First year courses

Year 1 Compulsory Course(s)

Faculty of Science and Engineering

Introduction to Business Engineering

Full course description

The aim of this course is to provide the foundation for business engineering. The student gets an overview of what it entails to become and to be a business engineer. Based on the societal needs of sustainability, big data/digitalisation and health/wellbeing, the course highlights the role of close cooperation between boardmen/women, scientists and engineers. The course will discuss the four fundamental functions of management: planning, organising, leading and controlling. In the course, students become familiar with the foundations of business engineering. This includes the relationship between engineering and management, planning and forecasting, managing research and development, managing engineering design, planning production activities, planning production operations, leadership as well as an introduction to marketing and cost calculations.

Course objectives

In this course, students

- demonstrate up-to-date academic knowledge that connects business to engineering and science
- are aware of the ethical consequences of solutions to complex problems
- connect business and engineering in solving complex problems
- explain the complexity of contemporary management problems
- understand and evaluate a complex business problem in the field of engineering
- understand complexity of contemporary management problems and how these affect society
- understand that a unity of knowledge beyond disciplines gives a better understanding of the present world

Prerequisites

Not applicable.

Recommended reading

- Morse, L.C. and Babcock D.L. (2014). Managing engineering and technology, International Edition, Sixth Edition, Pearson, 512pp.

BENC1001

Period 1
1 Sep 2020
23 Oct 2020

Print course description
ECTS credits:

5.0
Instruction language:
English
Coordinator:
L.R.J. Quintens
Teaching methods:
Lecture(s), PBL
Assessment methods:
Final paper, Written exam

Faculty of Science and Engineering

Calculus

Full course description

The course introduces some of the main mathematical tools, which must be known to modern business engineers. These include advanced integration techniques and the analysis of dynamical systems. The course offers students additional understanding of the role mathematics plays in modern society, the sciences and the business world.

After completing this course students should be able to:

1. Calculate limits using the limit laws.
2. Calculate derivatives by applying the product rule, quotient rule, and chain rule, and combinations thereof. In addition, the student can use these techniques to find the local and absolute extreme values of a given function.
3. Calculate integrals using the standard techniques of integration (substitution rule, integration by parts, trigonometric integrals and substitutions, integration of rational functions by partial fractions) and is able to recognize which technique is best used in a given situation.
4. Calculate with complex numbers, can plot them in the complex plane, is able to formulate and use DeMoivre's Theorem
5. Solve separable first-order differential equations and can calculate the general solution of a first-order linear differential equation by means of an integrating factor.
6. Solve homogeneous second-order differential equations with constant coefficients and calculate a particular solution for nonhomogeneous equations using the method of undetermined coefficients.

Course objectives

After passing this course, students will be able to perform basic single-variable calculus operations. We will cover limits and continuity, differential calculus of a univariate function, inverse and transcendental functions, mean value theorem, integral calculus, sequences and series, an introduction to differential equations, and some approximation theory. In addition to the main facts and concepts, problem-solving strategies will be discussed. Throughout the course numerical and computational aspects are highlighted using standard computer programs like Wolfram Mathematica and MATLAB. Weekly exercises, presented and discussed in tutor groups, allow students to test and refine their understanding of the covered material.

Prerequisites

The course unit assumes only prior knowledge acquired from Mathematics B as taught in pre-university programmes (VWO) on Dutch secondary schools (or equivalent).

Recommended reading

- University Calculus: Early Transcendentals in SI Units, 4th Edition Joel R. Hass, Maurice D. Weir, Global Edition

BENC1002

Period 1
1 Sep 2020
23 Oct 2020

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
M. Staudigl
Teaching methods:
PBL
Assessment methods:
Written exam

Faculty of Science and Engineering

Fundamentals of Engineering

Full course description

This course introduces the fundamentals of engineering. It provides an overview of the various engineering fields, which are covered in the Business Engineering programme, such as systems engineering, electrical engineering, mechanical engineering, transport phenomena (heat and fluid), sensor and optical engineering with a specific focus on the open-ended and multidisciplinary nature of typical engineering problems and the underlying scientific principles. The students familiarize with the engineering design cycle, which consists of formulating a problem, setting design requirements, generating several concepts, selecting the optimal solution and realizing it. Upon completion, students will be able to identify and explain the elementary process steps in scientific instrumentation design, modelling and engineering. Special attention is paid to the underlying scientific principles and laws of the mentioned engineering fields as well as the elementary modelling steps of engineering systems. The course prepares students for later courses in which they continue the development of their engineering skills to assist selection of appropriate materials for a design and accompanying make production process decisions. In this light, students need to perform this with an understanding of the business and financial impact, but also the academic environment as well as ethics, safety and sustainability aspects. Finally, the course explains the transdisciplinary role of engineers in a rapidly changing globalising world.

Teaching methods:
The course follows the problem-based learning approach with a company visit, 6 lectures, 6 tutorials and 6 workshops.

Assessment methods:
Team report made according to a predefined format (30% of the final grade) and final individual exam consisting of multiple choice and open-ended questions (70% of the final grade).

Course objectives

1. Reproduce knowledge on the generic engineering design cycle and describing functional elements in devices, systems, products.
2. Understand, explain and use basic engineering principles and recognition of orders of magnitude.
3. Perform elementary modelling and basic calculations on mechanics, energy, electricity, fluids and heat transfer.
4. Define an engineering problem and explain the relationship with business processes both in written text and via graphic schemes.
5. Demonstrate understanding of engineering problems related to their societal and regional context to detect the most viable by searching and studying additional literature.
6. Adapt to new and emerging technologies and recognize innovative elements in a design.

Prerequisites

No prerequisites are required.

Recommended reading

- Moaveni S. (2016). Engineering Fundamentals: An Introduction to Engineering, SI Edition. Cengage Learning, 5th edition, ISBN 978-1-4390-6208-1
- Khandani S (2005), Engineering design process. View date: 1-5-2019

For basic sketching: http://www.delftdesigndrawing.com/ and https://sketching.nl/. View date: 23-04-2020

BENC1003

Period 2
26 Oct 2020
18 Dec 2020

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinators:
G.J.M. Tuijthof
B.R.N. van Grinsven
Assessment methods:

Written exam

Faculty of Science and Engineering

Linear Algebra

BENC1004

Period 2
26 Oct 2020
18 Dec 2020

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
M. Musegaas

Faculty of Science and Engineering

Economics for Business Engineering

Full course description

This course is both an introduction to microeconomics as well as macroeconomics. Microeconomics is the economics branch concerned with the decisions of individuals and how they use markets to interact. We start by learning the basic concepts of microeconomics such as supply and demand, elasticities and the variety of market structures. We then focus on macroeconomics, which deals with the aggregate behavior of the economy. We will learn about such topics as why some countries grow faster than others, how the financial and monetary system work and the influence of monetary and fiscal policy on the aggregate demand for goods and services.

Course objectives

- Understand the basic concepts of microeconomics
- Learn about the different types of markets structures
- Learn and apply macroeconomic principles to understand the macroeconomic performance of a country
- Learn and understand the impact of fiscal and monetary policies

Recommended reading

- Mankiw, Gregory. Principles of Economics, 9th Edition (2020)

BENC1005

Period 4
1 Feb 2021
2 Apr 2021

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
D.F. Sampaio Lima
Teaching methods:
Lecture(s), PBL
Assessment methods:
Written exam

Faculty of Science and Engineering

Statistics

Full course description

In our course, we will focus on the following topics:

- Methods of data collection, and types of data.
- Descriptive statistics: describing important characteristics of populations or samples by numerical methods as the mean, median, mode (measures of central tendency), variance and standard deviation (measures of spread) as well as by graphical methods, like histograms, bar charts or Box-and-Whiskers displays.
- Probability theory, as an introduction to random variables.
- Discrete random variables and the most important discrete probability distribution: the binomial distribution; continuous random variables and two continuous probability distributions: the uniform and the normal distribution.
- Sampling theory, as the foundation of inferential statistics, or inductive reasoning.
- The construction of confidence intervals to estimate unknown population parameters.
- Hypothesis testing for both the proportion and means cases.
- Regressions analysis and ANOVA: the investigation of relationships.

Teaching methods:
Tutorial groups.

Assessment methods:
Final exam and intermediate quizzes.

Course objectives

- Recognize the importance of data collection, identify limitations in data collection methods and other sources of statistical bias, and determine their implications and how they affect the scope of inference.
- Use statistical software to summarize data numerically and visually, and to perform data analysis.

- Have a conceptual understanding of the unified nature of statistical inference.
- Apply estimation and testing methods to analyse single variables or the relationship between two variables in order to understand natural phenomena and make data-based decisions.
- Model numerical response variables using a single explanatory variable or multiple explanatory variables in order to investigate relationships between variables.
- Interpret results correctly, effectively, and in context without relying on statistical jargon.
- Critique data-based claims and evaluate data-based decisions.
- Complete two research projects: one that employs simple statistical inference and another that employs more advanced modelling techniques.

Prerequisites

None.

Recommended reading

- OpenIntro Statistics, 4th Edition, 2019, 422 pages, by David Diez, Çetinkaya-Rundel, Christopher D. Barr.

This is an open access text, you can download the text from the website of OpenIntro: https://www.openintro.org/stat/textbook.php?stat_book=os

BENC1006

Period 4
1 Feb 2021
2 Apr 2021

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
D.T. Tempelaar
Assessment methods:
Written exam

Faculty of Science and Engineering

Materials Engineering

Full course description

This course will cover 6 learning objectives:

1. Gain knowledge of materials classification and properties, of engineering, production and characterization methods as well as of various application areas
2. Understand the relationship between the production of materials for different applications and the business processes needed to support the production
3. Analyze a materials engineering problem and assess which expertise, materials, laboratory infrastructure and experiments are required to investigate and solve this problem in an efficient

manner through scientific research
4. Understand the complexity of the process of selecting, designing, producing and applying a material for an intended application
5. Understand the global developments of the production process of materials
6. Develop scientific knowledge in the field of materials engineering through study

To achieve these learning objectives, it is important to start this course with the understanding of the atomic structure and interatomic bonding in materials, because they form the basis for the classification of materials and for understanding of their properties. Different material classes (metals, ceramics, polymers, composites) will be studied and a large number of properties, including magnetic, electrical, thermal, optical, as well as mechanical properties will be thoroughly investigated for the different types of materials. Based on the gained theoretical knowledge students will be taught how to select the optimal material for a certain application and how these applications will impact businesses.

The course follows the problem-based learning (PBL) approach. Characteristic of this approach is that learning is the result of an engaged interaction between academic staff and students, fueled by their experience and knowledge, with the objective of developing understanding and insights. Next to tutorial sessions, the course prepares for other Engineering courses and the projects in the curriculum.
The course is structured including lectures, tutorials and a lab session (experimental).

The assessment of the course has three components.

1. Team report on a selected materials engineering topic (free to choose)
2. Lab report on the exercises done in the lab
3. Final examination (individual written exam), which consists of open questions and problems

Attendance of all tutorial meetings and the lectures is required.

Course objectives

The aim of the course is to instruct students in the fundamentals of materials science and engineering. The students will gain a better understanding of engineering and how it impacts our daily lives in various ways.

Prerequisites

- To be a student enrolled in the BSc Business Engineering programme.
- To have passed the courses Introduction to Business Engineering (Y1/P1) and Fundamentals of Engineering (Y1/P2)
- To be sufficient in English language (teaching and examinations will be conducted in English).

Recommended reading

- Materials Science and Engineering: An Introduction, 10th Edition, William D. Callister Jr., David G. Rethwisch, ISBN: 978-1-119-40549-8, January 2018

BENC1007

Period 5
5 Apr 2021

4 Jun 2021

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
E. Rosado Balmayor
Assessment methods:
Written exam

Faculty of Science and Engineering

Experimentation in Science and Engineering

Full course description

The experimentation in science and engineering course will introduce the entire process behind scientific research. Starting from the definition of a research question, going to the search for the theoretical principles that are behind the problem. In the final stage, students will learn how to design their experiment while keeping safety, sustainability and time management in mind. The theory will be applied with real life case studies. For these cases studies students will go through all former stages and design their experiment. Furthermore, sites visits will be planned in order to give students a realistic image of how experimentation is done in real life context in an engineering company.

This course consists of 8 tutorial group meetings, 6 lectures, 4 lab sessions and 1 company visit in which we discuss Problem Tasks and Case studies.
Problem Tasks are discussed following the seven-jump PBL approach. Case studies are real life problems where students will have to provide a solution for following the RBL approach. Students work together in small groups (2-3 people) in order to solve the problem. Furthermore, hands-on lab sessions will be coupled to the case studies.

There are 3 different points of assessment in this course:

1. A midterm examination on the theories and concepts discussed during the course and a case study (30%).
2. Team performance during the lab (10%).
3. A scientific paper (lab report) about the case studies/ lab experiments (2x30%).

Course objectives

• Students obtain an understanding of the fundamental processes in science and engineering research.
• Students are able to set up a scientific experiment and are familiarized with the execution of scientific research experiments.
• Students are able to plan and perform basic laboratory experiments in a safe manner, analyze and process the data.
• Students are able to apply knowledge to solve complex scientific research questions.
• Students understand the implications of new developments in science and engineering.
• Students are able to relate research questions to the appropriate scientific theory and relate

scientific theory to a research experiment.
- Students are able to work in small teams.

Prerequisites

This course does not have prerequisites.

Recommended reading

To be announced.

BENC1008

Period 5
5 Apr 2021
4 Jun 2021

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinators:
H. Diliën
B.R.N. van Grinsven
K.B.L. Eersels

Year 1 Compulsory Skill(s)

Faculty of Science and Engineering

Academic Skills and Project Management

Full course description

The scientific world has its own strict set of rules with respect to collecting and analyzing data and reporting on findings. The academic skills part of the course will provide students with an introduction into this array of skills. In addition, presentation training will be part of the course in order to help students strengthen their abilities to present their scientific work in an effective and efficient way. The project management part of this course offers an insight in the role of project management in different organizational contexts. Nowadays, the development of new products, services and processes is carried out in project groups. That means that people from different disciplines are brought together on a temporary basis to accomplish a complex task. Special attention is given to the following issues: project selection, project manager, project planning, resource allocation and project control.

Course objectives

- Presenting arguments in a logical way and formulate conclusions.
- Developing a solution to a case study problem in a team setting.
- Presenting scientific results (both oral and written) to an audience of academics and practitioners.
- Translating a problem into a manageable project.
- Developing an awareness of the range, scope and complexity of the phenomena, issues and problems related to project management.
- Offering an integrated perspective on managing complex projects (that can include organizational change).
- The ability to apply tools, techniques, methods and models for project management.

Prerequisites

No prerequisites are required.

Recommended reading

- Project management: a managerial approach 9th edition, Mantel, Meredith, Shafer and Sutton, Wiley, 2016. ISBN: 978-1-118-94583-4 (mandatory)
- The academic skills handbook, 1st edition, Hopins and Reid, 2018. ISBN 978-1-473-99715-8 (mandatory)

BENS1001

Period 1
1 Sep 2020
23 Oct 2020

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinators:
P.W.L. Bollen
L.R.J. Quintens

Faculty of Science and Engineering

Software Skills

Full course description

The skill "Software Skills" is the second skill of the BSc Business Engineering programme. It covers a variety of foundational software skills which every business engineer should have in his/her repertoire.
In this course, students will become acquainted with a wide range of software tools that will be encountered repeatedly during course and project work. They learn the basics of the writing of SQL queries (in Microsoft Access). This serves as a prelude to skills that will be further developed in the Computer Science skills in Year 2. Students will also learn to write scientific papers by using the

typesetting system LaTeX. A selection of project management tools are presented to the students for collaboration, communication, scheduling and so forth, building on the foundations provided by the Academic Skills and Project Management skill. Mathematical software tools encountered in the courses (MATLAB and R) receive further attention to anchor the skills learned in those courses. Moreover, an introduction to 3D modelling will be offered in order to get acquaintance with this skill and some of the potential applications in business engineering.

Teaching methods:
The course will alternate lectures where different tools will be presented and hands-on tutorials to put into practice the knowledge gained. The course will include, but not limited to, statistic for Business Engineering, numerical computing environments, collaborative tools, project management software and 3D modelling.

Assessment methods

1. Graded exercises: In the tutorials/laboratory sessions, students are presented with a list of exercises that help the student to gain practical experience in the material presented in the previous lecture. These exercises will typically require more time to complete than available in the tutorial/lab. They are completed at home and are submitted for grading.
2. Attendance requirement: The course consists of lectures and hands-on tutorials. Both lectures and tutorials cover important skills. Participation is therefore fundamental to an individual's success. Therefore, attendance of tutorial/lab meetings and the lectures is required. Missing 4 or more of the 14 meetings (tutorial group meetings or lectures) will lead to a FAIL for attendance.

Course objectives

The aim of this course is to ensure that students are able to use a wide range of software tools encountered in the work of a business engineer. After the course, students will be able to decide on different solutions depending on the nature of the problem and to combine them to accomplish engineering projects.

Prerequisites

No prerequisites are required.

Recommended reading

Given the many different software tools presented in this course, literature will be provided on a week-by-week basis.

BENS1002

Period 4
1 Feb 2021
4 Jun 2021

Print course description
ECTS credits:
5.0
Instruction language:

English
Coordinator:
E. Hortal Quesada

Year 1 Project(s)

Faculty of Science and Engineering
Market Research Project

BENP1001

Period 3
4 Jan 2021
29 Jan 2021

Print course description
ECTS credits:
5.0
Instruction language:
English

Faculty of Science and Engineering
Circular Economy Project (Life Cycle Assessment)

BENP1002

Period 6
7 Jun 2021
2 Jul 2021

Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
Y. van der Meer

Second year courses

Year 2 Compulsory Course(s)

Year 2 Compulsory Skill(s)

Year 2 Project(s)

Year 2 Elective Course(s)

Third year courses

Year 3 Compulsory Course(s)

Year 3 Compulsory Skill(s)

Year 3 Project(s)

Year 3 Elective Course(s)