation, data and process models play a key role. A data model specifies which data of the business process the supporting information systems should collect, store and manipulate. A process model specifies the steps in the business process and their interdependencies that have to be supported by the information system. Both types of model can be used to develop or configure information systems that support business processes.

**0HV00 – Behavioral Research Methods***

This course provides a general introduction to the behavioral and social research methods. The course introduces students to all phases of innovation science research from the conceptualization of a research question, to the operationalization of the research question, to the analysis of data, and writing of a research report. The course has a strong emphasis on "learning by doing". A major practical in the course is the design and implementation of a qualitative interview study. To prepare you for this study, you will be trained in conducting a professional research interview under the supervision of a professional trainer. You will also learn how to design a questionnaire for use in a (online or offline) survey, and learn how to practically deal with the quantitative data that is collected in a survey. You will apply various research methods in teams, and learn how to collaborate with others efficiently.

* No participation in group work; no testimonium can be obtained

**2DE20 – Mathematics 1***

This course consists of (parts of) the following modules: Systems of linear equations, Matrices, Vectorspaces, Bases, Rank, Determinants, Eigenvalues and eigenvectors, Diagonalizable matrices, Inner product spaces, Orthonormal bases, Linear transformations, Properties of linear transformations, Change of basis, Systems of linear differential equations, Functions of several variables, Double integrals.

*Prerequisite: the course 2WAB0 or 2WBB0. If you have acquired sufficient knowledge about Calculus in another way, this will be verified.

**7W9X0 – Transportation engineering**

Increasing requirements regarding comfort and accessibility claim better designed road infrastructure including surrounding environment. Solutions will be provided in order to create more comfortable and sustainable urban road infrastructure and environments.

The course consists of lectures and practical assignments. Theoretical, practical as well as statutory aspects will be dealt with.

**Quartile 4**

**1JK00 – Management of human behavior in organizations (Non IE)**

This course is about the human factor in all types of organizations. The focus is on phenomena which are the result of psychological processes in organizations. This is of practical relevance since adequate decision making of both managers and technical specialists are important factors to success.

After having followed this course, students should be able to:

- describe and criticize the most important theoretical perspectives within the field of organizational psychology
- describe how factors at the individual, group, and organizational level relate to job performance and job satisfaction.
- apply theoretical knowledge from organizational psychology onto a relevant personal experience or a current topic in the media.
- organize and lead a workshop in which group members actively participate.
- relate the behavior of group members to theoretical perspectives in organizational psychology and critically reflect upon this.

*Topics*: Leadership, communication, conflicts, negotiation, work motivation, attitudes, personality, individual and group decision-making, power, teams, stress and health, organizational structure and task design, organizational culture, human resource management, and organizational change.

**1CK40 – Intermediate finance and accounting***

The first part of this course builds upon the material taught in 1CV10. In particular, students learn how to create and analyze the cash flow statement. Besides, they learn how to use financial ratios to analyze and interpret the performance of a company.

In the second part of the course, students learn various (quantitative) methods and techniques to facilitate proper financial decision making. We start with techniques to evaluate deterministic cash flows streams. In particular, students learn how to work with the net present value and internal rate of return. Thereafter, students apply these techniques to value fixed income securities such as loans, mortgages and bonds. They also use these techniques to value firms, discuss how to structure firm capital and execute proper capital budgeting. Thereafter, students learn and apply the mean-variance model of Nobel laureate Markowitz and the capital asset pricing model. These models introduce (one-period) uncertainty and illustrate the trade-off between risk and return. Finally, students learn the basics of (financial) options, and how to use them to manage risk.

Two group assignments are part of this course. These assignments will deal with realistic business problems.

* Admission depended on motivation letter, interested students have to write a motivation letter to the responsible lecturer

**0SV20 – Industrial Ecology: mass flow based concepts**

In this course we will focus on mass flows: natural mass flows (elemental cycles, including the carbon cycle); flows through the industrial system and their environmental impact (materials, processes, products); and flows at a more aggregated level (product chains, sectors, compartments or complete economies). We will present basic concepts and data, and explore and apply analysis tools and

critically reflect on them. As such, the course is interesting for anyone involved in production, chemicals, building or energy.

The building blocks of the course are:

- Introduction to the field of industrial ecology and system thinking;
- The material basis: earth, materials and processes';
- Crucial environmental problems
- Mass flow analysis, embodied energy, and life cycle analysis (for environmental impact assessment), including modeling issues of goal and scope, system boundaries, sensitivity analysis, data quality, critical reflection; can apply this on simple examples (exam: conceptually & simple calculations) and on more complicated cases (several pre-structured assignments)
- Concepts, like industrial symbiosis, cradle-to-cradle, ecological footprint, depletion.

The course is strongly structured and consists of a set of modules which are sequentially discussed in the lectures. During the course there will be four intermediate multiple choice exams. In each intermediate exam, the study material of a set of three to four modules will be examined. In parallel, students will carry out four assignments. Only for the multiple choice exams a single retake is possible. The retake comprises the study material of all four intermediate exams.

This setup of the courses requires students to actively participate in the weekly lectures and align their study pace with the weekly provided study material.

**2DBI00 – Linear algebra and applications**

This course offers a wide range of interesting linear algebra techniques and very nice applications, including Big Data applications. These techniques are almost indispensable for the current Big Data era, and are also relevant for the field of Artificial Intelligence, including Deep Learning.

- You will learn how to solve linear systems, arguably the most common and important scientific problem.
- Least squares methods can be used to determine an approximate line (or polynomial, or spline) through a number of points (used in Computer Graphics).
- Rotations and reflections are useful for Computer Graphics and Robotics.
- Angles between vectors can be used to compare tastes of movies, music, or books, and to predict such tastes for the future.
- You will learn the idea behind Google PageRank and its connection with eigenvalues, how it is computed, and you can also apply similar techniques to finally determine which of Ajax, Feyenoord, or PSV is the best team.
- We can use text mining methods to determine the most important tweets or keywords from a set of tweets; useful for effective communication. Similar techniques may be used to study customer behavior.
- The course is designed to be interesting for many students, including (but not restricted to!) students from Computer Science, Data Science, and Robotics.
- The subjects are fascinating on their own, but also form an ideal preparation for subsequent courses such as Data Mining, Machine Learning, and Computer Graphics.
- The course offers a nice combination of theoretical (math) and practical (implementation) work, partly done in groups.

- You can use a language you already know (for instance Python or Matlab) or learn a new language (for instance Julia).

**2IS50 – Software Development for Engineers***

After this course, the student knows the main aspects of software development (requirements, design, implementation, testing, documentation, version control) and is able to develop as, an individual, simple Python applications that can be released for use and maintenance by others, for instance, as open source software.

Python: types, values, variables, expressions, assignment, if-elif-else, loops, functions, comprehensions, generators, modules, exceptions, i/o Some modules from the Python standard library Some standard algorithmic techniques, including recursion Built-in documentation using docstrings Automated testing with doctest and pytest Version control using Git Issues tracking, continuous integration with GitLab External documentation on readthedocs.io

*Prerequisites: the course 2WAB0 or 2WBB0 + knowledge about the basics of the programming language Python. If you have acquired sufficient knowledge about Calculus in another way, this will be verified.