Unfold your talent
VIA University College

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Curriculum

Programme section

Bachelor of Engineering in Mechanical Engineering

- **For students enrolled August 2017-2020.**

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Introduction

In accordance with the Diploma Engineering Education programme, the purpose of the diploma engineering programme is to qualify students to, nationally and internationally, carry out the following business functions;

- Transpose technical research results as well as scientific and technical knowledge to practical use in development tasks and in solving technical problems
- Critically acquire new knowledge within relevant engineering areas
- Independently solve common engineering task
- Plan, implement and manage technical and technological facilities, including being able to involve social, economic, environmental and occupational health consequences in the solution of technical problems
- Participate in collaborative and managerial functions and contexts at a qualified level with people who have different educational, linguistic and cultural backgrounds

In addition, the education must qualify students to participate in further studies.

VIA Engineering, endeavours to work in accordance with a common DNA for all engineering courses. The DNA contains a description of what especially characterizes the engineering programmes at VIA, as well as what to expect from a graduate from our engineering programmes.

At VIA Engineering, we are practice- and project oriented and focused on the surrounding world. These goals are achieved in the form of qualified graduates obtained through targeted education, relevant research and development as well as cooperation and ongoing dialogue with the business community. The programmes at VIA Engineering will qualify the graduates to perform practice- and development-oriented business functions.
English-language programmes and international admission is a characteristic of our engineering programmes. This profile creates a unique opportunity to educate students who can act in a Danish context in an increasingly global market. Our lecturers have a broad practical experience, and they understand how to anchor theory in practice through laboratory work, company visits and projects for and in collaboration with companies.

To ensure the usefulness of the content of the programme, the principles of the CDIO education concept are applied, ensuring that the individual courses are continuously reviewed, evaluated and developed.

1 Identity of the programme

The purpose of the Mechanical Engineering Programme at VIA is to enable the graduates to work within the areas of product development and construction of machines and plants and giving them the opportunity to specialize in 1) Intelligent Mechanics, 2) Polymers or 3) Sustainable Energy. It is crucial that the graduates, in relation to the above, develop a deep understanding for scientific problems, experimental competences and IT-tools. Furthermore, the graduates will develop competences enabling them to work as project managers both nationally and internationally within the mechanical area.

The purpose of the programme is primarily achieved by:

- Making project work an essential part of the course in which the technical elements of the programme are integrated via problem solving focusing on use-oriented and practical engineering work. In the project work, it is also important that the students develop technical, methodical, communicative and personal competences.
- Collaboration with research environments and companies in connection with the courses.
- Offering an international study environment, in which parts of the programme takes place abroad and several courses are carried out in English for both Danish and foreign students.
- Specific for students enrolled in August 2017: From 3rd semester onwards, the Danish and the international programmes are merged, and all courses are carried out in English. Students starting on the Danish programme, however, are allowed to make their projects in Danish.
- Using the student's internship actively to exchange knowledge and experience between VIA and the profession.
- Obtaining application and practice-oriented competences by using VIA's laboratory, work shop and library facilities.

2 Structure and content

The programme is organized as an ordinary full-time higher education. For students who complete the programme without an individually organized course sequence, the programme build-up, structure and progression, including tests, will be as indicated in the table at the end of this section.

The official duration of the degree programme is 3½ years, divided into 7 semesters corresponding to 210 ECTS credits. New students are enrolled once a year in August.

The scope of each course and project is documented in ECTS credits (European Credit Transfer System). 1 ECTS credit corresponds to 27.5 hours of standard study activity for a student and one study year equals 60 ECTS credits.

The reading of the study material requires English on level B in order to complete the programme.

The programme consists of:

- Compulsory courses and projects
- Elective courses
- Internship
- Bachelor Project
- Workshop practice

A semester consists of 3-6 courses as delimited courses. One course can have a volume of 5 – 10 ECTS credits and a project can have a volume of 5-20 ECTS credits.

The topics, volume, learning objectives and tests of the courses are described in this curriculum. For a more detailed description of the individual courses, the valid course descriptions are available on VIA's web site or on Studynet.

There are 5 weeks of practical workshops during 1-4 Semester.

The programme is structured as illustrated below:

Semester Theme	Course	Course	Course	Course/ Project	Project	
7. Elective course/ Specialisation	Elective course	Elective course	Elective course	BPR 2 Bachelor Project		
6. Elective course/ Specialisation	Elective course	Elective course	Elective course	BPR 1 Preparation of Bachelor Project	SEP 6 Semester Project	
5. Internship	INP1 Engineering Internship					
4. Business-oriented Innovation	TER 1 Thermo-dynamics	EMI 1 Experimentation, Measurements, Instrumentation	PQE 1 Production, Quality and Economy	FEM 1 Finite Element Method	INN 1 Innovation Project	SEP 4 Semester Project
3. Machine Construction and Electrical Drive Techniques	MAT 2 Mathematics 2	DYN 2 Dynamics 2	ELE 1 Electrical Engineering	MDE 1 Machine Design	SEP 3 Semester Project	
2. Analytical methods (mechanics and materials)	MAT 1 Mathematics 1	DYN 1 Dynamics 1	MEC 2 Mechanics 2	MED 1 Machine Element Design	SEP 2 Semester Project	
1. Product Development and Design of mechanical Equipment udstyr	MTR 1 Materials Science	TEM 1 Technology and Environment	MEC 1 Mechanics 1	TDE 1 Technical Design	SSE 1 Study Skills for Engineering Students	SEP 1 Product Development and Design of Mechanical Equipment

3 Compulsory courses of the programme, 1st – 4th semester

All courses and projects on the first four semesters are compulsory.

Each of the four first semesters contains a semester project that represents 5-10 ECTS credits. The overall purpose of the semester project is to tie the subjects of the semester together to a unified whole. Study techniques, Project Management, Project methodology, science theory, research methodology and teamwork will be introduced throughout the programme in connection with the semester projects.

Each semester has a theme in such a way that knowledge and skills are acquired through the courses and the competences are acquired and tested in the projects.

1st semester: Product Development and Design of Mechanical Equipment
2nd semester: Analytical Methods within the areas of Mechanics and Materials
3rd semester: Machine Construction and Electrical Drive Techniques
4th semester: Business-oriented Innovation

3.1 1st semester: Product Development and Design of Mechanical Equipment

Topics
- Materials Science (MTR1)
- Technological Processes and Environment (TEM1)
- Mechanics 1 (MEC1)
- Technical Design (TDE1)
- Study Skills for Engineering Students (SSE1)
- Product Development and Design of Mechanical Equipment, semester project (SEP1)

The learning objectives of the courses (knowledge, skills and competences) and test form are given in Appendix 2

Course purpose:

Materials Science (MTR1)
The main purpose of the course is to enable the student to select the relevant materials based on material properties and corrosion environment. It is crucial that the student tests theory in practice, through laboratory work, to gain a deeper understanding of science issues.
Technological Processes and Environment (TEM1)
The main purpose of the course is to enable the student – from a designer's point of view - to select relevant processing technologies taking into account time, cost and production volume, life cycle analysis and environmental aspects.
Mechanics 1 (MEC1)
Provide the student with basic skills in statics to analyze and solve problems/tasks within machine design.
Technical Design (TDE1)
To provide methods and tools within the fields of technical drawing and standard mechanical parts.
Study Skills for Engineering Students (SSE1)
To develop the student's basic skills and competences for the excellent performance of study and project related activities that are required in the process of working towards an engineering degree.
Product Development and Design of Mechanical Equipment, semester project (SEP1)

- To develop the student's ability to work problem- and project-oriented.
- To apply methods and tools in product development.
- To work interdisciplinary in a project, which must contain elements of all 1st semester subjects.
- To develop student's ability to systematic solve problems in collaboration with a project group, as well as documenting the project process and results in a report.

Volume
30 ECTS credits

Number of tests and test forms. For detailed information and requirements see appendix 2.

Materials Science (MTR1)	5 ECTS	Oral examination, 20 minutes Internal censor. 7-point scale Reexamination: As ordinary
Technology and Environment (TEM1)	5 ECTS	Oral examination, 20 minutes Internal censor. 7-point scale Reexamination: As ordinary
Mechanics 1(MEC1)	5 ECTS	Oral examination, 20 minutes Internal censor. 7-point scale Reexamination: As ordinary
Technical Design (TDE1)	5 ECTS	Oral examination, 20 minutes Internal censor. 7-point scale Reexamination: As ordinary
Study Skills for Engineering Students (SSE1)	5 ECTS	Passed/Not passed 80% attendance Minimum three tests (written or oral) passed Re-evaluation: Written assignment
Product development and Design of Mechanical Equipment (SEP1)	5 ECTS	Oral project examination Internal censor 7-point scale Reexamination: Special requirements – see appendix 2.

3.2 2nd semester: Analytical Methods in the areas of Mechanics and Materials

Topics
- Mathematics 1 (MAT1)
- Dynamics 1 (DYN1)
- Mechanics 2 (MEC2)
- Machine Element Design (MED1)
- Engineering focusing on analytical methods, semester project (SEP2)

The learning objectives of the courses (knowledge, skills and competences) and test form are given in Appendix 2

Course purpose:

Mathematics 1 (MAT1)
The course aims to introduce students to standard mathematical methods covering calculus, differential equations, complex numbers and vector functions. The course will prepare the student for continued study in the Mechanical Engineering program.
Dynamics 1 (DYN1)
The course should teach the students how to use the laws of particle kinematics and kinetics.
Mechanics 2 (MEC2)
That the student will be able to analyze stresses, strains and deflections in structures in order to assess a machine design in relation to safety against yielding and fracture.
Machine Element Design (MED1)
The main purpose of the course is to provide the student with the knowledge, methods and analytical tools within the fields of machine elements and technical design.
Engineering focusing on analytical methods, semester project (SEP2)
To develop the ability to work analytically, methodically and structured in collaboration with other students in the implementation of product analysis and product development projects. It is expected that the student also use learned knowledge and feedback from previous semesters.

Volume
30 ECTS credits

Number of tests and test forms. For detailed information and requirements see appendix 2.

Mathematics (MAT1)	5 ECTS	Written examination 4 hours Internal censor. 7-point scale Reexamination: The school can decide that the re-examination can be oral.
Dynamics (DYN1)	5 ECTS	Written examination 4 hours Internal censor. 7-point scale Reexamination: The school can decide that the re-examination can be oral.
Mechanics 2 (MEC2)	5 ECTS	Oral examination, 20 minutes External censor. 7-point scale Reexamination: As ordinary
Machine Element Design (MED1)	5 ECTS	Oral examination, 20 minutes Internal censor. 7-point scale Reexamination: As ordinary
Engineering focusing on analytical methods, semester project (SEP2)	10 ECTS	Oral project examination External censor 7-point scale Reexamination: Special requirements – see appendix 2.

3.3 3rd semester: Machine Design and Electrical Drive Techniques

Topics
Mathematics 2 (MAT2)

Dynamics 2 (DYN2)
Electrical Engineering (ELE1)
Machine Design (MDE1)
Machine Design and Electrical Drive Techniques, semester project (SEP3)

The learning objectives of the courses (knowledge, skills and competences) and test form are given in Appendix 2

Course purpose:

Mathematics 2 (MAT2)
The course aims to introduce students to linear algebra and basics of numerical programming in Matlab.
Dynamics 2 (DYN2)
The course should teach the students how to use the laws of rigid body kinematics and kinetics, as well as a basic introduction to mechanical vibrations.
Electrical Engineering (ELE1)
The main purpose is to gain knowledge about electrical systems, installations and to be able to calculate and select correct electric motors.
Machine Design (MDE1)
The main purpose of this course is for students to acquire the competences needed to design and dimension a simple machine assembly. Students will in some issues test theory in practice through laboratory work/assignment to gain a deeper understanding of science issues.
Machine Design and Electrical Drive Techniques, semester project (SEP3)
To develop the student's ability to work systematically with problem and project-based assignments. Devel-op competences in handling group work, discussions and analysis of relevant issues in a team. Ap-ply course curriculums and gain new knowledge in areas of drive systems and dimensioning of technical machines. Make students able of running and control projects by use of systematic tools

Volume
30 ECTS credits

Number of tests and test forms. For detailed information and requirements see appendix 2.

Mathematics 2 (MAT2)	5 ECTS	Oral examination, 20 minutes Internal censor. 7-point scale Reexamination: As ordinary
Dynamics 2 (DYN2)	5 ECTS	Oral examination, 20 minutes External censor. 7-point scale Reexamination: As ordinary
Electrical Engineering (ELE1)	5 ECTS	Oral examination, 20 minutes Internal censor. 7-point scale Reexamination: As ordinary
Machine Design (MDE1)	5 ECTS	Oral examination, 20 minutes External censor. 7-point scale Reexamination: As ordinary
Machine Design and Electrical Drive Techniques (SEP3)	10 ECTS	Oral project examination External censor 7-point scale Reexamination: Special re-quirements – see appendix 2

3.4 4th semester: Business-oriented Innovation

Topics
Thermodynamics (TER1)
Experimentation, Measurements and Instrumentation (EMI1)
Production Quality and Economy (PQE)
Finite Element Methods (FEM1)
Business oriented product development – semester project (SEP4)
Innovation (INO1)

The learning objectives of the courses (knowledge, skills and competences) and test form are given in Appendix 2

Course purpose:

Thermodynamics TER1
The student will obtain knowledge of the basic theory within thermodynamics and be able to perform elementary thermal calculations.
Experimentation, Measurements, Instrumentation EMI1
The main purpose of the course is - knowledge about measurement systems and working skills in planning, analysis and reporting experiments - knowledge, skills and competences with on-off control in general
Production, Quality and Economy PQE
The student will acquire knowledge about quality tools and factory layouts, how to secure a good and safe production setup and be able to think quality issues into their development of products, in order to produce them in a safe and easy way. Students will be able to determine means and methods for budgeting, investment and finance, directed to run development projects. Further to be able of judging related economical aspects, with regards to their business consequences and strategy of the company
Finite element methods FEM1
The main purpose of the course is to enable the student to solve linear static problems using the FE method and be able to recognize possibilities and limitations in using a commercial FE software.
Innovation INO1
Innovation is integral to business success in the 21st century and in this course, students will explore the innovator's mind-set and apply innovation processes to solve real-world problems. Students will be introduced to creativity, creative thinking, innovation theory and methods, and the primary learning experience will be hands-on going through the different phases of the innovation process. Innovation is not only getting a good idea, but also actually turning that idea into products or services that can be sold and make a profit in a highly competitive global market.
Semester project – Energy oriented project with economical and environmental aspects SEP4
To be able to complete a development project with regards to business evaluation and quality.

Volume
30 ECTS credits

Number of tests and test forms. For detailed information and requirements see appendix 2.

Thermodynamics (TER1)	5 ECTS	Written examination 4 hours External censor. 7-point scale Reexamination: The school can decide that the re-examination can be oral.
Experimentation, Measurements, Instrumentation EMI1	5 ECTS	Oral examination, 20 minutes Internal censor.

		7-point scale Reexamination: As ordinary
Production, Quality and Economy PQE	5 ECTS	Written examination in the end of the semester – 1 hour No censor Reexamination: As ordinary
Finite element methods (FEM1)	5 ECTS	Oral examination, 20 minutes External censor. 7-point scale Reexamination: As ordinary
Innovation (INO1)	5 ECTS	Written examination – multiple choice test. 20 minutes Passed/not passed Internal censor
Semester project – Energy oriented project with economical and environmental aspects SEP4	5 ECTS	Oral project examination External censor 7-point scale Reexamination: Special requirements – see appendix 2.

4 Internship, 5th semester

ME-INP1

The internship comprises a semester of 30 ECTS credits and is placed time wise on the 5th semester of the programme. As a general rule the internship period is paid and takes place either in a private or in a public company in Denmark or abroad. The duration of the internship must have a period of minimum 20 weeks full-time work.

The purpose of the internship is for the student to acquire insight into practical engineering equivalent to the work of an engineering assistant, combined with the integrated application of the concepts, methods and techniques of the applied disciplines acquired in the first four semesters.

The student is responsible for finding an internship, which must be approved by VIA, who will attach a supervisor to the intern.

The student prepares a plan for the internship programme with a corresponding assignment formulation, in cooperation with the company.

The basis for the assessment of internship is a continuous report from the student to VIA, a feedback from the internship company, as well as a presentation where the supervisor can ask detailed questions about the internship content.

If the internship is interrupted before the end of the internship period, the supervisor must, in consultation with the head of programme, assess whether the internship has had a duration and content sufficient for passing the internship.

The internship is assessed passed/not passed.

5 Elective courses and semester project, 6th – 7th semester

On 6th and 7th semester, it is possible to select elective courses. Apart from elective courses targeted selected specialisations, a number of relevant elective courses are offered on the Mechanical Engineering Programme. Descriptions of the individual elective courses will appear from the table under 5.1 as well as in the course descriptions.

It is also possible to choose elective courses offered by VIA's other programmes, except courses, which consists of study material which the student has had earlier on in the programme. Selecting courses from other programmes must be approved by an Engineering study counsellor in order to secure the relevance and an increase of the technical level.

On the Mechanical Engineering Programme, some of the elective courses are included in the following specialisations:

Intelligent Mechanics and Systems
Polymers
Sustainable Energy

A specialisation consists of 3 elective courses (15 ECTS credits), 6th semester project (10 ECTS credits) and bachelor project including preparation (20 ECTS credits), in total 45 ECTS credits.

Electives and specializations are only offered to the extent that sufficient students have chosen them.

5.1. Elective courses

On the Mechanical Engineering Programme, the following elective courses are as minimum available:

Course purpose:

Advanced Engineering Mathematics AEM1	**Semester**
The purpose of this course is to give students a mathematical foundation for studying mechanical engineer-ing beyond the Bachelor level. The focus is on a comprehensive introduction to partial differential equations and methods for their solution	6
Automation, Mechanical Design AMD1	
Kursets formål er at give den studerende viden om målinger og praktiske færdigheder inden for planlægning, analyse og afrapportering af eksperimenter.	6
Advanced Mechanics of Materials and Welded Structures AWS1	
The student will acquire knowledge about quality tools and factory layouts, how to secure a good and safe production setup and be able to think quality issues into their development of products, in order to produce them in a safe and easy way. Students will be able to determine means and methods for budgeting, investment and finance, directed to run development projects. Further to be able of judging related economical aspects, with regards to their business consequences and strategy of the company	7
Automatic Control AUC1	
To analyze a technical system, to specify automatic control requirements, and to select control strategy and controller. To give students a working knowledge about on-off control.	7
Advanced Designing in 3D-CAD CAD2	
The main purpose of the course is to provide the student with the knowledge and methods within the fields of more advanced CAD application used in an industrial environment.	7
Design of Energy Systems DES1	
The student will obtain knowledge and calculation practice of refrigeration and heat pump systems in order to be able to design an efficient, environmentally friendly energy plant.	6
Renewable Energy ENE1	

The purpose of the course is to ensure that the student will understand the design and calculation of renew-able energy plants with focus on energy production, energy savings and storage and environmental conditions	6
Introduction to Programming for Engineers PRG1	
Basics in algebra, calculus, probability, and statistics. Prior programming experience is not required.	6/7
Advances Linear Algebra ALA1	
To give a better understanding of linear algebra with a focus on topics and applications relevant for engineering	7
Finite Element Method, Advanced FEM2	
The main purpose of the course is to enable the student to solve nonlinear static problems and dynamic problems using the FE method and to give the student an overview of how a thermal analysis is performed using the FE method.	7
Fracture Mechanics and Fatique FRM1	
To give the students a basic knowledge about Fracture Mechanics and fatigue in metallic structures as well as its theory and applications	6
Geometrical Tolerancing and Inspection GTI1	
The main purpose of the course is to provide the student with the deep knowledge of GDT (-also called GPS) Geometrical Tolerancing and the physical inspection of GDT data. It is also the purpose to gain knowledge inside handling polygon data from scanning.	6
Innovation and Design of Products IDP1	
The main purpose of the course is to strengthen student's acquaintance with engineering procedures within the development and assessment of mechanical products from both re-design and conceptual design perspectives. Human-centered design thinking, business assessment and innovation strategies will be of emphasis.	7
Mechanics of Composite Materials MCM1	
The main purpose of the course is to enable students to understand the mechanics in a laminate and have a solid knowledge about the possibilities and restrictions in using composite materials in products and structures.	7
Robotics and Multibody Systems RMS1	
Analysis of commercial robots, design and analysis of "home-made" robots and mechanisms, simple programming of a robot, and basic knowledge of the application of machine vision in robotics.	6
Simulation of Injection Moulding of Thermoplastics SIT1	
The main purpose of the course is to give the student a basic understanding of the possibilities within mould flow simulations of thermoplastic polymers for injection moulding. Mould flow simulations help designers optimise the design of parts and moulds for injection moulding. The simulations provide information about mould filling, packing, cooling, warpage, flow rate, material viscosity etc.	7
System dynamics, Simulation and Control SMC1	
To give students knowledge about and ability to develop and analyze dynamic mechatronic models. To give the student basic knowledge about automatic control	6
Sustainable Power Production SPP1	
The main purpose is to gain basic knowledge and design of sustainable power production with wind tur-bines, photovoltaic cells and batteries fuel cells, hydrogen storage, and smart grid.	7
Thermoplastic Materials and Technologies TMT1	
The main purpose of the course is to enable the student to understand the basic characteristics of polymers, relate and use these characteristics to the design of parts, assemblies, and simple moulds, and understand and select relevant thermoplastic technologies with emphasis on injection moulding, with respect to functionality, economy and sustainability.	6

Number of tests and test forms. For detailed information and requirements see appendix 2.

Innovation and Design of Products (IDP1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Advanced Designing in 3D-CAD (CAD2)	5 ECTS	Two written examinations. 1 test – two hours and a course assignment. No censor
		7-point scale Re-examination: The school can decide that the re-examination can be oral.
Geometrical Tolerancing and Inspection (GTI1)	5 ECTS	Two written examinations. 1 test – two hours and a course assignment. No censor 7-point scale Re-examination: The school can decide that the re-examination can be oral.
Advanced Mechanics of Materials and Welded Structures (AWS1)	5 ECTS	Three tests during the semester Internal censor 7-point scale Re-examination: The school can decide that the re-examination can be oral.
Finite Element Method, advanced (FEM2)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Fracture Mechanics and Fatigue (FRM1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Automation, Mechanical Design (AMD1)	5 ECTS	Written test in the end of semester – 1 hour No censor 7-point scale Re-examination: As ordinary
Advanced Engineering Mathematics (AEM1)	5 ECTS	Written, 4 hours Internal censor. 7-point scale Re-examination: The school can decide that the re-examination can be oral.
Automatic Control (AUC1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Robotics and Multi Body Systems (RMS1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
System dynamics, Simulation and Control (SMC1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Thermoplastic Materials and Technologies (TMT1)	10 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Mechanics of Composite Materials (MCM1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary

Simulation of Injection Moulding of Thermoplastics (SIT1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Design of Energy Systems (DES1)	5 ECTS	Oral examination 20 minutes, two tests during the semester, course assignments
		Internal censor 7-point scale Re-examination: As ordinary
Renewable Energy (ENE1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Introduction to Programming for Engineers (PRG1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Advanced Linear Algebra (ALA1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary
Sustainable Power Production (SPP1)	5 ECTS	Oral examination, 20 minutes Internal censor 7-point scale Re-examination: As ordinary

5.2 Compulsory 6th semester project

On the 6th semester, a compulsory semester project is made, which will support the learned theory from the elective courses by means of a practice based project, consisting of the development and manufacturing of a product, laboratory assignments etc. Furthermore, the use of elements of advanced project methods is also included in the semester project.

Course/Topics	Volume	Number of tests
Semester project (SEP6)	10 ECTS	1 oral exam based on project work, external censor

5.3 Specialisation: Intelligent Mechanics and Systems

New technologies and new navigation systems make it possible to develop self-propelled mine searchers and driverless vehicles etc. Developing intelligent products and systems is about integration between software, system development and machine techniques. The student will work with the latest technologies, robots, satellite communication etc.
The keywords for this specialisation are:
- Modulation and simulation of mechanical systems
- Control and regulation techniques
- Monitoring systems
- Megatronics
- Measurement techniques and instrumentation
- Strength testing
- Mobile hydraulics
- Optical recognition
- Robots
- Remote control

- Dynamic GPS
- Satellite communication

Topics

Automatic Control, Digital Control and Simulation (AUC1)
Robotics and Multi Body Systems (RMS1)
System dynamics, Modelling and Simulation (SMS1)
6th semester project (SEP6): Robot programming, Lab. controlling and level regulation
Bachelor project (BPR1+2): Project within the area of Intelligent Mechanics and Systems

5.4 Specialisation: Polymers

Throughout the last century, materials such as metal, wood, glass, clay, cotton and wool have been replaced by polymers due to the tailor-made characteristics and the low price. Nowadays, polymers are included in so many products that it would practically be impossible to avoid getting into contact with them in some form or other. But how are products containing polymers produced? How is a Cola bottle produced?
The keywords for this specialisation are:

-Thermoplastics
-Thermosets
-Technologies
-Simulation of injection molding
-Design and development of items and tools
-Semester project about thermoplastic, thermosets or composites
-Collaboration with companies within the plastics industry

Topics

Thermoplastic Polymers and Technologies (TMT1)
Simulation of Injection Moulding of Thermoplastics (SIT1)
6th semester project (SEP6): Designing and manufacturing an injection molded thermoplastic or composite item.
Bachelor project (BPR1+2): Project in the area of Polymer

5.5 Specialisation: Sustainable Energy

The energy production of the entire world is facing a dramatic shift from coal, oil and gas for energy, not polluting the atmosphere with greenhouse gases. Development of future renewable energy systems is about the energy from solar, wind, waves and CO_2-neutral fuels such as straw and wood.

The student will work with basic energy engineering, energy conservation, design of energy plants and renewable energy technologies like wind turbines, solar thermal and photovoltaic, biomass and biogas, heat pumps and energy storage, etc.

The keywords for this specialisation are:
- Energy consumption and savings
- Environment and global warming
- Pumps and piping
- Heat transfer and heat recovery
- CHP and district heating systems
- CO_2 neutral fuels
- Photovoltaics
- Solar
- Cooling and heat pump technology
- Biogas
- Windmills
- Energy storage, hydrogen and fuel cells

Topics

Design of Energy Systems (DES1)
Renewable Energy (ENE1)
Sustainable Power Systems (SPP1)

6th semester project (SEP6): Designing and manufacturing/testing an energy component or an energy system.
Bachelor project (BPR1+2): Project within the area of Sustainable Energy

Students, having completed one of these specialisations, are entitled to add the specialisation on the diploma.

6 Practical Workshops

Workshop courses are practice-related courses of one week duration (No ECTS). The courses are conducted in parallel with 1-4 semesters. There are five courses:

ME-PWS1 (1st semester): Safety Manufacturing: Material reducing processes
ME-PWS2 (2nd semester): Working environment and safety of welding
ME-PWS3: (3rd semester) Manufacturing an assembly
ME-PWS4: (3rd Semester) Electro Technology, Hydraulic, Pneumatic
ME-PWS5: (4th semester) Energy, Polymers, Robotics

The learning objectives of the courses (knowledge, skills and competences) and test form are given in Appendix 2

7 Bachelor Project

ME-BPR1
ME-BPR2

The programme is concluded with a bachelor project (BPR2) which constitutes 15 ECTS credits of the total 210 ECTS credits of the programme and is finalized with a test. The bachelor project is commenced on 6th semester (BPR1) by choosing the subject and making a project description.

The Bachelor project must demonstrate individual self-critical reflection within the chosen subject, and must document the student's ability to apply engineering theories and methods. In addition, the bachelor project must reflect the student's ability to express himself/herself professionally and structured within his/her subject.

One of the prerequisites for being admitted to the bachelor project is that the student is considered to be ready for the exam, as BPR2 must be the last exam on the programme.

The Bachelor project is as a general rule prepared in groups of 3-4 persons.

The Bachelor project comprises an independent experimental, empirical and/or theoretical examination of a practical problem formulation related to the core subjects of the programme.

The project must be documented in the form of a report comprising project charter, outline of solution, calculations, drawings, etc. If the report is a group assignment, it must be clear who wrote which sections in the report.

The students are examined in the project by an oral test/group test with individual assessment according to the learning objectives described under section 1.The basis for the exam is the bachelor project. It is a prerequisite for participation in the exam that the bachelor project is handed in within the stipulated deadline, and meets the project requirements described.

The examination may take place at the earliest when all the other tests of the programme, including internship test, have been passed. The examination is assessed on the 7-point scale and with the participation of external examiner.

Course/Topics	Volume	Number of tests
Bachelor preparation (BPR1)	5 ECTS	Approved/not approved based on the project description, internal censor
Bachelor project (BPR2)	15 ECTS	1 oral exam based on the bachelor project report., external censor

8 Title and issue of diploma

Graduates who have completed the studies under this curriculum + the joint regulations for VIA Engineering are entitled to use the title Bachelor of Engineering in Mechanical Engineering.

Furthermore, it is possible to obtain the following specialisations:
- Intelligent Mechanics and Systems
- Polymers
- Sustainable Energy

Upon completion of the programme, VIA University College issues a diploma indicating title, programme, and specialisation if relevant. Furthermore, the diploma contains information about the number of ECTS credits of the individual elements, the result of the grades obtained, as well as the subjects of the interdisciplinary projects and the bachelor project. In addition, the admittance level on which the graduate was admitted to the programme is noted.
Should the education be discontinued, proof of passing study units is issued.

9 Appendix 1: Transition valid from Spring semester 2019 for students enrolled in August 2016.

7th Semester 30 ECTS Theme: Specialisation and Bachelor Project					
5 Elective course	5 Elective course	5 Elective course	20 ME-BPR2 Bachelor Project		
6th Semester 30 ECTS Theme: Semester Project					
5 Elective course	5 Elective course	5 Elective course	5 ME-BPR1 Bachelor Pro-ject-start up	10 ME-SEP6 Semester Project	
5th Semester 30 ECTS. Theme: Engineering internship in a Company					
4th Semester 30 ECTS Theme: Business-Oriented Development					
4 ME-TER1 Thermo-dy-namics	4 ME-FEM1 Finite Ele-ment Method	4 ME-OOQ1 Operational Quality Manage-ment and Environ.	4 ME-ECE1 Economics for engineers	6 ME.-EEX1 Engineering experi-ments Lab Testing Lab Measurement Statistics	8 ME-SEP4 Semester Project 4 Business-Oriented Development Interdisciplinary Project method 4 Theory of Science Project Management
3th Semester 30 ECTS Theme: Machine System Design, Dynamics and Dimensioning					
4 ME-DYN2 Rigid Body Dynamics	4 ME-MAT2 Linear Algebra and introduc-tion to Nu-merical Pro-gramming	10 ME-MDI1 Machine Dimensioning Electric motors AC and DC Mechanic Transmissions Hydraulics, Pneumatics Choice of drive systems		4 ME-INN1 Innovation Weeks	8 ME-SEP3 Semester Project 3 Machine System Design, Dynamics and dimensioning Project Method 3 Innovative Processes
2nd Semester 30 ECTS Theme: Engineering Focussing on Analytical Methods 10 ESC M1					
10 ME-ESC1 Engineering Science 1 Particle dynamics Mathematics		8 ME-MME1 Mechanics, Materials and El-ement Calculation Strength of materials, Mate-rials science Machine Ele-ment Calculation, FEM Anal-ysis in Inventor		4 ME-ELT1 Electrical Technology	8 ME-SEP2 Semester Project 2 Engineering Focusing on Analytical Methods Project Methods 2 Project Planning
1nd Semester 30 ECTS Theme: Product Development and Design of Mechanical Equipment					
6 ME-MEK1; Mechan-ics Statics, Strength of materials Mathcad Machine Element Cal-culation	4 ME-MTR1 Materials	4 ME-TEC1 Technological Processes	10 ME-PTD1 Product Development and Technical Design Graphic Presentation; Design; 2d/3d-CAD; Product Development; Machine Element		6 ME-SEP1 Semester Project 1 Product Development and Design of Mechanical Equipment Project Method 1 Presenta-tion

10 Appendix 2: Courses Mechanical Engineering Programme

Code	Title	ECTS-point	Knowledge	Skills	Competencies	Examination
ME-AEM1	Advanced Engineering Mathematics	5	After completing this course the stu- dent must know: * How differential equations are used in the modelling of physical phenom- ena including: mixing problems; the forced harmonic oscillator; the elas- tic beam; 1D and 2D wave equa- tions; the heat equation * The key concepts in the theory of ordinary differential equations (ODEs) and their solution including: direc- tional fields; linear, separable, exact ODEs; linear ODEs and sys- tems of linear ODEs w. constant co- efficients; phase plane methods, lin- earization * The key concepts in vector calcu- lus including: gradient, divergence, curl; line, surface and volume inte- grals; Gauss divergence theorem; Stoke's theorem * The key concepts in the theory of partial differential equations (PDEs) including: principle of superposition; boundary conditions; separation of variables; Fourier solutions * The key concepts in the theory of Fourier analysis including: Fourier series and integrals; expansion of even/odd functions	After completing this course, the stu- dent must be able to: * Recognize and solve different types of ODEs * Apply the most important differen- tial operators * Evaluate multi-dimensional inte- grals of vector functions also using integral transformation theorems * Calculate Fourier series and inte- grals * Recognize different types of PDEs and boundary conditions * Solve PDEs using Fourier analysis	After completing this course, the student must be able to: * Recognize physical phenomena and engineering problems where ODEs and/or PDEs are needed for mathe-matical modelling. * Perform such mathematical model- ling in simple cases and solve the resulting equations. * Use sources of information that ap- ply the language of ODEs, vector analysis, and PDEs in either a job situa-tion or in the context of further studies.	Requirements for attending examination No requirements Type of examination: Written 4 hours. Censor: Internal Allowed tools: All Re-examination: Please note that the school can decide that the re-examination can be oral.

Code	Title	ECTS-point	Knowledge	Skills	Competencies	Examination
ME-AMD1	Automation, Mechanical Design	5	The students shall gain knowledge in how mechanical and hydrostatic drives are build, work and can be used in machine constructions of mobile equipment.	The student will gain skills in - Selecting machine elements and use these for the purpose of auto- mation tasks.	The student will understand how analysis of mechanical and hydrostatic drives are to be carried out in order to find a solution. The student	Requirements for attending exam None Type of examination: 1 on-line course test in end of the semester.

Code	Title	ECTS-point	Knowledge	Skills	Competencies	Examination
			Students will know about: * Design and dimension of Hook's joints. * Equation system and design of planet or epicyclical gears. * Control and regulation of mobile hydraulic systems for open and closed hydraulic circuits. * Complex hydraulic circuits with load sensing, priority and combined linear and rotational actuator systems.	- Basic setups to produce complex track structures for mechanical machines. - Analyse of simple PLC program to predict the output.	will be able to explain the theory behind the calculations for a complex ma-chine system. He/she will collect analysis results and combine these to describe the design for making a complex system. They will be able to communicate their needs to suppliers of machine elements, and be able to find these suppliers through relevant channels. The student will be able to evaluate different possible solutions, to set up the most optimal system in a given situation.	Exam time: 60 minutes. No censor Tests account for 100 % of final grade Allowed tools: Personal notes Laptop Re-examination: As ordinary
ME-AUC1	Automatic Control	5	After the course, the student has knowledge of • The structure and elements of a control system • Selection of controller (P, PI, PD, PID), and determination of controller parameters • Control strategies (simple feedback, cascade feedback, feed forward) • Analytic (Bode plot, Root locus) and experimental controller (process reaction/ sustained oscillation) tuning • Static and dynamic response • Reference tracking and disturbance rejection • Analysis of closed loop response, using mathematics and using simulation • Logic control	After the course, the student can describe a technical system, select a proper control strategy, and estimate automatic controller parameters, taking reference tracking, disturbance rejection, stability and dynamics into consideration.	After the course, the student has competencies to analyze a minor technical system, to specify control requirements, and select control strategy and controller.	Requirements for attending exam Mandatory course activities completed Type of examination: Individual oral examination (app 20 min) based upon a subject found by draw. Preparation time 20 minutes. Examinations account for 100 % of final grade Censor: Internal Allowed tools: Course literature according to the course description, Personal notes, Laptop, Calculator Re-examination: As ordinary

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			• Specification of on-off control, using Grafcet diagrammes • PLC programming			
ME-AWS1	Advanced Mechanics of Materials and Welded Structures	5	The student will acquire knowledge in, * Codes of relevance for steel structures, mainly Eurocode 3 and DNV. * Modes of failure for steel structures, buckling of columns and plates. * Calculation of welded and bolted joints. * Practical considerations in the design of steel structures. * Fatigue calculations of welded joints * Numerical methods to evaluate weld stress and fatigue life.	The student will be able to, * Make design calculations on slender structures, plates and columns. * Assign non- destructive test methods to various types of welds. * Design welded and bolted joints. * Evaluate the lifetime of a component or welded joint subjected to fatigue.	The student will be able to take part in development projects on higher levels within various industries, which could include wind turbines, oilrigs, ships, bridges, buildings, masts, chimneys and many others. Be able to judge if the structural part can or should be designed according to a specific code or not.	Requirements for attending exam Test(s) during the course passed Type of examination: The evaluation is based upon three tests conducted throughout the semester. The average grade of these three tests counts as the final grade. Tests account for 100% of final grade. Internal censor Allowed tools: None Re-examination: Please note that the school can decide that the reexamination can be oral.
ME-BPR1	Bachelor Project - Start Up	5	Profound understanding of natural scientific issues, experimental qualifications, IT tools and group processes	Define and conduct an analysis phase including literature search, feasibility study, economical and technical analysis resulting in formulating a Project Description in accordance with the VIA Engineering Guidelines.	1. Plan and execute the analysis phase necessary for conducting a Project Description. 2. Define content and execution plan for a Bachelors Project within Mechanical Engineering. The project is to include technical research results as well as scientific and technical knowledge for practical application in	There will be no examination of ME-BPR1. The ME-BPR 1 outcome is to be seen as part of the ME-BPR2. Thus the complete Bachelor Project will count as 20 ECTS when passed.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
					development assignments and for solving technical problems. 3. Critically acquire new knowledge within relevant fields of engineering. 4. Define how to solve occurring engineering tasks in a rational manner. 5. Define how to conceive, design and implement technical and technological systems and whenever relevant pay the necessary considerations to social, economic, environmental and occupational health topics.	
ME-BPR2	Bachelor Project	15			1. Translate technical research results as well as scientific and technical knowledge to practical application in in solving technical problems. 2. Critically acquire new knowledge within relevant fields of engineering. 3. Solve occurring engineering tasks independently. 4. Conceive, design and implement technical and technological systems and whenever relevant pay the necessary considerations to social, economic, environmental and occupational health topics. 5. The degree in mechanical engineering at VIA University College	<u>Requirements for attending exam:</u> In order to be evaluated at the examination the project report must be handed in on time. <u>Type of exam</u> The examination will be carried out as follows: The whole group will present the project in approx. 30 minutes followed by an individual examination with the whole group present. Total durance approx. 45 minutes/ student. The basics for the examination are the Project report (Including Product Description, Process Report and appendices included) and the joint presentation of the project.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
					furthermore aims to qualify graduates to perform work functions, where the main objectives are product development and design of machines and systems, with an option of specialising within one of the three following categories: 1) Intelligent Mechanics 2) Polymers and Composites 3) Sustainable energy.	
ME-CAD1	Designing in 3D-CAD	5	The student will acquire knowledge and become confident with the use of the software Autodesk Inventor on a basic level sufficient enough to work with engineering design and documentation. Specified in topics: * Introduction to Inventor * User interface and file structure * Sketching, constraining and dimensioning * Creating and editing sketched features * Creating placed features * Creating and editing drawing views * Creating and documenting assemblies * Advanced part modelling techniques	Following completion of the course the student has skills in: * Using a popular 3D CAD program * Part modeling * Assembly modeling * Applying standard components from a content library * Creating drawing documentation of parts and assemblies in traditional 2D drawings	Upon completing the course, the student will have gained competences the use of a 3D CAD program and use suitable graphical drawing techniques when documenting a machine design. The student will gain knowledge in the use of Autodesk Inventor, sufficient to work with basic engineering design and documentation.	Requirements for attending exam: Test(s) during the course passed. Course assignment handed in before deadline Type of examination: Course assignments account for 60 % of final grade. Tests account for 40 % of final grade Censor: None Allowed tools: All Re-examination: Please note that the school can decide that the re-examination can be oral.
ME-CAD2	Advanced Designing in 3D-CAD	5	The student will acquire knowledge and become confident with the use of the software Autodesk Inventor on an advanced level inside.	The student gain skills to handle and use a CAD system in an engineering professional way and to under-stand	Understand the role of CAD technology in a deeper context regarding the interface and link to Manufacturing, Value Chain Management and	Requirements for attending exam Mandatory assignments handed in before deadline and accepted

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			Specified in topics: o Parametric and Family Parts and Assemblies(Factoryparts) o Sheet Metal o Surface Technology and Advanced Modelling o Frame Generator and other Content Center Tolls o Publishing to the Content Center o Welding - design and documentations o Dynamic Simulation o Rendering and animation. o Plastics Design o Manufacturing and CAM Programming (2-4 axis) incl lab exercises o Concurrent Engineering and simultaneously version handling.	and select relevant tools and technologies. More specific the student gain skills inside - Different model techniques in a multipart environment - Model techniques using surfaces and standards - Animation and simulation inside Dynamics and Machining (CAM)	Product Data Management Practice and fully understand Concurrent Engineering (CE) in a multi-user, global environment and understand the challenges in using CE in modern manufacturing	Course assignment handed in before deadline Tests in laboratory accomplished and accepted <u>Type of examination:</u> The evaluation is divided in 2 stages. The first stage (counting 40%) is based on a 2 hour test in the usage of a specific CAD software. The second stage (counting 60%) is the evaluation of the final and group based course assignment. To pass the course both stages must be passed with a minimum of 30% approved, and all exercises handed in before given deadline. Censor: None <u>Allowed tools:</u> All <u>Re-examination:</u> Please note that the school can decide that the re-examination can be oral.
ME-CVS1	CNC Virtual Simulation	5	After the course the student has knowledge of: - Design and build a virtual 4-5 axis machines and a robot with 6 degree of freedom - Create and assemble necessary CAD models and components building the CNC equipment - Define kinematic, velocity profile and limits for the different components in the CNC equipment	The student gain skills in the software Siemens NX inside design, building, simulation of virtual and digital production equipment – and understand the importance and industrial potential in simulating production processes.	The student get competences to understand, specify, build and evaluate Virtual Machine and Process Systems for industrial use.	The course terminates with the hand in of a mini project done in groups of 2-3 students, finally examined at an oral group examination. In the mini project the students design, build and assemble a virtual 5axis CNC machine equipped with a robot and simulate manufacturing of a given product.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			- Prismatic (2½D) to 5 axis CAM programming. - Simulate the CAM programming against the virtual CNC equipment. - On existing equipment measure and virtual build a 4-5 axis CNC machine - Simulate own developed CAM programme. - Cutting and tooling technology. - Tool Libraries and process planning - ISO code for CNC equipment. - Build own Postprocessors - G-code simulation			
ME-DES1	Design of Energy Systems	5	The student will acquire knowledge in, * Refrigeration plants * Heat pumps * Refrigerants * Energy efficiency and impact on the environment * Cooling load * Air conditioning processes	The student will be able to analyse the thermal load for an energy plant and on this basis combine process theory and common dimensioning practice to design an energy efficient cooling plant or heat pump with low environmental impact.	The student will obtain competences to communicate about designs of different types of energy plants. Furthermore, the student will be able to design simple energy plants in a methodical way and more complex systems in co-operation with energy engineers.	Requirements for attending examination No requirements Type of examination: Individual oral examination without preparation based upon course assignment Course assignments account for 10 % of final grade Final examinations account for 50 % of final grade (Mini project discussion and oral exam for all the topics in the course) 2 Tests during the semester account for 40% of final grade Censor: Internal Allowed tools: All

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
						Re-examination: As ordinary
ME-DYN1	Dynamics	5	The students will get knowledge about: Units, the kinematics of particle motion, force and acceleration for parti-cles, principle of linear impulse and momentum for particles, mechanical energy, and basic theory of fixed axis rotation for rigid bodies.	After completing the course, the student will be able to: * Use units consistently and perform unit conversions * Apply kinematic relations to the description of particle motion. * Perform absolute dependent motion analysis. * Account for the forces acting on a particle and draw a proper free-body diagram. * Set up and solve the equations of motion for particles and for simple systems of particles. * Describe the concepts of kinetic energy, work and potential energy and apply these to particle dy-namics problems. * Write well-structured Mathcad scripts for performing and documenting the solution of problems involving particle dynamics. * Solve simple dynamics problems for fixed axis rotation of rigid bodies	After completing the course, the student can: * Identify which parts of the acquired knowledge and skills that are relevant to a given, simple real-world mechanical problem. * Model real-world problems using the acquired knowledge and skills. * Expand her/his knowledge on dynamics in more advanced courses.	Requirements for attending exam There will be a mandatory course work corresponding to a minimal workload of 10 hours for the student. If the course work is not handed in and approved by the deadlines set by the teacher, the student has used one exam attempt. New deadlines for hand-in and approval will then be set. Type of examination Written 4 hours exam. If the student chooses to answer the exam using pen and paper, he or she must scan the solution sheets after the 4 hours. Scanners will be provided. Allowed tools All usual aids Re-examination Please note that the school can decide that the re-examination can be oral.
ME-DYN2	Dynamics 2	5	The students will get knowledge about: * the kinematics of rigid body motion * relative motion with both translation and rotation	After completing the course, the student will be able to: * Use kinematic relations in the description of rigid body motion.	After completing the course, the student can: * Identify which parts of the acquired knowledge and skills that relevant to	Requirements for attending examination A week before the exam, the student must upload solutions for the 10-15

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			* moment of inertia * equations of motion for general planar motion * energy in general planar motion * undamped and viscous damped free vibration with a single degree of freedom.	* Transform kinematic quantities between coordinate systems in relative motion. * Set up and solve the equations of motion rigid bodies in general planar motion. * Use energy methods to solve problems in rigid body dynamics * Describe undamped and viscous damped free vibrations with a single degree of freedom.	a given, simple real-world mechanical problem. * Model simple real-world problems using the acquired knowledge and skills. * Expand her/his knowledge on rigid body dynamics in more advanced courses.	problems selected as exam questions. These problems are announced no later than the last day of teaching. Type of examination Individual oral exam based upon a problem found by draw. The exam is a discussion with the students uploaded solution to the problem as starting point. Exam duration is approximately 20 minutes and there is no preparation. External censor Allowed tools None Re-examination Same as ordinary and with identical problems
ME-ELE1	Electrical Engineering	5	After the course, the student can expound: • Simple DC and AC circuits (complex impedance, current and voltage, phasor analysis, load reduction and complex power) • Single and three phase AC systems • Single phased transformers • Three phase systems and the power grid, power in balanced systems • DC motors, types and speed control • AC motors: o Construction, temperature and isolation classes, thermal protection,	After the course, the student has acquired skills in: • Analysis of DC and AC systems included in mechanical system • Loads Analysis	The student has acquired competence in selecting and dimensioning the electrical part of mechanical drivelines.	Requirements for attending examination None Type of examination: Individual oral examination where the student must explain how to solve a given problem. The problems are known in advance Individual oral exam based on solving a problem found by drawing lots. The duration is approx. 20 minutes. No preparation time for the exam. The exam papers are handed out at least one week before the exam. The exam counts 100% of the final grade.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			contactors o Start of motor, load types, start methods, start restrictions, DOL start, Y-D start, soft starters and frequency converters.			Internal Censor Allowed tools: None, however the course textbooks will be available in the examination room Re-examination: As ordinary
ME-EMI1	Experimentation, Measurements, Instrumentation	5	The main purpose of the course is - knowledge about measurement systems and working skills in planning, analysis and reporting experiments - knowledge, skills and competences with on-off control in general	After the course, the student has the following skills: - Identify fundamental error sources - Read data sheets - Perform parameter estimation - Data analysis (eg. parameter estimation, regression, t-test and anova) - Uncertainty analysis - Plan and document an experiment - The student understands hardware in on-off control systems - The student can specify the operation of the system. - Further, the student can develop the control for a system, including system operation and safety.	After the course, the student has competencies to - find proper sensors and instruments - plan and document an experiment (Definition of problem, Design of test system, Construction, Data collection, Data analysis, Interpretation and Reporting) - Design a complete on-off control for a machine, using typically a PLC as controller.	Requirements for attending exam Course assignment handed in before deadline Type of examination: Group presentation followed by an individual examination with presence of the whole group Censor: Internal Allowed tools: Course literature according to the course description Personal notes Laptop Calculator Re-examination: As ordinary
ME-ENE1	Renewable energy	5	The student will acquire knowledge in, – Energy savings – Thermal solar heating and simulating of energy storage systems using TRNSYS 17 – Other thermal energy system (Packed-bed storage, storage wall	Analyse the consumption of town or building and evaluate possible energy savings. Calculate the energy production from renewable sources with the integration of various energy storage scenarios. Calculate the eventually needs for supplementary	The student will be able to communicate with students, engineers and companies about renewable energy and outline proposals for renewable energy supply.	Requirements for attending examination Course assignments account for 40 % of final grade; it is divided into 20% for 2 assignments and 20% for 1 mini project. The final exam will count 60%. The final exam divided into:

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			and phase change energy storage) – Biomass and biogas – District heating and district heating network – Geothermal energy Renewable energy management (e.g. tax structures, costs for energy production, cost analyses, environmental issues)	fossil fuel production and the saving of CO_2 emission.		a. Oral evaluation on the mini project (30%) b. Additional question from draw on the spot (30%) Type of examination: Individual oral examination based upon a subject found by draw and mini project discussion. Censor: Internal Allowed tools: None Re-examination: Course assignments account for 40 % of final grade while the final re-exam count 60%. The students might asked to do new mini project if required, improve the already submitted one or keep it without improvement.
ME-EPHY1	Experimental Physics – A Project Oriented Course (ME)	10			After the course the student will be especially qualified to participate in experimentally based research and development. The course is intended to be a stepping stone for internship within the salt spreading business, for the formulation of final year projects and for further studies at Master and PhD level.	The oral presentation of the course work must be supplemented by a poster in A0 format and brief project documentation published with MATLAB®. The exam will take place at BYGHOLM on the last day of the course. The mark will be provided from the study administration within 14 days thereafter.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
ME-FEM1	Finite Element Method	5	The student will gain knowledge about the FE method and its applications. He/she will gain an understanding of how the method works and will be able to solve simple problems analytically and using a commercial software. The course will include the following topics: * Introduction to the FE method * Theory of elasticity * Bar and beam elements * Linear membrane elements * Quadratic membrane elements * Introduction to plates and shells * Introduction to 3D elements * Formulation of the stiffness matrix using different approaches * Boundary conditions * Mesh convergence and singularities * Parametric optimization * Introduction to Ansys Workbench	The student will be able to: * Solve linear static problems using different element formulations * Convert and idealize different types of geometries to accommodate the FE method * Perform FE calculations using Ansys Workbench * Optimize simple designs using Ansys Wokbench * Validate the results obtained from Ansys Workbench	Upon taking the course, the student will be able to judge about the possibilities in using commercial FE software in linear static problems. The student will be able to apply and compare the performance of different types of elements in FEA.	Requirements for attending exam: A course assignment handed in before deadline, presented in class and approved. The course assignment will be solved in Ansys Workbench. The course assignment is done in groups. Each group component answers to all statements and assumptions given in the handed in assignment. Type of examination: Individual oral examination about the theory of FEM based upon a subject found by draw. Examination accounts for 100% of the final grade Duration: 20 minutes Censor: External Allowed tools: The lecturer will provide 1 sheet of paper with a few FEM related notes that the students may use along the examination (such material will be shared with the students in advance) Re-examination: As ordinary
ME-FEM2	Finite Element Method, Advanced	5	The student will gain knowledge about the FE method and its applications. He/she will gain an understanding of how the method works and will be able to solve simple problems analytically and using a commercial soft-ware. The course will include the following topics:	The student will be able to: * Solve linear static problems using Ansys APDL * Perform dynamic FE calculations using Ansys Workbench and Ansys APDL * Interpret the results from a dynamic analysis and understand what they imply	Upon taking the course, the student will be able to judge about the possibilities in using commercial FE software in dynamic problems and in nonlinear static problems. The student will be able to validate his / her FEM models.	Exam prerequisites The course assignment must be handed in before the set deadline. Otherwise the student has used one exam attempt and a new deadline is set. Type of examination: Individual oral examination based upon a subject found by draw. Examination accounts for 100% of the final grade Duration: 20 minutes A laptop with Ansys installed is needed

						at the oral examination Censor: Internal <u>Allowed tools:</u> None <u>Re-examination:</u> As ordinary

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			* Static stress analysis using FE * Element technology * Validation of the FE model * Error estimation * Adaptive mesh generation * Linearized buckling analysis * Free vibration analysis * Structural dynamic problems * Nonlinear solution methods * Large deformations analysis * Nonlinear material modelling and analysis * Contact analysis * Problem solving with Ansys Workbench * Introduction to Ansys Classic * Introduction to heat transfer and coupled problems	* Accommodate the FE method to deal with different types of nonlinearities * Perform nonlinear FE calculations using Ansys Workbench and Ansys APDL * Validate the results obtained from Ansys Workbench and Ansys APDL		
ME-FPR2	International Project within Mechanical Engineering FPR M2	15	The students will further develop their knowledge about developing a project and leverage experiences from previous project work. They will be able to develop a project of high academic as well as practical engineering standards.	Following the course students will be able to • develop a project description and a problem definition • handle problem analysis, idea generation and decision-making • apply generic tools for project planning and execution • develop a written report including structure, formal requirements, project documentation and process report • work in a multicultural project group	The objectives of the course are to make the students • understand the elements that define problem-oriented and project-organized studies at School of Business and Technology, VIA University College • understand the elements of a problem definition and a project description and be able to develop both • understand the importance of innovative processes (problem analysis, idea generation, decision-making and implementation) • understand group dynamics and the theories behind the subject, including cultural differences	Requirements for attending examination During the course a project description must be developed and approved by the group supervisor. Only groups that hand in the written project by the stated deadline will have access to the project exam. Type of examination: Group examination with individual mark based on the course assignment. Group presentation - app. 30

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
					• understand and apply generic tools for project planning and execution • understand the role of the supervisor and project supervision in general • able to execute and document a project in written and oral English • able to structure a written report following formal requirements	minutes - followed by joint questioning session of app. 45 minutes / student. External examiner
ME-FPRPM1	International Project within Mechanical Engineering FPR PM M1	15	The students will acquire project oriented knowledge that will support them during their project work. Students will be introduced to problem-oriented, project-organized and interdisciplinary learning approach. Furthermore the course aims at giving students an opportunity to increase awareness of their own social skills in team-building processes across different cultural and academic traditions.	Following the course students will be able to • develop a project description and a problem definition • handle problem analysis, idea generation and decision-making • apply generic tools for project planning and execution • develop a written report including structure, formal requirements, project documentation and process report • work in a multicultural project group	The objectives of the course are to make the students • understand the elements that define problem-oriented and project-organized studies at School of Business and Technology, VIA University College • understand the elements of a problem definition and a project description and be able to develop both • understand the importance of innovative processes (problem analysis, idea generation, decision-making and implementation) • understand group dynamics and the theories behind the subject, including cultural differences • understand and apply generic tools for project planning and execution • understand the role of the supervisor and project supervision in general • able to execute and document a project in written and oral English. • able to structure a written report following formal requirements	Group examination with individual mark based on the course assignment. Group presentation - app. 30 minutes - followed by joint questioning session of app. 45 minutes / student. Internal or external examiner There will be given a mark from the ECTS scale (for fulltime students from the corresponding 7 step scale).

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
ME-FRM1	Fracture Mechanics and Fatique	5	Gain knowledge about the crack opening mechanisms in metallic materials. How the mechanism of crack propagation occurs as well as how fracture mechanics and fatigue is related.	After the course, the student will be able to, * Apply fracture mechanics methods to real life cracked parts in order to define the expected lifetime for the given specimen. * Calculate expected lifetime for new parts as well as being able to asses' designs, evaluate them with respect to fatigue, and fracture mechanics.	The student will be able to evaluate already cracked specimens and define the expected remaining lifetime for the given part. Furthermore, the student can act as part of a surveyor team that investigates broken machinery due to dynamic loading and describe the circumstances that lead to the failure. After the course, the student can use the knowledge and acquired skills in projects involving dynamical moving parts to calculate dimensions and specify designs.	**Prerequisites:** None **Type of examination:** Individual oral examination based upon a subject found by draw. Exam time: 20 minutes No preparation Examinations account for 100 % of final grade Internal censor. **Allowed tools:** None **Re-examination:** As ordinary
ME-IDP1	Innovation and Design of Products	5	Upon the completion of the course, the student will acquire knowledge: • To define human-centered design. • To describe user experience (UX) design methods. • To identify the fundamental ergonomics aspects in good product design. • To find, characterize and select the most relevant methods/ tools for user needs identification, acquisition and interpretation. • To identify and choose between different design approaches. • To define and formulate customer value proposition.	Upon the completion of the course, the student will be able: • To extensively apply User Experience (UX) design methods throughout a design project. • To implement correctly the selected methods/tools (e.g. Von Hippel, function analysis, think-aloud, role play, mood board, etc.) to achieve their designated goals for data analysis/synthesis from the product re-design and human-centered design perspectives. • To relate, evaluate, and reason the key findings derived from the various undertaken analyses and syntheses.	Upon completion, the student will be familiar with and able to implement Design Thinking models to start, plan, innovate, and complete a design project to a conceptual level including multiple dimensions e.g. the business perspective.	<u>Requirements for attending examination</u> <u>Type of examination:</u> 1) 15 minutes of group presentation presenting the A2 sized poster and prototype. 2) With the presence of all other group members, 15 minutes individual oral examination based up-on the submitted synopsis and an additional question drawn during the examination session. A list containing the additional questions will be accessible to the students at minimum one week in prior to the examination date. Examination counts for 100% of the

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			• To classify, interpret and implement business models for product design. • To reason system interconnectedness exploration is essential in design thinking.	• To identify and translate user needs to product requirements • To assess solution propositions in a business, risk and functionality perspective (e.g. DeBono, HOQ, 6D's of exponential technology) • To implement disruptive thinking to reflect on design solutions and reframe design problem.		final grade. External examiner <u>Re-examination:</u> Same as ordinary examination.
ME-INO1	Engineering Innovation Weeks (Mechanical Engineering)	5	After having successfully completed the course, the students will have gained: An understanding of innovation and its uses within the field of engineeringKnowledge about Design Thinking (double diamond) processKnowledge about how to create a systematic and measurable progress in innovation tasks integrating performance, business and sustainability aspects.The ability to define system thinking and to explain the advantages of system thinking in problem solving	After having successfully completed the course, the students will be able to:Engage in innovative processes in a cross-/inter-/multidisciplinary settingConceive, plan, and execute innovative ideasWork methodically with innovationCollect and apply relevant information about technologies, markets and end users To apply system thinking tools (e.g. causal loop diagram, mental model, concept mapping, etc) in problem analysis.Apply MakerSpace technologies for prototyping	After having successfully completed the course, the students will have gained competences in:Introducing innovative ideas into project work-Contributing own professional skills in teams with the objective of solving problems by using innovative processes and modelsClarifying multidisciplinary group competenciesDeveloping innovative products and solutions while taking into account both functionality, business, and sustainability	
ME-INP 1	Internship (ME)	30	The student must: • gain knowledge of theory, methodology and practice within a profession or one or more fields of study • be able to understand and reflect on theories, methodology and practice • be aware of non-technical – societal, health and safety, environmental, economic and industrial – implications of engineering practice	The student must: • be able to apply the methodologies and tools of one or more fields of study and to apply skills related to work within the field/fields of study or profession • be able to assess theoretical and practical problems and to substantiate and select relevant solutions • be able to communicate professional issues	The student must: • be able to handle complex and development oriented situations in study or work contexts • be able to independently participate in professional and interdisciplinary collaboration with a professional approach • be able to identify own learning needs and to organise own learning in different learning environments	

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
					• promote an engineering-oriented approach during the remaining semesters on the Bachelor programme • develop personal skills required for the professional career as engineer • form the basis for developing personal/professional network	
ME-MAT1	Mathematics 1 (ME)	5	The student will attain knowledge of standard mathematical methods in the following areas * Differentiation including the chain rule and partial derivatives * Approximation by Taylor series * Integration including partial integration and substitution * First order ordinary differential equations (ODEs) including separable ODEs * Second order ODEs with constant coefficients, the damped harmonic oscillator * Complex numbers including the Euler formula * Polar coordinates * Parametric curves * Vector functions and curves	After completion of the course the student must be able to * Calculate the derivative and integral of mathematical functions * Solve first and second order ordinary differential equations * Perform algebra using complex numbers * Parameterize simple plane curves * Describe dynamical variables such as position and velocity using vector functions * Interpret plots of functions of one or two variables The student must be able to explain all steps in calculations. Computer-Aided Algebra (CAS) tools may be used as tables of derivatives and integrals of elementary functions, for checking results, and for plotting and typesetting.	Having completed the course the student will be able to apply knowledge and skills to * Choose an appropriate mathematical method to solve problems in science and engineering analytically * Evaluate results obtained using mathematical methods qualitatively and quantitatively * Read texts using the mathematical methods covered	Requirements for attending examination Participation in at least 2 of 4 tests throughout the semester. Examination type Written exam 4 hours. Examination accounts for 100% of final grade Internal examiner Allowed tools All tools are allowed Use of the internet is not allowed. Re-examination Please note that the school can decide that the re-examination can be oral.
ME-MAT2	Mathematics 2 (ME)	5	The student will attain knowledge of basic linear algebra and statistics as well as scientific programming in the following areas: * Matrix algebra * Eigenvalues and eigenvectors	After completion of the course the student must be able to: * Perform matrix algebra * Find eigenvalues and eigenvectors of small matrices * Solve linear systems of ODEs	Having completed the course the student will be able to apply knowledge and skills to: * Formulate and solve linear problems in engineering using linear algebra analytically and numerically.	Requirements for attending examination All mandatory assignments handed in to the lecturer Type of examination: Individual oral examination based upon a subject found by draw.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			* Linear systems of ordinary differential equations (ODEs) * Probability and conditional probability * Mean and variance * Binomial, poisson and normal distributions * Data analysis in Matlab * Logical expressions * Branch and loop statements * Numerical solution of ODEs	* Use Matlab to perform the above tasks and for plotting as well as simple data analysis	* Read and write simple scripts and functions in Matlab.	Examination counts for 100% of the final grade No preparation Censor: Internal Allowed tools: Laptop Re-examination Same as ordinary
ME-MCM1	Mechanics of Composite Materials	5	Upon completion of the course, the student should be able to: - Explain the design process using fibre reinforced composites. - Indicate the difference between design for strength or compliance. - Name the different materials used in fibre reinforced materials and sandwich structures. - List the different manufacturing processes for fibre reinforced composites and sandwich materials - Describe the differences between micromechanics, ply mechanics and macromechanics - Explain the use of ANSYS Composite PrepPost (ACP) in order to evaluate the performance of fibre composite structures. - Describe the use of shell and solid models in order to analyse reinforced composite structures. - Identify the parameterization possible in ACP for the targeted optimization of fibre composite structures.	Upon completion of the course, the student should be able to: - Design components, using fibre reinforced composite materials and sandwich structures. - Analyse, simulate and verify the strength of components made of fibre reinforced composite materials and sandwich structures. - Use the tool Ansys Composite PrepPost effectively on various types of structures. - Apply the parameterization options available in ACP.	Upon completion of the course, the student should be able to: - Choose and apply the right design procedure, materials and methodology to design a component using fibre-reinforced materials. - Design and manufacture small components by hand layup and vacuum assisted resin transfer - methods. Furthermore, choose the correct adhesive and procedure in bonding laminates. - Determine the strength of structural adhesive connections. - Test and analytically verify the strength and stiffness of simple coupon specimens. - Analytically verify the strength and stiffness of laminae and laminates used in simple structures, - beams and stiffened panels. - Apply the correct failure criterion for different fibre-reinforced composites and various applications. - Apply the tool Ansys Composite	Requirements for attending examination Mandatory course activities completed. Course assignment handed in before deadline Type of examination: Individual oral examination based upon a subject found by draw. No preparation Examinations account for 100 % of final grade Internal censor Allowed tools: None Re-examination: Please note that re-examinations may take a different form than the ordinary exams.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			- Explain the essential failure criteria and their applications. - Identify the importance of recycling and circular economy.		PrepPost to 3D structures. - Conclude if a structure should be modelled using shell or solid elements. - Use the draping tool to effectively judge if a layup can be adapted to the correct shape.	
ME-MDE1	Machine Design	5	After the course, the student has knowledge about: * How simple mechanical, pneumatic and hydraulic machine systems are build, and know the most common machine elements used for such systems. * The basics for machine assemblies formed of main components, such as rotary and linear actuators, which works air driven or hydraulically. * The theoretical basis for calculation and dimensioning of standard mechanical components such as industrial gears, gear pairs, belts, couplings, clutches and brakes. * The theoretical basis for calculation and dimensioning of simple hydraulic systems, including Bernoulli's principle for fluid dynamics. * Function of standard hydraulic components. Simple open hydraulic circuits.	The students will have skills to, Calculate/define demands for a simple assembly, based on a given set of physical facts and functional needs. Select machine elements from product data and dimension the size of these, to connect them physically together into a simple machine system.	Having completed this course, students should be able to explain construction and functional principles of simple machines. Understand the parameters for choosing machine elements and for design/dimensioning of simple machine assemblies. Interpret and use the catalogue data for main components. Find and compare necessary knowledge and data by web searching. Set up possible solutions for the design of simple assemblies, based on specific demands and criteria.	Requirements for attending examination None Type of examination: Individual oral examination based upon a subject found by draw. Preparation time 20 minutes. Exam time 20 minutes. External censor Allowed tools: Personal notes Laptop Re-examination: As ordinary
ME-MEC1	Mechanics	5	The student will acquire knowledge of basic statics in the following subjects: • Force systems, forces, moments, couples and resultants.	Following completion of the course the student will be able to, • Set up a free body diagram and set up static equilibrium equations. • Calculate reactions and determine	The student will gain competence to design simple mechanical equipment and be able to participate in projects relating to simple design and dimensioning tasks.	Requirements for attending examination Type of examination: Individual oral examination, based upon solving an assignment found

			• Method of joints and method of sections applied to flat grids and calculation of forces in frames and machines. • Distributed loads, area centers, external loads on beams, internal forces in beams. • Diagrams for normal force, shear force and bending moment. • Relationships between load, shear force and bending moment. As well as knowledge at an introduction level of the following topics: • Strength values of materials, cross-section constants using tables. • Normal stress, shear stress, Von Misses stress and allowable stress. • Friction, friction types, dry friction.	internal forces in simple structures that are static determinate. • Dimension and design simple structures and select materials based on material strength values.		by draw. The duration is app. 20 minutes No preparation time at the examination. The examination assignments are handed out at least one week before the exam. Examination counts for 100% of the final grade Internal examiner. <u>Allowed tools:</u> None, however books from the course will be available at the examination room. <u>Re-examination:</u> As ordinary
ME-MEC2	Mechanics 2	5	The student will acquire knowledge in methods of analysis and calculation within mechanics in the following subjects: * Stresses and strains in materials. * Plane stress with the Mohr diagram, combined load. * Static failure theories. * Deflection of beams, statically indeterminate structures. * Buckling of columns.	Following completion of the course the student will be able to, * Calculate stresses and strains in materials from axial load, torsional load, bending, and transverse shear. * Analyses of plane stresses from combined loads of a structure by calculation and by use of Mohr diagram. * Dimensioning static loaded machine components and determine the safety factor against static failure * Calculate deflections of beams by integrating the elastic line equation and by use of superposition and standard figures.	The student will gain competence to analyze, evaluate and document a mechanical design in relation to its strength. In addition, the student will have the competence to self-expand his knowledge and skills in mechanics.	**Requirements for attending exam:** Tests in laboratory including a report of app. 3-4 pages accomplished and accepted. The work must be done in groups of app. four students. The workload is app. 6 hours per student. **Type of examination:** Individual oral examination, based upon solving an assignment found by draw. The duration is app. 20 minuts. No preparation time at the examination. The examination assignments are handed out at least one week before the exam. Examination counts for 100% of the final grade. External examiner

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
				* Calculate reactions in statically indeterminate structures. * Calculate for buckling of simple columns with a centrical axial load. * Design and approve static loaded structures.		**Allowed tools:** None, however books from the cource will be available at the examination room. **Re-examination:** As ordinary
ME-MED1	Machine Element Design	5	The student will acquire knowledge in calculating and selecting suitable mechanical standard components and apply them in a machine design. Specified in topics: * Shaft and key design * Bearings and bearing life * Springs * Screws and connections * Welded joints * Interference Fits * Fatigue design of shafts * GD&T tolerances * Design details using standard CAD components	Following completion of the course the student has skills in: * Designing shafts and keys * Selecting suitable standard components like bearings and screws * Designing interference fits * Geometric tolerancing * Using standard components in 3d CAD * Fatigue examinations with focus on rotating shafts	Upon completing the course, the student will have gained competences in identifying and applying suitable standard components in a machine design and designing rotating shafts. Furthermore, the student will have competences in arguing, relating and justifying technical solutions.	Requirements for attending examination Course assignment handed in before deadline Type of examination: Oral examination without preparation based upon course assignment(s) Duration: App. 20 min including 5 min of group presentation(grading included) Examinations account for 100 % of final grade Internal censor Allowed tools: All Re-examination: As ordinary
ME-MTR1	Materials Science	5	At the successful completion of the course, the student will be able to explain: • Mechanical properties of metals. • Deformation and strengthening mechanism for metals. • The relation between deformation, stress and fracture in tension-loaded materials. • Metal failure. • The iron-carbon diagram.	At the successful completion of the course, the student will be able to: • Select a suitable material for manufacture of components in steel, cast iron, stainless steel, titanium, aluminium, or polymers. • Select a suitable heat treatment. • Carry out common test methods for materials. • Apply corrosion preventive measures for different corrosion forms.	At the successful completion of the course, the student will be able to participate in product development tasks covering the design and/or evaluation and improvement of steel, cast iron, titanium, aluminium or polymer items. Furthermore, the student should be capable of seeking, validating and acquiring additional knowledge within the subject independently.	Requirements for attending examination Tests in laboratory accomplished and subsequent test report accepted. Type of examination: Individual oral examination based upon a subject found by draw, without preparation. The duration is approx. 20 minutes. Examination counts for 100% of the

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			• Phase transformations for metals. • Thermal processing of metals. • Main aspects about corrosion. • Polymer structures. • Common manufacturing processes for polymer parts. • Composites structures and design choices. • How to choose materials based on material properties and corrosion environment.			final grade. Internal censor <u>Allowed tools:</u> None, however the lecturer will provide the course literature/book for the student during examination. <u>Re-examination</u> As ordinary
ME-PQE1	Production, Quality and Economy	5	The student will gain knowledge about: * Common quality systems and how to use them. * Different possible production layouts and setups, in order to be able to select between them. * ERP systems and material management in factories. * ISO 9000 / ISO 14000 systems and the importance of those in production. * Financial statements and tools to analyze on them. * Cost ratios price calculations. * Budget setup and control of project's. * Immaterial rights	The student will gain skills in: * Selecting suitable plant layout * Analyzing operational and quality technical conditions of production enterprises * Analyzing products cycle time and influence on the production strategy. * Work through productional lead-time analysis of products * Estimate cost prices * Operate simple processes in ERP system. * Develop corporate/project financial statements * Define relevant investment options * Make profit and cash budgets	Upon completing the course, the student will be able to combine analysis results and evaluate the operability of the producing companies, describe and apply quality management methods and quality control into prod-uct development and production setups, analyze a company's productional opportunities in terms of financial and strategic strength, judge engineering related decisions with regards to their consequences in quality and ease of production, analyze projects financial statements, choose among investment options, and make profit and cash budgets and use these as management tools.	<u>Requirements for attending examination</u> Mandatory course activities completed <u>Type of examination:</u> 1 on-line exam in end of the semester. Exam time: 60 minutes. Test account for 100 % of final grade No censor <u>Allowed tools:</u> Personal notes Laptop <u>Re-examination:</u> As ordinary
ME-PWS1	Test of Materials	0				
ME-PWS2	Manufacturing technology 1	0				

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
ME-PWS3	Manufacturing technology 2	0				
ME-PWS4	Workshop 4: - Electro technology, Hydraulic and Pneumatic	0	Electro technology: Understanding a DC series and parallel circuit: - Ohm's Law - Kirchhoff's Voltage and current Law - Equivalent resistors Understanding of AC circuit both single and three phases: - Single phase impedance connection - Star-Y and Delta-Δ resistors connection - Investigate Electrical drivetrain of DC-motor and understand their characteristics Hydraulic and Pneumatic: Understanding the following in basic circuits: - Regulate speeds in hydraulic systems - Control forces for hydraulic circuits - Basal difference in the use of pneumatic and hydraulic circuits - Functions of different types of system components	Electro technology: Using a multi-meter to measure DC/AC quantities, such as voltage, current and resistance. Build a DC-circuit at a bread board Assembly of an electrical DC/AC drivetrain and be able to investigate its characteristics Hydraulic and Pneumatic: How to regulate speeds in hydraulic systems How to control forces for hydraulic circuits Knowing the basal difference in the use of pneumatic and hydraulic circuits Knowing the functions of different types of system components	Electro technology: After the course, participants will have gained insight into voltage drop and current distribution in a DC-circuit. Furthermore, understand the different in star versus delta connection for three phase AC-circuit and the relationship between speed and torque curve for a DC motor Hydraulic and Pneumatic: After the course, participants will have gained insight into how hydraulic systems is build up and what to do to control it. Furthermore, in which way hydraulic and pneumatic systems work differently and what the different types of components can be used for, in basic systems.	Mandatory participation and each exercise to be approved by the Lecturer. Approved/Not approved
ME-PWS5	Workshop 5: Energy, Polymers, Robotis	0		Energy Measuring the drag force for different aerodynamics shapes and to find the pump performance curve. Polymers Understanding of the manufacturing processes of injection molding, extrusion, thermoforming, welding and blow molding.	Energy The participants will be able measure the drag force and lowering the drag coefficient by modify the shape and to be able find the link between the flow rate and the head for the centrifugal pump. Polymers After the course, participants will have gained insight into the most	

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				Robotics Programming Universal Robot UR3 and to start up production line - Festo Industry 4 plant and produce some product parts.	common polymer manufacturing processes Robotics Be able to do simple programming of a robot and to start up a production line.	
ME-REI1	Reverse Engineering and Inspection	5	After the course, the student has the knowledge of: o Scanning (Blue Light Scanning) a model o Manipulating polygon models – smoothing, close holes, split and separate o Creation of curves o NURBS surface Technology o Link between NURBS created and CAD models o Alignment of polygon model against CAD data o Measuring differences between the 2 models according to given tolerances o Measuring and Inspect tolerances and GDT values o Different alignment methods and awareness off the difference o Process control regarding specific tolerances and GDT values o SPC and Process Control (Cp and Cpk values)	The student will gain knowledge about the special behavior of polygon models and the technologies available for manipulating and designing proper models. The student will learn, practice and exercise the interface between polygon models and CAD systems, as this is a normal practice by modeling and engineering “organic” models- and use this knowledge in a qualified way to decide, what method to use in a specific part design (model and/or CAD). The student will theoretical and practical work with Inspection and understand single inspection and process inspection.	The student get the competencies to understand, specify and evaluate Reverse Engineering and Inspection activities in a modern manufacturing environment.	
ME-RMS1	Robotics and Multibody Systems	5	The student can explain the structure of robots, mechanisms, multi body systems and manipulators. In addi-tion, the student can express	The student can design a manipulator (for example a special designed robot for industry and laboratories)	The student can analyze a commercial robot and design and construct a	Requirements for attending examination Requirements for attending examination:

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
			kinematics, kinetics, and dynamics for robot systems. Robots: • Spatial descriptions of robots, mechanisms and manipulators • Coordinate transformation and transform arithmetic • Forward manipulator kinematics (position, velocity and accelerations) and inverse manipulator kine-matics • Manipulator kinetics (forces and torques) • Planning robotic motion • Calculation of motion, forces, tor-ques for robots with MathCAD and simulation with MatLab. • Programming of robots Multi Body: • Mechanism definition and struc-ture. • Frames, body orientation, general-ized coordinates, geometric con-straints and driving constraints. • Kinematical analysis (position, ve-locity and acceleration) • Kinetic analysis, mass and inertia, applied forces • Forward and inverse dynamics • Multi Body programs (for example in MatLab) Machine vision	and analyze the dynamics (posi-tions, velocities, accelerations, forces and torques in time domain). The student can write simple pro-grams for a robot. The student can analyze a closed mechanism (multi body system) with respect to motion, forces and tor-ques. In addition, the student can apply Multi Body analysis software. The student can decide, if and how a vision system must be applied.	"home-made" robot or mechanism on sketch level.	- A certificate form Universal Robot Academy - A simulation finished in RoboDK (15 hours) - Course assignments for examina-tion (25 hours) <u>Type of examination</u> Individual oral examination without preparation based upon course as-signment(s) Examinations account for 100 % of final grade Censor: Internal <u>Allowed tools</u> Course literature according to the course description, Personal notes, Laptop, Calculator <u>Re-examination</u> As the ordinary examination

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			• Structure of machine vision system • Applications of machine vision • Image enhancement, segmentation and feature extraction • Image recognition			
ME-SEP1	Semester Project: Product Development and Design of Mechanical Equipment	5		Students completing the project acquire skills in: • Compile a project description • Use idea generating tools • Compile a technical report • Document the project process	After the project, students should be able to: • Work interdisciplinary in a project that will contain elements of all the 1st semester's subject areas. • Make a problem analysis • Describe a problem (problem formulation), as well as action plan (total project description) • Conduct a product development process of mechanical equipment • Design and dimensioning mechanical equipment, including selecting suitable materials and manufacturing technologies. • Document the result in a project report and accompanying attachments (Appendix) • Describe the project process in a process report • Formulate the reports in a concise, accurate and clear language • Present orally and state the reasons for selected solutions and methods used • Gain an understanding of the group work form and solve a specific task in collaboration with a group of fellow students	Prerequisites: The project report and process report must be handed in before the deadline. Type of examination: Group presentation followed by an individual examination with the presence of the entire group. The individual assessment is based on the reports, the group presentation, the individual examination, and the individual student's efforts during the process of the project Duration: approx. 15 minutes + approx. 15minutes/students. Intern censor Allowed tools: Laptop, reports, models Re-examination: Students who failed a semester project in January or June must attend an information meeting on the last Friday in June. At this meeting, the students will get information on specific deadlines as well as the process of re-exam. They will form new groups, if possible in relation to the number of failed

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
						students at the individual semesters. Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Deadline for hand in of the project is mid-August (exact date will be informed at the meeting). There will be no guidance in the period up to hand in. Oral assessment of the project takes place in September.
ME-SEP2	Semester Project 2: Analytical Methods in the Areas of Mechanics and Materials	10	Students who complete the project: * Have knowledge about structuring and planning tools. Keywords include: WBS, function tree, Gantt chart, network planning, estimation of duration, MS-project. * Have knowledge and experience of cooperation techniques. Keywords: collaboration, conflict resolu-tion, group test. * Have knowledge about optimal material selection based on characteristic mechanical loads.	Students who complete the project acquire skills in: * Structure and plan a project * Define a project appropriately * Choose suitable methods and models for solving the challenges of a project * Apply cooperation techniques * Apply analytical engineering methods to product optimization. * Select materials based on mechanical stresses and Life Cycle Analysis.	After the project, students should be able to: * Take responsibility for organizing and implementing a project using skills in structuring, planning and cooperation. * Analyze, evaluate and document the problems of a project using relevant engineering theories and methods, primarily within the fields of mechanics, materials science, design/3D CAD, and machine elements.	<u>Requirements for attending examination</u> The project report and process report must be handed in before the deadline. <u>Type of examination:</u> Group presentation followed by an individual examination with the presence of the entire group. The individual assessment is based on the reports, the group presentation, the individual examination, and the individual student's efforts during the process of the project Duration: approx. 15 minutes + approx. 15minutes/students. External censor <u>Allowed tools:</u> Laptop, reports, models <u>Re-examination:</u>

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
						Students who failed a semester project in January or June must attend an information meeting on the last Friday in June. At this meeting, the students will get information on specific deadlines as well as the process of re-exam. They will form new groups, if possible in relation to the number of failed students at the individual semesters. Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Deadline for hand in of the project is mid-August (exact date will be informed at the meeting). There will be no guidance in the period up to hand in. Oral assessment of the project takes place in September.
ME-SEP3	Machine Design and electrical drive techniques.	10	Students are obligated to identify and gain additional knowledge of relevance for the project. This will be in the areas of machine design and construction and relevant issues of Machine Directive. Students shall show that they know about communication and process for steering a project.	Students are to select, implement and document relevant engineering methods throughout the project work. This containing dimensioning in relation and with consideration to both static and dynamic loads and selection of machine elements and drive units.	After completion of the project, the student must be able to document the project planning and structure of a group's workflow and cooperation. Use elementary models and methods in connection with finding and selecting solutions. Choose and use relevant theories and methods from the semester and from earlier semesters, including circuit theory, dynamics, mechanical transmission and components, in preparation for designing and calculating larger ma-	<u>Requirements for attending examination</u> The project report and process report must be handed in before the deadline. <u>Type of examination:</u> Group presentation followed by an individual examination with the presence of the entire group. The individual assessment is based on the reports, the group presentation, the in-

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
					chines. Evaluate conditions in respect to rules and regulative, such as the Machine Directive. Design and construction of the chosen solution must be documented with calculations and machine drawings, from sketches and up to finished print-out of CAD-drawings.	dividual examination, and the individual student´s efforts during the process of the project Duration: approx. 15 minutes + approx. 15minutes/students. External censor Allowed tools: Laptop, reports, models <u>Re-examination</u> Students who failed a semester project in January or June must attend an information meeting on the last Friday in June. At this meeting, the students will get information on specific deadlines as well as the process of re-exam. They will form new groups, if possible in relation to the number of failed students at the individual semesters. Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Deadline for hand in of the project is mid-August (exact date will be informed at the meeting). There will be no guidance in the period up to hand in. Oral assessment of the project takes place in September.

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
ME-SEP4	Semester project – Energy oriented project with economical and environmental aspects	5	The students will get knowledge about: - Using stage gate project model for short efficient tasks. - Working on a real life problem from the energy based industry problem. - Using economical analysis for products. - Making detailed life cycle analysis for products.	- Obtained skills in Practical problem-solving. - Obtained skills in analyzing components with respect to stress- and deflection using FEM analysis if relevant. - Obtained skills in analyzing components with respect to production costs, overall business potential and environmental impact.	- Being able to form, plan and complete an efficient development project with justified selection of development methods. - Can combine, adopt and optimize project control methods in order to make an effective project period. - Being able to work with stage gate model to ensure a successfully project completion. Examples of focused areas: • Waste heat recovery • Energy efficiency • Energy Optimization in Process Systems • Heat exchanger design • Thermal energy systems design and analysis • Life cycle analysis with respect to National and International emission agreements	<u>Requirements for attending examination</u> The project report and process report must be handed in before the deadline. <u>Type of examination:</u> Group presentation followed by an individual examination with the presence of the whole group. Duration: approx. 15 minutes + approx. 15minutes/students. External censor. <u>Allowed tools:</u> All <u>Re-examination:</u> Students who failed a semester project in January or June must attend an information meeting on the last Friday in June. At this meeting, the students will get information on specific deadlines as well as the process of re-exam. They will form new groups, if possible in relation to the number of failed students at the individual semesters. Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Deadline for hand in of the project is

Kode	Titel	ECTS-point	Viden	Færdigheder	Kompetencer	Eksamen
						mid-August (exact date will be informed at the meeting). There will be no guidance in the period up to hand in. Oral assessment of the project takes place in September.
ME-SEP6	Semester Project - Project execution in a cross - cultural and -professional environment	10	* Social behaviour theory * Communication and negation theory * Management theory * Prototyping and testing * Management and Leadership * Theory of Science – History of evolution	*Selection and execution of Personality and group tests * Defining test series * Identifying own and others science-theoretical belief.	Proactively improve own and group efficiency through proactive self-reflection, team development, collaboration and project management. Ability to reflect and validate on own behaviour from a Theory of Science perspective. Relate to the term evidence in a practical context, evaluate, validate design outcome through experiments, and test. If specialisation: To enhance competencies within chosen specialisation (See additional comments).	<u>Requirements for attending examination</u> The project report must be handed in before the deadline. <u>Type of examination:</u> Oral exam based upon the report and on the individual students ability understand, prioritize and exploit the theory as a tool for improving project work efficiency. Presentation approximately 20 minutes followed by an individual examination off approximately 15minutes / student with the entire group present. External censor <u>Allowed tools:</u> All <u>Re-examination:</u> Students who failed a semester project in January or June must attend an information meeting on the last Friday in June. At this meeting, the students will get information on specific deadlines as well as the process of re-exam.

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						They will form new groups, if possible in relation to the number of failed students at the individual semesters. Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Deadline for hand in of the project is mid-August (exact date will be informed at the meeting). There will be no guidance in the period up to hand in. Oral assessment of the project takes place in September.
ME-SIM1	Simulation of Polymer Mould Flow and Fiber Reinforced Composites	5	Upon completion of the first part of the course, the student should be able to: - Explain the use of Moldex3D in order to design proper parts and moulds for injection moulding. - Explain in which way the model geometry influences the injection moulding process. - Outline which parameters can be adjusted for an optimal injection moulding. - Indicate the necessary data for the injection moulding. Upon completion of the second part of the course, the student should be able to: - Explain the use of ANSYS Compo-	Upon completion of the course, the student should be able to: - Use Moldex3D for parts and moulds analysis, for optimisation of parts and injection moulding process. - Analyse, simulate and verify the strength of components made of fibre reinforced composite mate-rials and sandwich structures - Use the tool Ansys Composite PrepPost effectively on various types of structures - Apply the parameterization options available in ACP	Upon completion of the course, the student should be able to: - Optimise plastic part and mould design by using advanced injection-moulding simulation. - Apply the tool Ansys Composite PrepPost to 3D structures. - Conclude if a structure should be modelled using shell or solid elements. - Use the draping tool to effectively judge if a layup can be adapted to the correct shape. - Choose the correct failure theory for laminated composite structures.	<u>Requirements for attending examination</u> Mandatory course activities completed <u>Type of examination:</u> Two individual oral examinations for each part. For the first part (Mold-ex3D), the examination will be based on a forehand given assignment. For the second part (Ansys ACP), half of the time will be dedicated to discuss a forehand given assignment which must be solved in Ansys ACP and the other half will be dedicated to theoretical questions about the course. Each of the two examination grades accounts for 50 % of final grade. To

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			site PrepPost (ACP) in order to evaluate the performance of fibre composite structures. - Describe the use of shell and solid models in order to analyse reinforced composite structures. - Identify the parameterization possible in ACP for the targeted optimization of fibre composite struc-tures. - Explain the essential failure criteria and their applications.			pass the course, both exams must be passed (min. grade 2) Each part of the course will be examined separately. The first exam will take place right after the autumn break, the other in the exam period in January. -No preparation -Internal censor <u>Allowed tools:</u> None <u>Re-examination:</u> Please note that re-examinations may take a different form than the ordinary exams.
ME-SMC1	System dynamics, Simulation and Control	5	Formulation of system equations for technical systems (mechanical, electromechanical, hydraulic, pneumatic and thermal systems) • Solution of linear differential equations, using Laplace transformations • Application of transform concepts to engineering systems (transients and frequency response) • Analysis of systems using Laplace transform and simulation • Numeric methods for simulation (using for example MatLab) • Simulation of engineering systems using Simulink. • Planning and interpretation of simulation • Logic control	The student can formulate models of technical (mechanical, electromechanical, hydraulic, pneumatic or thermal) systems, analyze the static and dynamic behavior in time domain and frequency domain, and simulate with MatLab / Simulink. The student understands hardware in on-off control systems and can specify the operation of the system. Further, the student can develop the control for a system, including system operation and safety.	The student can develop and analyze dynamic Mechatronic models. The student can design a complete on-off control for a machine, using typically a PLC as controller.	<u>Requirements for attending examination</u> - Course assignments for examination (30 hours) <u>Type of examination</u> Individual oral examination without preparation based upon course assignment(s) Examinations account for 100 % of final grade Censor: Internal <u>Allowed tools</u> Course literature according to the course description, Personal notes, Laptop, Calculator <u>Re-examination</u> As the ordinary examination

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			• Specification of on-off control, using Grafcet diagrammes • PLC programming			
ME-SPP1	Sustainable Power Production	5	The student will acquire knowledge in 1. Photovoltaic cells and batteries 2. Fuel cell and hydrogen storage 3. Smart grid 4. Wind energy 4.1 Wind resources 4.2 Rotor blades for a wind turbine 4.3 Terrain classification, Roughness and orography 4.4 Wind turbine generator 4.5 Wind farm 4.6 Wind turbine transformer and electrical grid 4.7 Cooling system in wind turbine 4.8 Wind turbine components materials	Use the WAsP computer program to estimate annual power production for a wind turbine or a group of wind turbines (Wind farm) and Q blade software for wind turbine blades design. Calculate the power output of photovoltaic cells installation with energy storage. Be able to select between different energy storage scenarios.	The student will be able to carry out study project in the area of sustainable power production and to participate in projects in corporation with experienced engineers.	Requirements for attending examination Mandatory course activities completed Type of examination: Individual oral examination without preparation based upon course assignment(s) Test account for 30 % of final grade Examinations account for 70 % of final grade Censor: Internal Allowed tools: As ordinary Re-examination: Please note that re-examinations may take a different form than the ordinary exams.
ME-SPR2	International Project within Mechanical Engineering SPR M2	10	The students will further develop their knowledge about developing a project and leverage experiences from previous project work. They will be able to develop a project of high academic as well as practical engineering standards.	Following the course students will be able to: • develop a project description and a problem definition • handle problem analysis, idea generation and decision-making • apply generic tools for project planning and execution • develop a written report including structure, formal requirements, pro-	The objectives of the course are to make the students • understand the elements that define problem-oriented and project-organized studies at School of Business and Technology, VIA University College • understand the elements of a problem definition and a project description and be able to develop both • understand the importance of innovative processes (problem analysis,	Requirements for attending examination During the course a project description must be developed and approved by the group supervisor. Only groups that hand in the written project by the stated deadline will have access to the project exam. Type of examination: Group examination with individual

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				ject documentation and process report • work in a multicultural project group	idea generation, decision-making and implementation) • understand group dynamics and the theories behind the subject, including cultural differences • understand and apply generic tools for project planning and execution • understand the role of the supervisor and project supervision in general • able to execute and document a project in written and oral English • able to structure a written report following formal requirements	mark based on the course assignment. Group presentation - app. 20 minutes - followed by joint questioning session of app. 15 minutes / student. Internal examiner
ME-SPRPM	International Project within Mechanical Engineering SPR PM M1	10	The students will acquire project oriented knowledge that will support them during their project work. Students will be introduced to problem-oriented, project-organized and interdisciplinary learning approach. Furthermore the course aims at giving students an opportunity to increase awareness of their own social skills in team-building processes across different cultural and academic traditions.	Following the course students will be able to: • develop a project description and a problem definition • handle problem analysis, idea generation and decision-making • apply generic tools for project planning and execution • develop a written report including structure, formal requirements, project documentation and process report • work in a multicultural project group	The objectives of the course are to make the students • understand the elements that define problem-oriented and project-organized studies at School of Business and Technology, VIA University College • understand the elements of a problem definition and a project description and be able to develop both • understand the importance of innovative processes (problem analysis, idea generation, decision-making and implementation) • understand group dynamics and the theories behind the subject, including cultural differences • understand and apply generic tools for project planning and execution • understand the role of the supervi-	Group examination with individual mark based on the course assignment. Group presentation - app. 20 minutes - followed by joint questioning session of app. 15 minutes / student. Internal or external examiner There will be given a mark from the ECTS scale (for fulltime students from the corresponding 7 step scale).

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					sor and project supervision in general • able to execute and document a project in written and oral English. • able to structure a written report following formal requirements	
ME-SSE1	Study Skills for Engineering Students (ME)	5	The student should be able to • Explain the study activity model, CDIO, SOLO taxonomy, VIA Engineering's DNA • Differentiate between different learning styles and identify own preferred learning style • Explain the strengths and weaknesses of Problem-Based Learning (BPL) • Outline the stages of team development (such as the Tuckman stages) • Identify a project report and a process report and describe the content of the typical main sections of each • Explain the phases of a project (problem analysis, project description, problem solving, documentation) • List the features of academic and technical writing and understand the concept of plagiarism • Define the characteristics of reliable sources (source criticism) • Outline cultural traits that can influence team work in a project • Explain the basics of 3D CAD: sketching, basic modelling, use of	The student should be able to: • Apply good study techniques for planning, reading and note-taking in an intentional manner • Prepare and deliver oral presentations • Communicate correctly also taking target audience and cultural differences into consideration • Write a project report and a process report for the semester project following the VIA Engineering guidelines • Explain and apply the elements of a project description • Design parts and generate assemblies in a 3D-CAD program and document parts and assemblies in traditional 2D drawings	The students should be able to: • Reflect on active learning and how to take responsibility for their own learning • Analyse and apply team dynamics such as communication, motivation, decision-making and conflict resolution. • Apply 3D CAD for technical communication and documentation in semester projects	

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			placed features, assemblies, 2D drawings, and basic simulation			
ME-TDE1	Technical Design	5	Students who complete the course: • Has acquired knowledge in relevant graphic methods / techniques in the field of mechanical engineering. Keywords include: Double-angled projection, unfolding, isometric view, sketching, technical drawing fundamentals according to DS/ISO 128 and DS/ISO 129, surface characteristic, surface roughness, welding symbols, drawing structure (layout, main assembly drawing, sub-assembly drawing, detail drawing, part lists), dimensional tolerances and fits (tolerance system, choice of tolerances / fits) and selected mechanical parts.	Students who complete the course gain skills in: • Communicate graphically in 2D and 3D • Perform technical drawings according to DS/ISO 128/129, including applying tolerances (general and fits) • The hierarchy of technical drawings for mechanical engineering covering sketching, layout-, part-, sub-assembly, assembly drawings and part lists. • Identify and choosing appropriate standard parts.	Upon completing the course, students should be able to: • Design a mechanical product on basis of the stated requirements and criteria. • Communicate with suppliers about technical specifications. • Produce the necessary documentation for production. • Communicate with Production regarding means and methods for a mechanical product.	<u>Requirements for attending examination</u> All course assignments are individual and must be approved by the teacher and the final exam-assignment must be handed in before deadline. <u>Type of examination:</u> Oral examination without preparation based upon the last and final exam-assignment. Duration: App. 20 min (grading included) The examination accounts for 100 % of final grade Internal censor <u>Allowed tools:</u> All <u>Re-examination:</u> As ordinary
ME-TEM1	Technological Processes and Environment	5	The student must gain knowledge about: • Greenhouse effect and circular economy Bulk deformation • Sheet metal forming. • Joining and fastening. • Material removal. • Metal casting. • Powder metallurgy.	Upon completing the course, the student is expected to possess the required skills to: • Select suitable technological processes based upon production volume, geometry, surface requirements, tolerance requirements, load situation etc. • Account for the function of different types of production equipment.	Upon completing the course, the student must be able to participate in development tasks covering the design and/or evaluation and improvement of products, by choosing suitable technological processes. The student must be able to analyze, interpret and use a life cycle analysis having in mind economic and environmental aspects. Furthermore, the student should be	<u>Requirements for attending examination</u> None <u>Type of examination:</u> Individual oral examination based upon a subject found by draw. No preparation. Examinations account for 100% of final grade Internal censor

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			• Design for manufacturing including choice of processes and cost calculations. • Simple life cycle analysis of products and their cost price	• Estimate the cost price of products. • Perform a simple life cycle analysis on a product.	capable of seeking, validating and acquiring additional knowledge within the subject on his/her own.	The lecturer will provide the course literature/book for the student during examination. Allowed tools: Personal notes Re-examination: As ordinary
ME-TER1	Thermodynamics	5	The student will know and understand the basic concepts and relation of thermodynamics including: The role of thermodynamics, thermodynamic properties of pure substances, first and second law of thermodynamics, entropy, gas cycles and internal combustion engines, steam cycles, steady heat conduction, internal forced convection, heat exchange.	The student will be able to: • Analyse a thermodynamic system and select relevant theory in order to enable the student to calculate variables and main capacities for the system. • Apply thermodynamic calculations to choose geometric dimensions or standard components for a system. • Calculate and depict processes for ideal gas and water vapor. • Analyze vapor power cycles for production of power and heat. • Analyze gas power cycles based on Otto cycles and spark-ignition engines. • Analyze heating and cooling of a fluid flowing in a tube and work with the logarithmic mean temperature difference. • Perform a general energy analysis on heat exchangers. • Use EES software for thermodynamic calculations.	The student will be able to include energy aspects in mechanical projects, to solve simple thermodynamic problems, and to communicate with engineers and companies about energy aspects of projects. The student will also be able to follow more advanced courses, for example the courses of the Energy specialization.	Requirements for attending examination: None, but note that some course activities will count towards the final grade even if the student fail to participate Type of examination: 4 hours written exam, electronic hand-in – no scanner provided Course activities (2 tests and approximately 7 hand-ins) account for 30%, final exam for 70%. External censor Allowed tools: All Re-examination: Please note that the school can decide that the re-examination can be oral.

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ME-TMT1	Thermoplastic Materials and Technologies	10	The student must gain knowledge about: **Polymeric materials:** o Definitions o Types o Properties o Data sheets. **Technologies:** o Injection moulding o Extrusion o Thermoforming o Surface treatments o Joining methods o Other technologies. **Design methods and rules regarding relevant technologies.** **Injection moulding tools:** o Design o Materials o Manufacturing o Functions. **Sustainability** o Recycling o Circular economy o Biodegradability.	After the course, the student must be able to: - Select polymers according to their physical and chemical characteristics, for either producing new products or replacing products made of other materials. - Design polymer products according to specific rules related to the relevant technologies. - Select relevant technologies with respect to function, economy, and sustainability. - Understand the function of, and design simple injection moulding tools. - Estimate the cost of injection moulded products. - Evaluate a product's sustainability.	Upon completing the course, the student is expected to participate in development tasks covering evaluation, design, and improvement of polymeric products, having in mind economically feasible technologies, tooling, and sustainability. Furthermore, the student should be capable of seeking, validating, and implementing additional knowledge within the subject by own hand.	Requirements for attending examination Course assignment handed in before deadline. Type of examination: Oral group presentation of the course assignment (approx. 10 minutes) followed by an individual examination (approx. 15 minutes per student) with the presence of the whole group. Two tests during the course account for 30%, final exam for 70%. Internal examiner. Allowed tools: All Re-examination: Same form as ordinary exam and accounting for 100% of the grade (course tests not taken into account).