Find vejen frem
VIA University College

Dato: August 2021

Rev. April 2023
-Technical corrections in assessments
-Addition of IT-PRG1 + ME-ALA1

Rev. February 2024 & Junie 2024
-Description IDE1 (former SEP6)
- Corrections in assessments

Curriculum
Programme section

Bachelor of Engineering in Mechanical Engineering

Applicable to students enrolled in August 2021

Contents

Introduction

In accordance with the Executive Order on Bachelor of Engineering, the purpose of Bachelor of Engineering is to qualify the students to carry out the following professional functions nationally and internationally:

- 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 tasks
- 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 programmes work on the basis of a common graduate profile. The graduate profile is a common profile for all VIA Engineers. The graduate profile is to be combined with the identity of the specific engineering programme.

At VIA Engineering, we are practice-oriented, project-oriented and world-focused. This is put into practice in the form of qualified new graduates obtained through targeted teaching, relevant research and development, as well as collaboration and ongoing dialogue with the business community. The programmes must qualify graduates to handle practical and development-oriented business functions.

Programmes in English as well as admission of international students are hallmarks 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 vast and solid practical experience and know how to anchor theory in practice through lab work, company visits and projects for and in collaboration with companies.

1 Identity of the programme

The Mechanical Engineering Programme at VIA has the additional goal of qualifying its graduates to handle business functions, where the main aim is product development and the construction of machines and plants, with the possibility of specialisation in 1) Intelligent Mechanics, 2) Polymers or 3) Sustainable Energy. It is central that in relation to the above, graduates gain a deep understanding of scientific issues, experimental skills and familiarity with IT tools. At the same time, the goal is for graduates to develop skills to be able to function as project managers within the field of machinery, both nationally and internationally.

The goals of the programme are achieved primarily by:

- Project work being an essential aspect of the teaching, where the academic elements of the programme are integrated via problem solving into a whole, with a focus on application-oriented and practical engineering work. In project work, emphasis is also placed on the students developing academic, professional, methodological, communicative and personal skills.
- Collaborating with research environments and businesses in connection with the implementation of the teaching.
- Offering an international study environment, where parts of the study can be completed abroad, and where several courses are held in English for Danish and foreign students alike.
- Actively using the student's engineering internship to bring about the exchange of knowledge and experiences between VIA and the profession.
- Achieving application- and practice-oriented skills primarily by utilising VIA's facilities within laboratories, manufacturing workshops and libraries, as well as completing internships and practical workshops.
- Priority being given to interdisciplinary focus areas within Digitalisation, Sustainability and Innovation and Entrepreneurship in the programme across the various semesters.

2 Graduate profile for VIA Engineers

Purpose
The newly graduated VIA engineer works problem-oriented, project- and team-based and contributes to advising, developing, inventing and quality-assuring products and solutions. The VIA engineer creates innovative, digital, sustainable and workable solutions to and for current and future societal and engineering challenges worldwide.

Skills
VIA Engineering educate holistic-thinking engineers who, through societal insight and personal development, can exploit the full potential of technology. Therefore, the skills of the VIA engineer range from highly specialised engineering skills to personal skills and the skills of the outside world.

Professional engineering skills

- Masters and applies – with critical reflection – highly specialised engineering knowledge.
- Works challenge-driven, innovative and problem-oriented when developing engineering results.
- Integrates engineering and scientific knowledge, skills and methods in solving engineering challenges.
- Designs, plans, simulates, manages, implements and evaluates engineering solutions and products using digital and technological tools.
- Implements and operates solutions that match engineering needs within the industry.

Organisational skills

- Organises and manages projects and processes based on both risk assessment and market and business understanding.
- Collaborates inter-professionally with a global view and respect for the organisation, culture and methods of businesses and stakeholders.

- Involves knowledge of sustainability and circular economy in the development and implementation of new solutions.

Personal skills
- Works consistently with a curious and innovative mindset and seeks out, critically acquires and brings new knowledge into play throughout life.
- Communicates effectively and collaborates professionally with colleagues and people of different educational and cultural backgrounds.

3 Teaching and working methods

The engineering programme's priority focus areas within Digitalisation, Sustainability and Innovation and Entrepreneurship are integrated into relevant courses, so that together they constitute learning streams for all three areas.

Active and practice-oriented learning is supported by:
- Dialogue-based teaching with a high degree of active participation from students.
- Lectures in subjects where there is a large proportion of knowledge transfer. Lectures are usually combined with practice sessions with a student tutor.
- Project work and problem-oriented learning (PBL) are an essential part of the teaching, as the academic elements of the education programme are integrated into application-oriented engineering projects with emphasis on methodological problem solving.
- Projects being carried out in groups within the programme and in an interdisciplinary collaboration with other engineering programmes.
- Collaborating with research environments and businesses in connection with the implementation of the teaching.
- Offering an international study environment, where parts of the study can be completed abroad and where several courses are held in English for Danish and foreign students alike.
- The student's engineering internship being actively used to bring about the exchange of knowledge and experiences between VIA and the profession.

Application- and practice-oriented skills are primarily achieved by utilising VIA's facilities within laboratories, manufacturing workshops and library.

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

Teaching can be physical, online or located at another campus.

4 Structure and content

The programme is organised as an ordinary full-time higher education programme.
The structure and progression including exams is stated in the overview on the next page.

The official duration of the degree program is 3½ years, divided into 7 semesters of 30 ECTS, corresponding to 210 ECTS points in total.

The scope of each course or project is documented in the form of ECTS points (European Credit Transfer System). 1 ECTS point corresponds to a workload of 27.5 hours for a student, an academic year of 60 ECTS thus corresponds to 1,650 hours of work for the student.

New students are admitted in August every year.

The study includes:

- Compulsory courses and projects
- Elective courses
- Internship
- Bachelor project
- Practical Workshops

A semester consists of 3-5 courses, which are time delimited courses. A course's scope can range from 5 to 10 ECTS points, and a project's scope from 10 to 20 ECTS points.

The purpose, scope, learning objectives and exams of courses are described in this curriculum. For a detailed and complete description of the individual courses, please refer to the course descriptions in force at any given time, which are available on VIA's website and on VIAs Studynet.

There are 5 practical workshops associated with the mechanical engineering programme.

Programme: 1st-7th semester

The programme is structured as illustrated below:

Semester & Theme	Course 5 ECTS	Course 5 ECTS	Course 5 ECTS	Course/Project 5 ECTS	Project 5 ECTS	Project 5 ECTS
7th semester *Bachelor Project and Specialisation*	**AUC1** Automatic regulation and control techniques	**Electives** With focus on specialisation	**Electives** With focus on specialisation	**Bachelor Project**		
6th semester *Automation and Specialisation*	**DSM1** Dynamic systems	**AUT1** Automatic machine systems	**Elective** With focus on specialisation	**BPR1** Preparation for bachelor project	**IDE1** Innovation and Entrepreneurship project	
5th semester *Internship*	**INP1** Engineering internship					
4th semester *Energy And Business*	**FEM1** Finite element analysis 1	**TER1** Thermo and fluid dynamics	**DIG2** Digitalization 2: Industry 4.0	**ECE1** Economy for engineers	**SEP 4** Semester Project 4: Sustainable energy in a business perspective	
3rd semester *Machine Elements and Electronics*	**MEM1** Machine elements and design	**ELE1** Electronics 1	**DYN2** Dynamics 2	**MAT2** Mathematics 2	**SEP 3** Semester Project 3: Company project and machine design	
2nd semester *Machine Design and Materials*	**MEC2** Mechanics 2	**MMT2** Materials, Technologies and Environment	**DYN1** Dynamics 1	**MAT1** Mathematics 1	**SEP 2** Semester Project 2: Advanced product design, mechanics, production and materials	
1st semester *Machine Design and Digitalization*	**MEC1** Mechanics 1	**MMT1** Materials and technologies 1	**DIG1** Digitalization 1: CAD and micro controllers	**TDE1** Technical design	**SEP 1** Semester Project 1: Design from need to product	

In case of ECTS credits transfer or in the transition to a new study curriculum, special arrangements can occur.

Practical Workshops: 1-5

Workshop are practice-related courses of a 24-hour duration (not ECTS-triggering). The courses are conducted in parallel with 1-4 semesters. There are the following five courses:

- ME-PWS1: Turning and Milling
- ME-PWS2: §17, Welding, cutting and bending
- ME-PWS3: CNC machining and 3d scan
- ME-PWS4: Electricity, hydraulics and pneumatics
- ME-PWS5: Energy and Plastics

The practical workshops are structured as illustrated below: **Valid for admission 2021**

Semester Theme	Description
4th semester *Energy and Polymers*	**PWS5** Workshop 5: Practical work shop in energy systems, polymer production methods and robotics
3rd semester *Electrics, hydraulics and pneumatics*	**PWS4** Workshop 4: Practical work shop in electrical direct current- and alternating current systems, electro motors, hydraulic- and pneumatic circuits and components
3rd semester *CNC-Machining*	**PWS3** Workshop 3: Practical work shop in CNC machining, CAD/CAM and assembly techniques
2nd semester *Welding, cutting and bending*	**PWS2** Workshop 2: Practical work shop in flame cutting, TIG/MAG- welding, plasma cutting bending and assembly techniques
1st semester *Turning and Milling*	**PWS1** Workshop 1: Practical work shop in machining, measuring techniques and safety

The learning objectives (knowledge, skills and competences) and test form of the courses are shown in Appendix 1.

5 Compulsory elements of the education programme, 1st-4th semester

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

The 1st-4th semesters all contain a semester project amounting to 10 ECTS and included will be learning inputs in the form of videos, online lectures, learning paths etc. amounting up to 2.5 ECTS. The amount of learning inputs can vary in the different semesters. The learning inputs are followed up by discussions initiated by the project supervisor.
The overall purpose of the semester project is to link the semester's courses together as a whole. Study technique. project management, methodology, scientific theory, research methodology and teamwork are introduced through the study in connection with the semester projects.

For summer admission, the 6th and 7 semesters contain, compulsory courses as well as elective courses and projects that are targeted at specializations.

Each semester is themed, and knowledge and skills are acquired through the courses, while competencies are acquired and can be tested in the project – Problem-oriented learning.

1. Semester: Machine Design and Digitalization
2. Semester: Machine Design and Materials
3. Semester: Machine Elements and Electronics
4. Semester: Energy and Business
5. Semester: Internship
6. Semester: Automation and Specialisation
7. Semester: Bachelor Project and Specialisation

5.1 1. semester

1. SEMESTER - Machine design and digitalization

In the 1st semester, the student is introduced to mechanical design, materials and production methods and a basic teaching in 3d CAD and technical drawing is given. The student gains an understanding of digital control methods through the use of sensors and actuators.

The purpose of the courses, ECTS and assessment:

Mechanics (MEC1) – 5 ECTS	**Assessment**
The course aims to provide the student with basic skills in statics and strength theory to be able to analyse and dimension products, machines and production equipment within the industrial field.	Prerequisites for exam: None Exam type: Individual oral exam based on solving an assignment found by drawing lots. The duration is approx. 20 minutes. No preparation time for the exam. The exam assignments are handed out at least one week before the exam. Exam counts 100% of the final grade. Internal censor Tools allowed: None, however, the course textbooks will be available in the exam room. Re-exam: As ordinary
Materials and Technologies (MMT1) – 5 ECTS	

The main purpose of the course is to enable the student to choose relevant types of steel based on material properties and to select relevant manufacturing technologies.	Prerequisites for exam: The laboratory report must be submitted on time and must be approved by the lecturer. Exam type: Individual oral exam, without preparation. Duration approx. 25 minutes Exam counts 100% of the final grade Internal co-examiner Weighting: The material part and the technology part each weigh 50% of the total grade. Tools allowed: All Re-exam: As the ordinary exam
Digitalization (DIG1) – 5 ECTS	
The course aims to equip students with basic digital skills in engineering. The course is divided into two tracks: - 3D CAD and digital twins - Micro controllers and automation	Prerequisites for exam: Mandatory assignments approved by the teachers. Exam type: Individual written exam Duration is 2 hours The exam counts for 100% of the final grade Internal censor Tools allowed: All Re-exam: Same as ordinary
Technical Design (TDE1) – 5 ECTS	
The course aims to provide the student with knowledge and methods for outlining and illustrating machine constructions according to the applicable standardized rules.	Prerequisites for exam: All 14 mandatory assignments must be approved by the teacher. Exam type: Individual oral exam without preparation based on the final course assignment uploaded to Wiseflow. Duration is 20 minutes The exam counts for 100% of the final grade Internal censor Tools allowed: All Re-exam: Same as ordinary
Semester Project (SEP1) – 10 ECTS	
In order to train the student's practical professional skills, the Semester and Bachelor projects at VIA Engineering work in a group context with the solution of a current academic problem.	Prerequisites for exam: The project report and process report must be submitted before deadline. Exam type:

The objectives are thus: – Apply professional skills in a problem-based context. – Solve engineering problems based on current semesters' subjects. – Demonstrate the ability to prioritize between issues and work in detail with selected issues The focus of the teaching in SEP1 is: Basic introduction into study techniques and team-based project work PBL theme: LEARN TO LEARN.	Oral group exam with individual assessment. Group presentation, approximately 20 minutes followed by a group examination, approximately 20 minutes per student including voting. Grades are given on the basis of the work submitted as well as the individual's performance during the examination. Internal censor Tools allowed: All Re-exam: Last Friday in June an information meeting will be held for students who have not passed the semester project either in January or June. Here, information is provided on specific deadlines and details, just as new project groups are formed where possible in relation to the number of failed students in the individual semesters. Based on the feedback the students have received after the ordinary exam, either a new project must be prepared or the non-passed project can be improved. The project must be submitted in mid-August (exact date and time is to be announced at the information meeting). There will not be supervisors available for supervision at the reexams. The project will be evaluated at an oral re-examination in September.

The learning objectives of the courses (knowledge, skills and competencies) are given in Appendix 1.

Scope:
30 ECTS

5.2 2. semester

2. SEMESTER - Machine design and materials

In the 2nd semester, emphasis is placed on extended mechanics and product design and the student expands his knowledge in material knowledge, dynamics and mathematics.

The purpose of the courses, ECTS and assessment:

Mechanics (MEC2) – 5 ECTS	**Assessment**
The aim of the course is to enable the student to analyse stresses, strains and deformations in structures with the purpose of assessing a machine construction in relation to safety against permanent deformation and fracture.	Prerequisites for exam: Tests in the laboratory and associated report of app. 3-4 pages have been completed and approved. The work must be carried out in groups of approx. four students. The scope of the work is approx. 6 hours per student. Exam type: Individual oral exam based on solving an assignment found by drawing lots. The duration is approx. 20 minutes. No preparation time for the exam. The exam assignments are handed out at least one week before the exam. Exam counts 100% of the final grade. External examiner. Tools allowed: None, however, the course textbooks will be available in the exam room. Re-exam: As ordinary
Materials, Technologies and Environment (MMT2) – 5 ECTS	
The main purpose of the course is to enable the student to choose relevant materials among cast iron, stainless steel, titanium, aluminium or polymers, based on material properties and corrosion environment. Choose relevant manufacturing technologies in a design and development situation.	Prerequisites for exam: None Form of examination: Individual oral examination, without preparation Duration approximately 25 minutes Exam counts 100% of the final grade Intern co-examiner Weighting: The material part and the technology part each weigh 50% of the total grade. Tools allowed: All Re-exam: As the ordinary exam
Dynamics (DYN1) – 5 ECTS	
The course aims to provide the student with basic skills in particle dynamics and forms the basis for DYN2.	Prerequisites for exam: Mandatory assignment in Mathcad. If the assignment is not handed in and approved by the deadline set by the teacher, an exam attempt has been used. A new assignment and deadline will be set before the reexam. Exam type: Written 4 hours. If the student prepares their solution by hand he/she must scan the solution at the end of the exam. Scanners will be provided. Tools allowed: All usual

	Re-exam: The school can decide to conduct the reexam as an oral exam
Mathematics (MAT1) – 5 ECTS	
The course aims to strengthen and expand the student's basic skills in mathematics, especially in differential calculus.	Prerequisites for exam: None Exam type: Written exam Duration is 4 hours Grade is exclusively based on the exam External censor Tools allowed: All usual, but no communication and no use of the web during the exam Re-exam: Same as ordinary
Semester Project (SEP2) – 10 ECTS	
The purpose is to train basic study techniques and team-based project work in connection with making extended product design. Apply professional competencies in a problem-based context and solve engineering problems based on current and previous semesters' subjects.	Prerequisites for exam None Type of examination: Group presentation on the basis of project report and processreport ollowed by an individual examination with the presence of the whole group. Duration: approx. 20 minutes + approx. 20 minutes/students. Censor: External Allowed tools: All 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 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.

The learning objectives of the courses (knowledge, skills and competencies) are given in Appendix 1.

Scope:
30 ECTS

5.3 3. semester:

3. SEMESTER - Machine elements and electrical engineering

In the 3rd semester, machine components that are both static and dynamic are calculated and dimensioned and electrical systems are taught in order to select correct electric motors. Knowledge of dynamics and mathematics expands.

The purpose of the courses, ECTS and assessment:

Machine Elements and Design (MEM1) – 5 ECTS	**Assessment**
To acquire methods and tools in machine elements, technical design and dynamically loaded shafts.	Prerequisites for exam: Course assignment submitted before deadline. Exam type: Oral group exam without preparation based on the course assignment. Duration for 2 students approx. 30 min. incl. 5 minute group presentation. Incl. assessment. Exam counts 100% of the final grade. External Examiner. Tools allowed: All Re-exam: As ordinary
Electrical Engineering (ELE1) - 5 ECTS	
The main purpose is to gain knowledge about electrical systems, electrical installations and to be able to calculate and select correct electric motors.	Prerequisites for exam: 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. Internal Censor Allowed tools: None, however the course textbooks will be available in the examination room Re-examination: As ordinary
Dynamics (DYN2) – 5 ECTS	
The course should enable students to apply kinematics and kinetics for describing the movement of rigid bodies, as well as introducing the description of mechanical vibrations.	Prerequisites for exam: On week before the exam, the student must hand in solutions of the 8-12 problems which have been chosen as exam questions. The students are informed about the choice of exam problems on the last day of teaching at the latest. Exam type: Individual oral exam based on a randomly chosen problem. The exam is a discussion based on the students solution. Duration is approximately 20 minutes. There is no preparation time. External co-examiner.

	Tools allowed: None Re-exam: As the ordinary exam with the same exercises. Solutions must be handed in again.
Mathematics (MAT2) – 5 ECTS	
The purpose of the course is to introduce students to linear algebra and basic numerical programming in MATLAB	Prerequisites for exam: Mandatory test in Matlab must be submitted before deadline set by the teacher. If the test is not submitted the prerequisites are not met and the student are not allowed to take the exam. New deadlines will be set for the re-examination. Exam type: Individual oral exam - 20 minutes - based on a question drawn by lottery. No preparation. The exam accounts for 100% of the final grade. Tools allowed: None Re-exam: As ordinary
Semester Project (SEP3) – 10 ECTS	
Apply professional competencies in a problem-based context. Solve engineering problems based on current and previous semesters' subjects. Demonstrate the ability to prioritize between issues and work in detail with selected problem(s) PBL theme: INDEPENDENT KNOWLEDGE INVOLVEMENT	Prerequisites for exam None Type of examination: Group presentation on the basis of project report and processreport ollowed by an individual examination with the presence of the whole group. Duration: approx. 20 minutes + approx. 20 minutes/students. Censor: External Allowed tools: All 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 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.

The learning objectives of the courses (knowledge, skills and competencies) are given in Appendix 1.

Scope:
30 ECTS

5.4 4. semester

4. SEMESTER - Energy and Business

The 4th semester is characterised by dealing with energy and business understanding, but also analytical accounting and digitalisation.

The purpose of the courses, ECTS and assessment:

Finite Element Method (FEM1) – 5 ECTS	**Assessment**
The main purpose of the course is to enable the student to solve linear static problems using the finite element (FE) method and be able to recognize possibilities and limitations in using a commercial FE software.	Prerequisites for 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 member is responsible for all statements and assumptions given in the handed-in assignment. If the prerequisite is not fully met, the student has used one exam attempt and a new deadline is set for qualification to the reexam. Exam type: Individual oral examination about the theory of FEM based upon a subject found by draw. Duration: 20 minutes. No preparation time before the exam. The questions for examination will be shared with the students at the end of teaching. Examination accounts for 100% of the final grade. Censor: External. Tools allowed: 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 along with the exam questions). Re-exam: Same as ordinary.
Thermo and fluid dynamics (TER1) – 5 ECTS	
The student will obtain knowledge of the basic theory within thermodynamics and be able to perform elementary thermal calculations. Incorporate energy aspect in mechanical projects and have a basic knowledge of energy specialisation.	Prerequisites for exam: Mandatory assignments. If the assignment is not handed in and approved by the deadline set by the lecturer, an exam attempt has been used. A new assignment and deadline will be set before the re-exam. Exam type: Written 4 hours, Digitally submission The final exam counts 100% Tools allowed: All Re-exam: As ordinary Final examinations counts for 100 % of final grade
Digitalization (DIG2) – 5 ECTS	

The purpose is to provide the student with basic engineering digital competencies within the industry 4.0 area. The course is co-read across the sector to raise the quality of the digital foundation.	Permit criteria exam: submitted the course assignments Exam type: Course evaluation is a group-based exam. First, the group presents their synopsis together (10 min), followed by a group oral exam 30 min. (including voting). The synopsis counts for 50% and the exam counts for 50% of the final grade Internal censor Allowed tools: All Re-exam: Same as ordinary exam, but without the initial presentation.
Economics for Engineers (ECE1) - 5 ECTS	
The main purpose of the course is to enable students to assess and present the financial consequences of a business case concerning investments in capital equipment and / or product and market development.	Prerequisites for exam: None Exam type: 3 hours written exam. External censor Tools allowed: All except access to internet. Re-exam: Same as ordinary exam
Semester Project (SEP4) – 10 ECTS	
To be able to complete an energy oriented project covering economic and environmental aspects	Prerequisites for exam None Type of examination: Group presentation on the basis of project report and processreport ollowed by an individual examination with the presence of the whole group. Duration: approx. 20 minutes + approx. 20 minutes/students. Censor: External Allowed tools: All 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 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.

The learning objectives of the courses (knowledge, skills and competencies) are given in Appendix 1.

Scope: 30 ECTS

5.5 5. semester

5TH SEMESTER - Engineering Internship

The internship comprises a semester of 30 ECTS and timewise is placed in the 5th semester of the programme. As a general rule the internship period is paid and settled in a private or public company in Denmark or abroad. Student must be on an internship for a minimum of 20 full weeks excluding holidays, etc.

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

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

In collaboration with the company, the student prepares a plan for the internship with appertaining formulated assignments.

The basis for assessment of the internship is an ongoing report from the student to VIA, feedback from the internship company and a presentation where the supervisor can ask elaborating questions about the content of the internship.

If the engineering internship is interrupted before the end of the agreed internship period, the internship supervisor must, in consultation with the head of the education programme, assess whether the internship has been of sufficient length and content for there to be grounds for passing the internship present.

The internship is graded as passed/not passed. Internal evaluation

5.6 6. semester

6. SEMESTER - Automation and specialization

In the 6th semester, a compulsory cross-sectoral semester project is carried out, which aims to develop and document an inter-organizational innovation project in collaboration with a company or institution. There is also the possibility of a cross-sectoral semester project, where work is done on an entrepreneurial project.

Compulsory courses in measurement technology and automatic machine systems are completed and electives are chosen with a focus on specialization.

The bachelor project begins in the 6th semester (BPR1) with choice of subject and preparation of project description.

The purpose of the courses, ECTS and assessment:

Innovation and Entrepreneurship project (IDE1) – 10 ECTS	Assessment
A cross-sectoral semester project that aims to develop and document an across disciplinary innovation and entrepreneurship project based on primary data collection.	Exam prerequisites Hand in 6 written assignments to be approved in WISEflow before deadline. Type of exam: Exam is based upon the IDE1-report submitted in WISEflow before deadline.

	The group presents their prototype/pretotype. The exam room can be customized by the group to support the presentation. Group exam with individual assessment. Group presentation approx. 15 minutes followed by joint evaluation with joint discussion and individual question rounds for approx. 60 minutes per group including assessment. Individual grades are given based on an overall assessment of the submitted work as well as the individual's presentation during the exam. External assessment. Tools allowed: All. Re-exam: Based on the submitted project, the examiner gives the student guidance on necessary improvements in relation to passing the exam (possibly, that a new project should be prepared). The students are informed about specific deadlines and details of the project work. Project groups are formed if possible. No further guidance is provided in the period leading up to submission. The project is assessed at an oral project exam.
Dynamic Systems (DSM1) - 5 ECTS	
The main purpose is to gain knowledge of dynamic systems	Exam requirements None Exam Individual oral exam, 20 minutes, without preparation. The exam counts for 100% of the final grade. Internal examiner. Allowed aids: None Reexam: Same as ordinary exam.
Automatic Machine Systems (AUT1) - 5 ECTS	
The course aims are to provide the student with basic skills in pneumatic and hydraulic systems and to give knowledge in product dimensioning and analysing of machines and production equipment, within the industrial field.	Exam prerequisites none Exam type: Individual oral exam (20 min), based on solving a problem found by draw. 20 minutes preparation time for the exam. The exam counts for 100% of the final grade. External censor Allowed tools: Own notes, textbooks, para Re-examination As ordinary.

Preparation for Bachelor Project (BPR1) - 5 ECTS	
To document the ability to analyse and explore a technical problem and set up plans and methods for solving it. To work efficiently and self-driven alone and in collaboration with others as a mechanical engineer through a project definition phase. To demonstrate the ability to apply acquired knowledge, utilize feedback from previous and current semesters and independently acquire new knowledge when relevant.	Exam prerequisites Approved 30-minute individual multiple choice test on Philosophy of Science Exam type: Written group project description with oral group exam with individual assessment. An overall grade is given for the project description, the project initiation phase and the oral presentation and subsequent examination. Internal assessment Re-examination: As ordinary
Elective – 5 ECTS	

The learning objectives of the courses (knowledge, skills and competencies) are given in Appendix 1.

Scope:
25 ECTS + 5 ECTS (elective)

5.7 7. semester

7. SEMESTER - Bachelor project and specialization

In the 7th semester, a compulsory educational element in automatic regulation and control engineering is carried out, with the aim of obtaining knowledge and skills in the management and regulation of mechanical automatic systems and electives are selected with a focus on specialization.

The Bachelor's project (BPR2) which has begun in the 6th semester with the choice of topic and preparation of the project description is continued.

The purpose of the courses, ECTS and assessment:

Bachelor Project (BPR2) – 15 ECTS	Assessment
To document the ability to work efficiently and self-driven in collaboration with others as a Mechanical Engineer. To deliver expected results in time and acting proactive to reach the project goal.	Exam prerequisites: None Type of exam The examination will be carried out as follows: The whole group will present the project followed by an individual examination with the whole group present. Total durance approx: • Group presentation: 20 minutes. • Individual examination: 15 minutes/ student • Evaluation and feedback per group: 30 minutes The basics for the examination are the project report (including product description, process report and appendices) handed in before deadline and the joint presentation of the project Reexam: As ordinary
Automatic Control and Monitoring Technology (AUC1) - 5 ECTS	

To analyse technical automatic systems and specify automatic requirements for control as well as to select the correct control strategy and management. To provide students with a practical knowledge of on-off control.	Prerequisites for 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
Elective – 5 ECTS	
Elective – 5 ECTS	

The learning objectives of the courses (knowledge, skills and competencies) are given in Appendix 1.

6 Electives

Electives must be chosen in the 6th and 7th semesters. In addition to electives that are targeted at selected specializations, a number of relevant elective courses are offered for the Mechanical Engineering program. Descriptions of the individual elective courses appear from the overview of the courses under section 7.1 and from the course descriptions in appendix 1.

It is also possible to choose one course of 5 ECTS from another education program at VIA, but not courses where the content essentially consists of material from the previous courses of study. Any course choice from other programs must be approved by a study advisor in the engineering programs, as it must be ensured that the chosen course is relevant to the program and constitute an increasing academic level.

The following elective courses are offered at the Mechanical Engineering program.

The purpose of the courses, ECTS and assessment:

Robotics and Multibody Systems (RMS1) – 5ECTS	**Assessment**
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.	Exam prerequisites None Type of examination Individual oral examination - 20 minutes - without preparation. Examinations account for 100 % of final grade Censor: Internal Allowed tools None Re-examination As the ordinary examination
System dynamics, Simulation and Control (SMC1 – 5 ECTS	

To give students knowledge about and ability to develop and analyze dynamic mechatronic models. To give the student basic knowledge about automatic control.	Exam prerequisites None Type of examination Individual oral examination without preparation. 20 minutes Examinations account for 100 % of final grade Censor: Internal Allowed tools None Re-examination As the ordinary examination
Renewable Energy (ENE1) – 5ECTS	
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	Prerequisites for exam: Mandatory assignments. The assignments must be submitted by the deadline and be approved afterwards. Fail to meet the prerequisites will disqualify entering the examination. As of re-exam, a new set of assignment(s) and deadline will be set before the re-exam. Exam type: Oral Examination. The oral exam will count 100% and divided into: a. Oral evaluation based on a mini group project handed in be- fore deadline (50%) b. Additional question from draw on the spot (50%) Grade is on individual basis. Tools allowed: The submitted report of the mini project. Re-exam: Similar to the ordinary exam.
	Case specific: A new set of assignment(s) and deadline might be set before the re-exam. The students might need to work on a new mini project when necessary, improve the already submitted one or keep it without improvement.
Design of Energy Systems (DES1) – 5ECTS	

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.	Prerequisites for exam: Mandatory assignments. If the assignments are not handed in and approved by the deadline set by the lecturer, the prerequisites are not met and new assignment and deadline will be set before the re-exam. Exam type: The final exam will count 100%. The final exam divided into: a. Individual oral evaluation on a mini group project handed in before deadline (50%) b. Additional question from draw on the spot (50%) Tools allowed: All Re-exam: As ordinary
Sustainable Power Production (SPP1) – 5ECTS	
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.	Prerequisites for exam: Mandatory assignments. If the assignments are not handed in and approved by the deadline set by the lecturer, the prerequisites are not met and new assignment and deadline will be set before the re-exam. Exam type: The final exam will count 100%. The final exam divided into: a. Individual oral evaluation on a mini group project handed in before deadline (50%) b. Additional question from draw on the spot (50%) Tools allowed: All Re-exam: As ordinary
Innovation and Design of Products (IDP1) – 5 ECTS	
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.	Prerequisites for exam: All assignments are submitted by the deadline. Exam type: Oral Examination in two sessions: 1) 15 minutes of group presentation of the key findings from the mandatory design project.

	2) With the presence of all other group members, 15 minutes individual oral examination based upon the submissions and an additional question drawn at the examination. A list containing the additional questions will be accessible at minimum one week before the examination date. Examination counts for 100% of the final grade. Internal censor Tools allowed: The group-basis submissions and the tested (and refined) prototype. The lecturer will provide at the examination the additional questions list for reference purposes. Re-exam: Same as ordinary examination.
Finite Element beregning (FEM2) – 5ECTS	
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.	Exam prerequisites The course assignment must be handed in before the set deadline. Fail to meet the prerequisites will disqualify entering the examination. As of re-exam, a new set of assignment(s) and deadline will be set before the re-exam. 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 Allowed tools: None Re-examination: As ordinary
Advanced Designing in 3D-CAD (CAD2) – 5 ECTS	
The main purpose of the course is to provide the student with the knowledge and methods within the fields of more advanced CAD applications for use in the industry.	Exam prerequisites Mandatory assignments handed in before deadline and accepted by the lecturer. Any tests in laboratory accomplished and accepted. Exam type: The evaluation is divided into 2 stages: The first stage (counting 40%) is based on a 2 hour exam in the usage of the CAD software. The second stage (counting 60%) is based on the final and group based group assignemnt handed in the end of the course. To pass the course both stages must be passed with a minimum of 50% approved. Censor: Internal Tools allowed: All

	Re-exam: Same as ordinary. .
Advanced Linear Algebra (ALA1) – 5 ECTS	
To give a better understanding of linear algebra with a focus on topics and applications relevant for engineering.	Prerequisites for exam: The course assignment must be handed in before the set deadline. Fail to meet the prerequisites will disqualify entering the examination. As of re-exam, a new deadline will be set before the re-exam. Exam type: Individual oral exam based on a randomly drawn topic. Duration is approximately 20 minutes. There is no preparation time. Internal co-examiner. Tools allowed: None Re-exam: As the ordinary exam.
Introduction to Programming for Engineers (IT-PRG1) – 5 ECTS	
Basics in algebra, calculus, probability, and statistics. Prior programming experience is not required.	Prerequisites for exam: At the end of the course, the student must upload a written summary of their 6 programming assignments that make up a portfolio of Python programs and of their group project, a total of 5 pages. The summary must include a brief reflection of the learning outcome of solving each of the assignments/group project and may include the docstrings that were written in the programs. Exam type: The exam is a 20-minute oral examination that departs from one of the six assignments that the student made during the semester. The exam will also include an examination of the group project assignment. The final grade will be based on an overall assessment of the six assignments, the group project, and the oral examination. All assignments and projects are programming assignments. Tools allowed: All allowed for the project and the small assignments. At the exam, the student is expected to show their programs which means they must bring a working laptop that is able to display and run their code. Re-exam: If the portfolio or group project are deficient, the student(s) will have to make the necessary adjustments based on input from the teacher. An oral examination will then follow.
Advanced Engineering Mathematics (AEM1) – 5 ECTS	
The purpose of this course is to give students a mathematical foundation for studying mechanical engineer-ing	Exam prerequisites No requirements

beyond the Bachelor level. The focus is on a comprehensive introduction to partial differential equations and methods for their solution.	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.
Cirkulær Økonomi og LCA (SE-LCA1) – 5ECTS	
The purpose of this course is to: a) Provide the students with knowledge of the principles of Life Cycle Assessment (LCA), and how to carry out and interpret LCA analyses of chosen product and services relevant for engineers. b) Provide the students with knowledge of the principles and contents of Circular Economy (CE) and make them able to use this knowledge for business development in line with the UN Sustainable Development Goals (SGD). c) Learn how LCA analyses can be used in relation to making decisions leading to development of Circular Economies.	Prerequisites: Mandatory course activities completed. Mandatory assignments handed in before deadline and accepted. Type of examination: A case based written exam with internal examiner. Allowed tools: Re-exam: Not passing the course - a new course assignment will be given, to be accepted and evaluated in equal manner as within the course.

7 The specializations of the education

The following specializations are offered at the Mechanical Engineering program:

- Intelligent Mechanics: Robots, Automation, Industry 4.0, Digitization
- Polymers Design: Lightweight constructions, plastic and composite materials
- Sustainable Energy: Wind turbines, solar heating, energy storage, CO2 reduction

Each specialization is associated with specific electives as well as the projects of 6 and 7 semesters.

A specialization consists of 2 electives (10 ECTS), 6th semester project (10 ECTS) and bachelor project including preparation (20 ECTS) a total of 40 ECTS.

Electives and specializations are created to the extent that there are sufficient students enrolled in the elective or specialization.

Specialization: Intelligent Mechanics and Systems

The interaction between man and technology is in focus and the student will work with the latest new technologies, robots, satellite communication, etc.

The development of intelligent products and systems is about integration between software, hardware, system development and mechanical engineering.

The keywords for the specialization are:

- Modelling and simulation of mechanical systems
- Control and regulation technology
- Monitoring systems
- Mechatronics

- Measurement technique and instrumentation
- Strength test
- Mobile hydraulics
- Optical recognition
- Robots
- Remote control
- Dynamic GPS
- Satellite communications

Contents:
Automatic Control, Digital Control and Simulation (AUC1)
Robotics and Multi Body Systems (RMS1)
System dynamics, Modelling and Simulation (SMC1)
6th semester project (SEP6): Robot programming, Lab. control and level control
Bachelor project (BPR1 + 2): Project in Intelligent Mechanics and Systems

Completion of this specialization entitles to a profile designation on the bachelor's degree.

Specialization: Polymers

Plastics belong to the family of polymeric materials and over the last century, materials such as metal, wood, glass, clay, cotton and wool have been replaced by polymeric materials due to their tailored properties and low cost.

Today, the polymers are included in so many products that it will be quite impossible to avoid contact with them in one form or another. But how do you make products from polymer materials? How is a cola bottle made?

The keywords for the specialization are:
- Thermoplastic
- Tempered plastic
- Technologies
- Simulation of injection moulding
- Design and development of items and tools
- Semester projects within thermo- or thermosetting plastics
- Collaboration with companies from the plastics industry

Contents:
Thermoplastic Materials and Technologies (TMT1)
Simulation of Injection Moulding of Thermoplastics (SIT1)
6th semester project (SEP6): Design and manufacture an injection moulded, thermoplastic or composite item
Bachelor project (BPR1 + 2): Project in Polymers

Completion of this specialization entitles to a profile designation on the bachelor's degree.

Specialization: Renewable Energy

The whole world's energy production is facing a dramatic shift from coal, oil and gas to energy sources that do not pollute the atmosphere with greenhouse gases. Development of the sustainable energy systems of the future is about energy from solar, wind, waves and CO2-neutral fuels such as straw and wood.

The student will work with basic energy technology, energy savings, design of energy plants and renewable energy technologies such as wind turbines, solar heat and solar cells, biomass and biogas, heat pumps and energy storage, etc.

The keywords for the specialization are:

- Energy consumption and energy savings
- Environment and greenhouse effect
- Pumps and piping systems
- Heat transmission and heat recovery
- Cogeneration and district heating systems
- CO2-neutral fuels
- Solar cells
- Solar heating system
- Cooling and heat pump technology
- Biogas
- Windmills
- Energy storage and fuel cells

Contents:
Design of Energy Systems (DES1)
Renewable Energy (ENE1)
Sustainable Power Systems (SPP1)
6th semester project (SEP6): Design and manufacture / test an energy component or an energy system.
Bachelor project (BPR1 + 2): Project within Sustainable Energy

Completion of this specialization entitles to a profile designation on the bachelor's degree.

8 Bachelor Project

ME-BPR1
ME-BPR2

The programme concludes with a bachelor project (BPR2), which accounts for 15 of the education programme's total 210 ECTS and concludes with an examination. The bachelor project commences in the 6th semester (BPR1) with a choice of subject and preparation of a project description.

The bachelor project must demonstrate independent critical reflection within the chosen topic, and must doc- ument the student's ability to apply engineering theories and methods. The bachelor project must also reflect the student's ability to express themselves in an academic and structured manner within their subject.

A condition for being able to commence the bachelor project is the student being assessed as being likely ready for the examination, as BPR2 must be the last examination of the study.

As a rule, the bachelor project is prepared in groups of 3-4 people.

The bachelor project includes an independent experimental, empirical and/or theoretical treatment of a prac- tical problem in connection with the central topics of the education programme.

The project must be documented in the form of a report containing a project basis, solution description, cal- culations, drawings, etc. If the report is a group assignment, it must be clear who wrote which sections of the report.

The students are examined in the project by oral examination/group test with individual assessment in ac- cordance with the programme's overall goals as described in Section 1 of the Curriculum. The basis for ex- amination is the bachelor project. It is a prerequisite for participation in the exam that the bachelor project is submitted within the stipulated deadline and meets the described criteria for the project.

Examinations can take place at the earliest when all the other examinations of the programme, including in- ternships, have been passed. The examination is assessed according to the 7-point scale and with the par- ticipation of an external examiner. It is the student's own responsibility to keep track of the number of ECTS passed. The student cannot take the exam in BPR2 if there is a lack of passed ECTS.

9 Title and issue of degree

Graduates who have completed the programme of study according to this curriculum + joint regulations, are entitled to use the Title Bachelor of Engineering in Mechanical Engineering.

It is also possible to obtain the following special designations:

- Intelligent Mechanics and Systems
- Polymers
- Sustainable Energy

For completed education, VIA University College issues a diploma stating the title, direction and, if applicable specialty designation. In addition, information is provided on the scope of the sub-elements in ECTS, the re- sult of the assessments achieved as well as the topics for the interdisciplinary project and the graduation project.
In the event of interrupted education, proof of passing study units is issued.

10 Appendix 1: Learning objectives courses Mechanical Engineering enrollment 2021

Code	Title	ECTS	Knowledge	Skills	Competencies
ENG-IDE1	Innovation and Entrepreneurship project	10	After having successfully completed the course, the students will have gained: • An understanding of innovation and entrepreneurship and its uses within the field of engineering and business. • Knowledge about three different innovation processes Design Thinking, Effectuation and Lean Startup • Knowledge about how to create a systematic and measurable progress in innovation and entrepreneurship tasks	After having successfully completed the course, the students will be able to: • Engage in innovative and entrepreneurial processes in a cross-discipline setting • Conceive, plan, and execute innovative ideas • Work methodically with innovation and entrepreneurship • Collect and apply relevant data/information about technologies, markets, and end users • Apply method to gain insights about the solutions impact on the current market. • Convey and argue for the results of a cross-disciplinary project group and the project group's learning process using correct professional terminology and optimal tools both in writing, graphically and orally.	After having successfully completed the course, the students will have gained competences in: • Introducing innovative ideas into project work • Contributing own professional skills in multidisciplinary teams with the objective of solving problems by using innovative and entrepreneurial processes and models • Clarifying multidisciplinary group competencies • Analyze group dynamics and adapt working methods and collaboration methods to new group constellations to achieve effective collaboration in cross-disciplinary project teams • Independently structuring and planning own learning process in an interdisciplinary learning environment Able to independently argue for the application and implementation of valid knowledge
ME-AEM1	Advanced Engineering Mathematics	5	After completing this course the student must know: * How differential equations are used in the modelling of physical phenomena including: mixing problems; the forced harmonic oscillator; the elastic beam; 1D and 2D wave equations; 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 systems of linear ODEs w. constant coefficients; phase plane methods, linearization * The key concepts in vector calculus including: gradient, divergence, curl; line, surface and volume integrals; Gauss divergence theorem; Stoke's theorem * The key concepts in the theory of partial differential equations (PDEs) including:	After completing this course, the student must be able to: * Recognize and solve different types of ODEs * Apply the most important differential operators * Evaluate multi-dimensional integrals of vector functions also using integral transformation theorems * Calculate Fourier series and integrals * 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 modelling in simple cases and solve the resulting equations. * Use sources of information that apply the language of ODEs, vector analysis, and PDEs in either a job situa-tion or in the context of further studies.

Code	Title	ECTS	Knowledge	Skills	Competencies
			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		
ME-ALA1	Advanced Linear Algebra	5	After completing the course, the student can: - Define a vector space and explain concepts like basis and dimension - Define linear transformations and list important examples Recognize eigenvalue problems	After completing the course, the student can: - Solve systems of linear equations and account for the structure of the solution set - Manipulate vectors and matrices Solve eigenvalue problems and perform singular value decomposition Write computer code to manipulate data in vector and matrix form	After having completed the course, the student can: - Analyse physical systems using linear algebra tools and concepts - Implement simple numerical algorithms Understand technical texts using the language of linear algebra
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. 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.	The student will gain skills in - Selecting machine elements and use these for the purpose of automation tasks. - Basic setups to produce complex track structures for mechanical machines. - Analyse of simple PLC program to predict the output.	The student will understand how analysis of mechanical and hydrostatic drives are to be carried out in order to find a solution. The student will be able to explain the theory behind the calculations for a complex machine 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.
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 • Specification of on-off control, using Grafcet diagrammes	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.

Code	Title	ECTS	Knowledge	Skills	Competencies
			• PLC programming		
ME-AUT1	Automatic Systems	5			
ME-BPR1	Bachelor Project – Preparation Course	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 a Project Description being in accordance with the VIA Engineering Guidelines Can prioritize, choose, and justify the selection of solution models for complex issues, including reflecting on the choice of scientific method. Can argue for the selection of sources, references, and data in connection with project work.	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 development assignments and for solving technical problems. 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. Can independently and critically analyze new knowledge and argue for its application related to the project work. Can work analytically, methodically, and systematically on the semester project within the project group and incorporate ethical considerations within the profession.
ME-BPR2	Bachelor Project (ME-)	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 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.

Code	Title	ECTS	Knowledge	Skills	Competencies
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 a more advanced level. Most of the following topics will be covered: - Sheet Metall - Parts and I - Assemblies (Family members) – based on parametersl - Features and feature reuse - Use of Content Center - Publishing to the Content Center - Assembly Functions and assembly reuse - Frame Generator - Weldment - design and documentation - Plastic Design - Surface Technology and Advanced Modelling - Dynamic Simulation Design Accelerator (optional)Rendering and animation (optional)Manufacturing and CAM Programming incl lab exercises (optional)	The student will gain skills to handle and use a 3D CAD system in an engineering professional way and will be able to understand and select relevant tools and technologies	Use and Understand the role of 3D CAD technology in a deeper context regarding the interface and link to Manufacturing, Value Chain Management and Product Data Management.
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. Fur-thermore, the student will be able to design simple energy plants in a methodical way and more complex systems in co-operation with energy engineers.
ME-DIG1	Digitalisation 1	5	The student will acquire knowledge of the following: • The user interface and understanding of the structure in a 3D CAD-system • Use sketching, constraints and dimensions as basis for 3D features • Create geometrical features • Create assemblies • Create and edit 2D drawings for parts and assemblies • Use of CAD in Maker Space • Recognize and identify datatypes • Data acquisition with different sensors	The student will acquire skills in: • Create 3D parts and assemblies in a 3D CAD-system • Assemble and document parts on a 2D drawing • Use digital twins in connection with 3D printers og CNC machines • Recognise and identify datatypes • Write, test and document simple scripts for controlling a microcontroller • Data acquisition • Use of sensors and actuators	After completing the course the student will be able to: • Use a 3D CAD program • Account for data flow and relate it to microcontroller systems • Design and implement simple circuits with microcontrollers, sensors and actuators.

Code	Title	ECTS	Knowledge	Skills	Competencies
			• Use of actuators in automatic processes • Basic knowledge about I/O as well as ADC and DAC		
ME-DSM1	Dynamic Systems	5	After the course the student will be familiar with - Solving linear differential equations using the Laplace transform - Analysis of dynamic systems using the Laplace transform - Simulation of dynamic systems	After the course the student will be able to - Describe dynamic systems using differential equations - Solve differential equations - Calculate the step and impulse response of dynamic systems - Write simple Matlab scripts to simulate dynamic systems	After the course the student can describe a dynamic system mathematically and determine the time evolution analytically and by simulation
ME-DYN1	Dynamics 1	5	The student will acquire knowledge of: - SI units - Kinematics - Force and acceleration - Linear momentum - Mechanical energy - Rotation of rigid bodies about a fixed axis	The student will acquire the following skills: - Consistent use of units and unit conversion - Use kinematical terms to describe motion of particles - Analyse dependent motion - Draw free body diagrams - Set up and solve the equations of motion for particles and systems of particles - Describe the concepts of kinetic energy, work and potential energy and use these to solve problems in particle dynamics - Write structured Mathcad script to solve problems in particle dynamics - Solve simple problems with rotating rigid bodies	The student will be able to: - Identify which parts of the acquired knowledge and skills are relevant for a given real world mechanical problem - Model mechanical systems - Use the acquired knowledge in more advanced courses
ME-DYN2	Dynamics 2	5	After completing the course, the student can: - account for the kinematics of rigid bodies - reproduce the formulas for relative motion - explain the definition of the mass moment of inertiare - produce Newtons Laws as appropriate for the kinetics of rigid bodies - account for the mechanical energy of rigid bodie - sdescribe different kinds of vibrations for a system with one degree of freedom	After completing the course, the student can: - apply kinematic relations to in the description of rigid body motion - transform kinematic quantities between coordinate systems in relative motion - calculate mass moments of inertia - set up and solve equations of motion for systems of rigid bodies in general planar motion - apply energy methods in problems involving rigid bodies - set up and solve equations of motion for free as well as	After having completed the course, the student can: - Identify which knowledge and which skills that are relevant for a given, simple mechanical problem - Model simple, but realistic mechanical systems using the skills acquired - Attend advanced courses in dynamics

Code	Title	ECTS	Knowledge	Skills	Competencies
				viscously damped mechanical vibrations with one degree of freedomapply CAS software to calculations within dynamics	
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, contactors o Start of motor, load types, start methods, start restrictions, DOL start, Y-D start, soft starters and frequency converters.	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.
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 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)	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 fossil fuel production and the saving of CO2 emission.	The student will be able to communicate with students, engineers and companies about renewable energy and outline proposals for renewable energy supply.
ME-FEM1	Finite Element Method	5	The student will gain knowledge about the FE method and its applications. Upon completion of the course, the student should be able to: • Describe bar and beam elements • Outline the characteristics of the membrane elements • Define plates, shells and 3D elements • Describe the steps to evaluate stresses in FE • Explain the formulation of the stiffness matrix using different approaches • Identify different boundary conditions • Outline how to conduct a mesh	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 simulations using Ansys Workbench • Optimize simple designs using Ansys Workbench • 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, compare and validate the performance of different types of elements in FEA.

Code	Title	ECTS	Knowledge	Skills	Competencies
			convergence study and how to deal with singularities • Define parametric optimization		
ME-FEM2	Finite Element Method, Advanced	5	The student will gain knowledge about the FE method and its applications, including: - Static stress analysis using FE - Element types - 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	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 - 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	Upon taking the course, the student will be able to judge about the possibilities in using commercial FE soft-ware in dynamic problems and in nonlinear static problems. The student will be able to validate his / her FEM models.
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. - To classify, interpret and implement business models for product design.	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 redesign 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 be able to implement Design Thinking models to start, plan, innovate, and complete a design project to a conceptual level by taking into account the relevant multiple aspects including system thinking and sustainability, user experience and business innovation

Code	Title	ECTS	Knowledge	Skills	Competencies
			- To reason system interconnectedness exploration is essential in design thinking.	- To identify and translate user needs to product design requirements. - To assess solution propositions from business, risk and functionality perspectives (e.g. DeBono, HOQ, 6D's of exponential technology).To implement disruptive thinking to reflect on design solutions and to reframe design problem	
ME-INP1	Engineering 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 profes-sional approach • be able to identify own learning needs and to organise own learning in different learning environments • promote an engineering-oriented approach during the remaining semesters on the Bachelor pro-gramme • develop personal skills required for the professional career as engineer • form the basis for developing personal/professional network
ME-MAT1	Mathematics 1	5	After completing the course, the student can: - Explain limits of simple expressions - Describe the meaning of a functions derivative - Reproduce rules for derivatives, including the chain rule - Explain the meaning of partial derivatives - Explain the connection between definite integrals and areas under and between graphs - Identify order and type of ordinary differential equations - Explain the use of polar coordinates - Explain how the complex numbers is an extension of the reals	After completing the course, the student can: - Find limits - Calculate derivatives using standard differentiation rules - Calculate partial derivatives - Determine characteristics of curves, including tangent vector, normal vector and curvature - Calculate indefinite integrals, using substitution and integration by parts when appropriate - Determine definite integrals - Convert between Cartesian and polar coordinates - Apply complex numbers, including conversion between different representations	After completing the course, the student must be able to: Use the covered methods in other courses when appropriate. Read texts that use the notation and concepts covered.
ME-MAT2	Mathematics 2 (ME)	5	The student will acquire knowledge in the following: - Matrix arithmetic - Analyse linear systems of differential equations (ODEs)Probability, mean and variance	The student will acquire the following skills: - Perform matrix arithmetic - Calculate eigenvalues and -vectors for small matrices - Solve linear systems of ODEs	The student will be able to: - Formulate and solve linear engineering problems analytically and numerically - Read and write simple scripts in Matlab - Apply the acquired skills in more advanced courses

Code	Title	ECTS	Knowledge	Skills	Competencies
			- Account for the binomial, Poisson and normal distributions - Discuss data analysis in Matlab - Describe the use of logical expressions - Use branches and loops - Solve ODEs numerically	- Calculate simple descriptive statistics - Use Matlab to solve the above - Solve simple numerical problems in Matlab	
ME-MEC1	Mechanics 1	5	The student acquires knowledge of basic statics within the following: • Description and calculation of force systems, forces, moments, couples and resultants. • Formulation and description of static equilibrium, supports, free body diagram and equilibrium conditions. • The application of join method and section method applied to plane trusses, force calculation in frames and machines. • Definition and calculation of distributed loads, area centroid, external loads on beams, and internal forces in beams. • Identification and formulation of equations for normal force, shear force and bending moment. • Analysis of relationships between load, shear force and bending moment. • Use of cross-sectional constants and material strength values in dimensioning. • Identification and calculation of normal stress, shear stress, Von Misses stress and allowable stress. • Description of dry friction.	The student who completes the course acquires skills in: • Making free body diagrams and formulate static equilibrium equations. • Calculate reactions and determine internal forces in simple structures, which are statically determined. • Dimension and design simple structures and choose materials based on the material's strength values. • Provide calculation documentation in a technical report.	After the course, the student must be able to: • Perform analysis of mechanical loads as a starting point for the design and dimensioning of a simple product. • Be able to take part in projects concerning simple design and dimensioning tasks.
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 in-determinate 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 ma-chine 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.

Code	Title	ECTS	Knowledge	Skills	Competencies
ME-MEM1	Machine elements and design of machines	5	The student will gain knowledge of machine elements and machine design to be able to: - Explain the theoretical calculation basis for dimensioning of shafts as well as bolted and welded joints. - Explain principles of gears, torque conversion and power loss in mechanical transmissions. - Explain the parameters that form the basis for dimensioning and selection of machine elements such as screws, bearings, shaft / hub connections, couplings, clutches,gears, belts and chains in a machine construction. - Identify and explain the working principles and technical solutions for designing machines.	The student who completes the course acquires skills in: - Analyze loads, simplify and decide calculation models for dimensioning of machines and machine elements. - Calculate, dimension and design shafts, including determining safety against yielding and fatigue. - Calculate, dimension and design simple bolt and weld joints. - Dimension, select and implement suitable standard machine elements such as bearings, bearings, shaft / hub connections, couplings, clutches, gears, belts and chains for a machine construction. - Prepare layout drawing and drawing documentation using geometric tolerances and standard components in CAD. - Use Mathcad or equivalent digital tool for calculation documentation.	After the course, the student must be able to: - Set up possible solutions for the design of machine systems, based on specific requirements / criteria and assess which solutions are best suited. Including choosing solutions that ensure minimal environmental impact. - Find the necessary knowledge in catalogs and technical literature regarding machine elements/components as well as interpret and apply this knowledge in connection with machine design. - In addition, the student will have the competence to develop his or her own knowledge and skills in machine design.
ME-MMT1	Materials and Technologies	5	After completing the course, the student will be able to: • Explain metals' mechanical properties • Explain the increase of strength in metals • Explain the relation between deformation, stress and fracture in tension loaded materials • Explain materials' failure • Explain forging • Explain assembly and fastening • Explain machining • Explain fast prototyping • Explain cost price and calculation • Explain greenhouse effect • Explain circular economy and the sustainable circles • Explain and make a simple life cycle analysis • Explain United Nations Sustainable Goals • Use Edupack program	After completing the course, the student will gain skills in: • Select an appropriate type of steel for manufacturing of components. • Select an appropriate strength increasing method. • Perform common tests for materials. • Select suitable technological processes based on production volume, geometry, surface requirements, tolerance requirements, load situation, etc. in relation to environmental impact and the sustainable principles. • Explain the function of different types of production equipment. • Estimate the cost price of products. • Perform a simple life cycle analysis of a product. • Use Edupack program for selection of materials and technologies	After the course, the student must be able to: • Select suitable materials and design components based on their mechanical properties as well as their manufacturing and machining technologies in relation to the sustainability principles. • Furthermore, the student must be able to independently apply, assess, and acquire new knowledge within the subject.

Code	Title	ECTS	Knowledge	Skills	Competencies
ME-MMT2	Materials, Technologies and Environment	5	After completing the course, the student will be able to explain: - Steel phase transformations. - Heat treatment of steel. - Characteristics and applications of cast iron. - Important aspects of corrosion. - Properties and applications of corrosion resistant metals. - Polymer structures.Common manufacturing processes for polymer parts. - Composite structures and design choices. - The manufacturing processes casting, sheet metal technology, powder metallurgy and machining (advanced) as well as their use.	After completing the course, the student will acquire skills in: - Choosing a suitable corrosion resistant metal. - Selecting an appropriate heat treatment method. - Anticipating and avoiding corrosion-related problems. - Constructing polymer blanks. - Selecting an appropriate manufacturing process for polymers and composites. - Explaining the function of different types of production equipment. - Choosing suitable technological processes based on productionvolume, geometry, surface and tolerance requirements	After the course, the student must be able to: - Select suitable materials and design components based on their mechanical properties as well as their manufacturing and machining technologies. - Furthermore, the student must be able to independently apply, assess, and acquire new knowledge within the subject.
ME-PWS1	Workshop: Turning and Milling	0			
ME-PWS2	Workshop: Welding, cutting and bending	0			
ME-PWS3	Practical Workshop 3	0	Upon completion of the course, the student will be able to: - Program and run basic tasks in 3-4 axis CAM and understand the structure of a CNC program. - Have knowledge about the preparation and implementation of scanning on items for either Inspection or Reverse Engineering. - Be able to measure deviations and tolerances on the scanned items and be able to understand the meaning of concepts such as Alignment and Datums. - Able to convert noncomplex Scan data to CAD and measure the deviation. - Have an overall insight into the GPS standard and in practice have measured, scanned and inspected according to the standard.	Upon completion of the course, the student will have skills to: - CAM program and run CNC programs on a smaller milling cutter. - Conduct scanning on modern industrial scanning equipment. - Be able to measure surface deviations, tolerances and GPS tolerances on the scanned item. - Understand the significance of measurement reports and not least assumptions for the reported data, measurements and tolerances. - Understand the meaning and relevance of optimizing a given topic.	After the course, the student should be able to: Understand and use acquired knowledge about CAM programming and CNC machining Use scanning technology in a broad context Inspection and GPS competence at a basic, but grounded, level
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	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	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-

Code	Title	ECTS	Knowledge	Skills	Competencies
			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	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	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.
ME-PWS5	Workshop 5: Energy, Polymers, Robotics	0		<u>Energy</u> Measuring the efficiency of the solar collector and to be able to evaluate the pumps performance curve. <u>Polymers</u> Understanding of the manufacturing processes of injection molding, extrusion, thermoforming, welding and blow molding. <u>Robotics</u> Programming Universal Robot UR3.	<u>Energy</u> The participant will be able measure the temperature of the water and absorbing plate to evaluate the efficiency for the solar collector and be able find the link between the flow rate and the head for the centrifugal pump. <u>Polymers</u> After the course, participants will have gained insight into the most common polymer manufacturing processes <u>Robotics</u> Be able to do simple programming of a robot.
ME-RMS1	Robotics and Multibody Systems	5	The student can explain the structure of robots, mechanisms, multi body systems and manipulators. In addition, the student can express 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, torques for robots with MathCAD and simulation with MatLab. • Programming of robots	The student can design a manipulator (for example a special designed robot for industry and laboratories) and analyze the dynamics (positions, velocities, accelerations, forces and torques in time domain). The student can write simple programs for a robot. The student can analyze a closed mechanism (multi body system) with respect to motion, forces and torques. In addition, the student can apply Multi Body analysis software. The student can decide, if and how a vision system must be applied.	The student can analyze a commercial robot and design and construct a “home-made” robot or mechanism on sketch level.

Code	Title	ECTS	Knowledge	Skills	Competencies
			Multi Body: • Mechanism definition and structure. • Frames, body orientation, generalized coordinates, geometric constraints and driving constraints. • Kinematical analysis (position, velocity and acceleration) • Kinetic analysis, mass and inertia, applied forces • Forward and inverse dynamics • Multi Body programs (for example in MatLab) Machine vision • Structure of machine vision system • Applications of machine vision • Image enhancement, segmentation and feature extraction • Image recognition		
ME-SEP1	Semester Project 1 (ME-)	10	Professional: Knows theories, models and methods from the courses in relation to the solution of the semester project assignment. Product development: Including requirements, criteria and properties Idea generation methods - unsystematic (eg Brainstorming) and systematic (eg Morphology). Presentation: Can convey concepts and principles regarding technical communication in written and oral form, including structuring, drawing and calculation documentation. Process: Effective teams: Can account for involved theories of group dynamics, team collaboration and conflict resolution. Own learning process: Can refer to involved theories about learning, motivation, feedback and study techniques. Project framework: Can identify relevant knowledge in relation to academic and technical written communication, including the report's structure, references and source management. Can identify relevant presentation techniques for the target group, as well as use presentation techniques. PBL: Can explain basic elements within	Professional: Can select theories, models and methods from the disciplines and apply them in a form that is both relevant and rational in relation to the solution of the semester project assignment The following skills from the subjects are used, among others: - Compilation of free body diagrams - Dimensioning, design and functionality - Material selection and production methods - 3d and 2d drawing documentation according to current rules - Structured presentation of drawings and calculations Process: Effective teams: Can jointly formulate and apply a group contract in the group work. Can be part of and establish collaboration with project group and supervisor Own learning process: Can apply knowledge of learning theory and motivation theory in connection with own learning process as well as give and receive feedback. Project framework: Can act source-critically as well as use references and source management - including avoiding plagiarism. Can convey the results of the	Professional: Can select, combine and adapt theories, models and methods from the subjects and apply them in a form that is usable, relevant and rational in relation to the solution of the semester project assignment Can design and dimension a product based on analysis of mechanical loads. Can provide a structured presentation of drawings and calculations Process: Effective teams: Can describe and reflect on the project group's collaboration - including their own efforts - to define opportunities for improvement for future projects. Own learning process: Can reflect on own ability to learn through the various teaching activities, including the project group's work. PBL: Can take responsibility for the student-led part of the semester project.

Code	Title	ECTS	Knowledge	Skills	Competencies
			PBL. Can identify relevant issues and specific requirements for a problem formulation. Project management: Can identify relevant project management methods, including planning, meeting management, risk assessment and quality assurance.	project work and the project group's learning process in a structured way using professional concepts, both written, graphic and oral. Can communicate in writing and orally to different target groups. PBL: Can set up a problem formulation, describe different solution options and explain solution proposals. Project management: Can account for the choice of and use of tools and methods for project management to achieve specific goals in the project work.	
ME-SEP2	Semester Project 2 (ME-)	10			
ME-SEP4	Semester project 4- Energy oriented project with economical and environmental aspects	10	Technical Professional knowledge learning objectives 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. Process: Personal attributes and attitudes, awareness of own personal knowledge, personal skills and attitudes. The extent of own abilities, responsibility to improve yourself to overcome personal weaknesses.	Technical: - 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. Process: Own Learning Process: Define and reflect on own learning goals from the current and previous semesters in the process report with the purpose of future improvement Project Framework: Communicate and argue for the project work's results and the project group's learning process in a structured manner using technical terms both in writing, graphically and orally. Argue for the choice of sources and references in connection with the project work PBL: Work with a holistic view of the project, the subjects and the outside world. Reflect on knowledge sharing in the project group and the quality of the project work	Technical: Course competence learning objectives: 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 Process: Effective Teams: Plan, structure and collaborate effectively in groups based on a chosen work form and adjusted collaboration methods Analyse and reflect on the connection between knowledge sharing in the project group and the quality of the project work Own Learning Process: Analyse own learning needs and structure own learning process independently Apply relevant and valid knowledge independently and critically Project Framework: Independently explain new knowledge and

Code	Title	ECTS	Knowledge	Skills	Competencies
				Understand different communication forms and be able to act accordingly Identify ethical considerations in the project work	argue for its application in connection with the project work Work analytically, methodically and structured with the semester project in the project group. Project Management: Can combine, adapt and optimize project management methods in the duration of the project work Argue for digital tools used for project management as well as digital knowledge collection tools and portals
ME-IDE1	Innovation and Entrepreneurship project	10	After having successfully completed the course, the students will have gained: • An understanding of innovation and entrepreneurship and its uses within the field of engineering and business. • Knowledge about three different innovation processes Design Thinking, Effectuation and Lean Startup • Knowledge about how to create a systematic and measurable progress in innovation and entrepreneurship tasks	After having successfully completed the course, the students will be able to: • Engage in innovative and entrepreneurial processes in a cross-discipline setting • Conceive, plan, and execute innovative ideas • Work methodically with innovation and entrepreneurship • Collect and apply relevant data/information about technologies, markets, and end users • Apply method to gain insights about the solutions impact on the current market. • Convey and argue for the results of a cross-disciplinary project group and the project group's learning process using correct professional terminology and optimal tools both in writing, graphically and orally.	After having successfully completed the course, the students will have gained competences in: • Introducing innovative ideas into project work • Contributing own professional skills in multidisciplinary teams with the objective of solving problems by using innovative and entrepreneurial processes and models • Clarifying multidisciplinary group competencies • Analyze group dynamics and adapt working methods and collaboration methods to new group constellations to achieve effective collaboration in cross-disciplinary project teams • Independently structuring and planning own learning process in an interdisciplinary learning environment Able to independently argue for the application and implementation of valid knowledge
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)	The student can formulate models of technical (mechanical, electromechanical, hydraulic, pneumatic or thermal) systems, analyze the static and dynamic behavior in time do-main and frequency domain, and simulate with MatLab / Simulink.	The student can develop and analyze dynamic Mechatronic models.

Code	Title	ECTS	Knowledge	Skills	Competencies
			• Simulation of engineering systems using Simulink.		
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.
ME-TDE1	Technical Design	5	The student will acquire knowledge of the following: - Sketching of isometric views and doing simple developments - Using 3d CAD in technical drawing - Illustrating using the first quadrant method (European) - Dimensioning after known standards (DS/ISO 128, 129) - Using tolerances in relation to assemblies - Combine surface roughness with production methods - Weldment sections in relation to weld symbols - The use of geometrical tolerancing when design machine components - Structured drawing documentation (layout, assemblies, detail drawings and parts lists)	The student will acquire skills in: - Presenting technical documentation in 2D and 3D - Creating machine drawings according to DS/ISO 128/129 and using general tolerancing and fit tolerances - Define an describe machine components making sketches, drawings, assembly drawings and parts lists. - Identify and using standard parts in machine design	After completing the course, the student will be able to: - Present and sketch technical ideas - Construct a product from described criteria's - Argue technical solutions in a dialog with suppliers - Produce technical documentation for production - Understand production preparation of raw materials and have a dialog about production methods
ME-TER1	Thermodynamics	5	Describe, construct and interpret a thermodynamic system. Apply and understand the main laws and fundamental concepts of thermodynamics. Calculate and depict processes for ideal gas and water vapour. Apply elementary flow theory for calculations and dimension of pipe systems and pumps. Calculate and dimension heat exchangers/heat transmission. Calculate main data for plants that use water vapour for production of power and heat.	Analyse a thermodynamic system and select relevant theory in order to enable the student to calculate variables and main capacities for the system. Use the thermodynamic calculation as basis of calculation of geometric dimensions for the system or selection of components. Use EES software for thermodynamic calculations	The student will be able to identify energy aspects in mechanical projects and solve simple thermodynamic problems and/or communicate with engineers and companies about energy aspects.

Code	Title	ECTS	Knowledge	Skills	Competencies
ME-TMT1	Thermoplastic Materials and Technologies	1	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.