Addendum for the TER-tables section of the 2020-2021 Teaching and Examination Regulations of the Bachelor's programme

Study programme: B Mechanical Engineering
Study programme code: 34280
Type of study programme: full-time, part-time
Location of the classes: Eindhoven

This addendum has been determined after consent of the IMR on 28-06-2021 and the DPC on 28-06-2021.

In the TER-Engineering, appendix E: OpER-tables Mechanical Engineering, the following rows will be deleted and added:

For semester EW7_IE, the following rows will be deleted:

	WACM5 / WACM10 / WAEP13 / WAEP14	Selective module 1 (period 1)	4.00	See module	See module	See module	See module	See module requirements	See module

and

	WADG2 / WAPM13 / WAEP12	Selective module 2 (period 2)	4.00	See module	See module	See module	O-V	See module requirements	See module

For semester EW7_IE, the following rows will be added:

	WACM5 / WACM10 / WAEP13 / WAEP14 / WADG2 / WAPM13 / WAEP12	Selective module 1 (period 1)	4.00	See module	See module	See module	See module	See module requirements	See module. Selective module 1 can not be the same as selective module 2.
	WACM5 / WACM10 / WAEP13 / WAEP14 / WADG2 / WAPM13 / WAEP12	Selective module 2 (period 2)	4.00	See module	See module	See module	See module	See module requirements	See module. Selective module 1 can not be the same as selective module 2.

For semester EW7_ET, the following row will be deleted:

	WAPM13 / WADG2 / WABI	Selective module (period 2)	4.00	See module	See module	See module	See module	See module requirements	See module

For semester EW7_ET, the following row will be added:

	WAPM13 / WADG2 / WABI / WACM5 / WACM10 / (EAGC7A+EAGC7B)	Selective module (period 2)	4.00	See module	See module	See module	See module	See module eisen	See module

Addendum for Study programme section of the Students' Charter with the 2020-2021 Teaching and Examination Regulations of the Bachelor's programme

Study programme: B Automotive
Study programme code: 30018 Type of study programme: full-time
Location of the classes: year 1 & 2 in Eindhoven, year 3 & 4 in Helmond

Study programme: B Elektrical Engineering
Study programme code: 34267
Type of study programme: full-time, part-time
Location of the classes: Eindhoven

Study programme: B Mechatronics
Study programme code:30026 Type of study programme: full-time Location of the classes: Eindhoven

Study programme: B Mechanical Engineering
Study programme code: 34280
Type of study programme: full-time, part-time
Location of the classes: Eindhoven

In the OER Engineering 2020-2021, appendix D OER tables Mechatronics, the next schedule replaces the old schedule:

Mechatronics 2020/2021	Criteria S12 (P-phase)	Criteria S3 (Core phase)	Criteria S4 (Core phase)	Criteria S5 (Internship)	Criteria S6 (Minor)	Criteria S7 (Specialization)
To S12 (P-phase)	Admission Requirements					
To S34 (Core phase)	≥ 45 EC					
To S5 (Internship)	≥ 105 EC					
To S6 (Minor)	= 60 EC					
To S7 (Specialization)	≥ 105 EC			= 30 EC or repairable		
To S8 (Graduation Internship)	= 60 EC	Option 1: = 60 EC Option 2: max. 1 subject open		= 30 EC		Option 1: = max. 2 subjects open Option 2: = max. 1 subject open

Internship:

105 EC over 2 years of study. Best result is Propedeuse completed and 45 EC or more in year 2.

Additional rules:

- *Internship before Semester 7*
- *Semester 7 will only be given in the fall semester*
- *If you want to swap Internship with Minor in the same study year, you should always submit a request at the board of exam*

Graduation:

Option 1: *2 subjects open in S7*

Option 2: *1 subject open in S7 and 1 subject open in S3 or S4*

Study programme section of the Students' Charter with the 2020-2021 Teaching and Examination Regulations of the Bachelor's programme

Study programme: B Automotive
Study programme code: 30018 Type of study programme: full-time
Location of the classes: year 1 & 2 in Eindhoven, year 3 & 4 in Helmond

Study programme: B Electrical Engineering
Study programme code: 34267
Type of study programme: full-time, part-time
Location of the classes: Eindhoven

Study programme: B Mechatronics
Study programme code:30026 Type of study programme: full-time Location of the classes: Eindhoven

Study programme: B Mechanical Engineering
Study programme code: 34280
Type of study programme: full-time, part-time
Location of the classes: Eindhoven

The study programme's section of the Students' Charter was adopted by the institute's director on *24-02- 2021*, after obtaining the IPC's consent on *22-02-2021* and the **PC** consent on *9-02-2021.*

The teaching and examination regulations of the study programme expand on the general section of the teaching and examination regulations of Fontys Bachelor's programmes.

This general section for the **2020-2021** academic year was established by the Executive Board on **10 December 2019**, following the consent of the students' section of the CPC, which was given on **9 February 2021.**

Key

Italics	*text may be deleted if it does not apply*
Blue	specific details applicable to the study programme are to be included
Blue italics	*text may be deleted if it does not apply*
yellow	*note in yellow. This may be left out in the study programme's TER*
Green	***changes in comparison with the TER 2019-2020***

The study program specific section of the study statutes,

Which are described in the Teaching and Examination regulations 2020-2021 for the bachelor program

Electrical Engineering (34267)
from Fontys Hogeschool Engineering (43) in Eindhoven.

This version of the Teaching and Examination regulations contains a number of statutes and study program specific details that are applicable to the student from the February 2021 cohort of Electrical Engineering students.

Students that start their bachelors degree in Electrical Engineering in February 2021 will follow a new program that leads to the same level of competencies as previous cohorts. The lesson material is in English.

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A – Teaching and Examination Regulations

Section 1 General

Article 1 Definitions

Academic year	The period from 1 September up to and including 31 August of the following year.
Advice regarding the continuation of studies	Advice given to students at the end of the first year of the foundation phase of a Bachelor's programme regarding the continuation of their studies either with the programme or elsewhere. This advice may entail a binding rejection (binding negative study advice).
Assessment	Generic term for tests aimed at assessing a student's competencies in a professional situation that is as authentic and realistic as possible.
Assessor	An examiner that grades the student's progress in acquiring the required competencies.
CAA	Centre for Administrative Activities. The CAA is the internal partner within Fontys of the representative and participatory bodies and their discussion partners with respect to optimising how these bodies function.
Certificate	The certificate as referred to in Section 7.11 of the Dutch Higher Education and Research Act (*Wet op het Hoger Onderwijs en Wetenschappelijk Onderwijs*, WHW).
CPC	Central Participation Council
Cohort	The group of students who are enrolled for the first time in the foundation year of a study programme on the same reference date to which the prevailing Teaching and Examination Regulations (TER) apply. For students who enrol in a higher year, cohort membership is determined on an individual basis.
Competency	A cluster of related knowledge, skills and attitudes that influences a substantial part of a person's job, is related to the performance of the job, can be measured and tested against accepted standards and can be improved through training and development.
Competency examination	*A test to assess whether a student has certain competencies.*
Component test	If an interim examination consists of several tests, each of those tests is referred to as a component test.
Coordinating institute	The coordinating institute is the Fontys Institute which bears final responsibility for the development, implementation, assessment and improvement of a minor programme.
Credit	One credit equals 28 standard study-load hours. Students are awarded credits on passing the interim examination of a unit of study. The international term for credits is **ECTS** credits (EC's).
Education components	The courses offered to students to help their learning process.
CROHO	Central Register of Higher Education Study Programmes, which is a register of all study programmes. Students that pass the interim examinations of a study programme registered in CROHO are entitled to an official higher professional education certificate with the associated degree (Associate degree, Bachelor or Master).
Deficiency	Any required prior qualification(s) a student lacks.
Diploma supplement	Document drawn up in accordance with a European format that is added to the certificate and states the nature, level, context, content and status of the study programme.
Dual-study programme	A dual-study programme is organised in such a way that education is alternated with one or more periods of professional practice related to the study programme. The study programme therefore consists of an educational segment and a practical segment, both of which are integral parts of the study programme.
DUO	Short for Dienst Uitvoering Onderwijs, a government agency charged with implementing education legislation and regulations.
Diploma with subject combination	Former senior general secondary education (*HAVO*) or pre-university education (*VWO*) diploma based on subject combinations. These diplomas were issued before the HAVO and VWO profiles were introduced (from 1998).
ECTS	European Credit Transfer System. The system that is used to express credits in order to facilitate international comparison. See also: credits.
EVC (RPL)	*Erkenning van eerder Verworven Competenties* (Recognition of Prior Learning).

Examination	**Assessment administered by the Examination Board to determine whether students have successfully completed the educational components of a study programme or the foundation-year phase.** The final examination may also include a supplementary assessment conducted by the Examination Board.
Examination Appeals Board	The Board as referred to in Sections 7.60 up to and including 7.63 of the WHW and Articles 45 and 46 of the Students' Charter. The organisation, duties and powers of the Board are laid down in the Rules of Procedure adopted by the Examination Appeals Board and approved by the Executive Board.
Examination Board	The board of persons referred to in Section 7.12 of the WHW.
Examiner	Member of staff or external expert not employed by the institution who has been designated by the Examination Board to administer examinations and assess the results thereof.
Executive Board	The administrative body of Fontys University of Applied Sciences, as described in the articles of association and the WHW.
Executive institute	A Fontys institute responsible for the execution of a minor.
Exemption	Full or partial exemption from meeting enrolment and / or admission conditions and / or sitting interim examinations.
Exit assessment	*Part of the competency examination administered at the student's request when **he** wishes to terminate **his** study programme prematurely.*
Exit qualifications	Qualifications students must have on completing the study programme.
Fontys minor	A minor open to all Fontys students, so long as they meet any admission criteria for the minor, with a focus on overarching and distinctive themes.
Foundation year	First phase in a Bachelor's programme.
Fraud	Any act (including plagiarism) or omission that either partially or fully impairs the correct assessment of a person's knowledge, understanding, skills, competencies, professional attitude, powers of reflection, etc.
Full-time study programme	A full-time study programme is a study programme whose structure is such that students are assumed not to participate in any activities other than academic activities.
Hardship clause	A provision in a law or regulation that makes it possible to deviate from regulatory provisions in favour of the student or external student.
He / him	**He / him is taken here to refer to men, women and individuals who do not identify as either of these options**.
IELTS	International English Language Teaching System, a tool used to determine a student's command of the English language.
Institute	The operational unit at Fontys that is, in particular, responsible for organising Fontys's core competencies and that executes the primary processes.
Institute Director	The staff member charged with running a Fontys institute.
Institution	The Fontys Universities of Applied Sciences.
Intake assessment	Portfolio assessment conducted at the student's request to validate previous learning experiences prior to enrolment in the study programme. A fee covering the costs is charged for an intake assessment.
Intake interview	Interview conducted at the student's request prior to the start of the study programme if the student believes that he has competencies acquired previously. An intake interview comprises a general assessment from which no rights can be derived by a student.
Interim examination	An examination of the knowledge, understanding, skills and / or competencies of a student required to conclude a unit of study, including an assessment of the results of such an examination *(Section 7.10(1) of the WHW)*. An interim examination may consist of one or more component tests.
IPC	Institute Participation Council
Learning outcome	A learning outcome is a statement about what the student, at the end of an educational unit, is expected to know, to understand, able to do, and how the student demonstrates this.
Main subject	**A specific definition of the curriculum within a programme, which begins immediately from year 1 or following the foundation year.**
Major	*That part of the Bachelor's programme with a study load of 210 credits that contributes to the competencies associated with the programme and that is directly related to the study programme(s)'s registration in the CROHO.*
Minor	*Programme of optional subjects within a Bachelor's programme with a study load of 30 credits that contributes to generic or specific competencies.*

Minor regulations	Regulations that describe the content, the education components, the testing and the completion of a minor. The regulations of all minors offered by Fontys can be found on the Fontys website (www.fontys.nl/minors). The regulations of the minors associated with a particular study programme have been included as an appendix of the study programme's TER.

Nt2 diploma	Diploma of the Nt2 official state examination in Dutch as a second language, of which programme II is considered to be the guideline for admittance to higher education.
Occupational requirements	**The legal requirements to which the practice of a particular profession is subject.** A study programme aimed at such an occupation will prepare students to meet the relevant requirements. *(Section 7.6 of the WHW).*
Part-time study programme	A part-time study programme is a study programme whose structure is such that the student is able to participate in supplementary activities, either work-related or educational, alongside the study programme.
Period	Half a semester. An academic year consists of four periods
Portfolio	A collection of evidence, digital or otherwise, with which students can demonstrate that they master the competencies of a particular study programme.
Post-foundation year phase	Second phase of a Bachelor's programme.
Principle	All study programmes offered are based on one of the following principles: non-denominational private education (NPE), Roman Catholic (RC), Protestant Christian (PC) or a combination of general special education, Roman Catholic and Protestant Christian (**NPE**, RC, PC).
Profiling Fund Board	Board charged by the Executive Board with implementing the Profiling Fund scheme, formerly known as the FSS Board.
Profiling Fund Scheme	Scheme for the granting of support to students in the form of graduate funding, committee member grants or **attendance fee** from the profiling fund, now known as the Profiling Fund Scheme
PC	Opleidingscommissie (Programme Committee, PC), a committee established for a particular study programme of **an institute** referred to in Section 10.3c of the Act (see the Regulations on the Participation Councils and Degree PC's).
Tailored programme	Special programme which differs from the standard programme.
Teaching period	Period in the academic year during which education components are organised. A teaching period is referred to as a study quarter in the Fontys annual calendar.
TER	Teaching and examination regulations. The TER consists of a general section for all study programmes offered by the Fontys Universities of Applied Sciences as well as information specific to individual study programmes. The TER forms a part of the study programme section of the Students' Charter.
Test	**Activity used to assess whether a student has certain knowledge, insight, skills and / or competencies.**
Top-**class** athletes scheme	Scheme for top-**class** athletes that specifies which students are eligible to benefit from it and the facilities that they may use under it.
Student	A person who is enrolled in the institut**ion**, as referred to in Sections 7.32 up to and including 7.34 of the WHW.
Student counsellor	Staff member appointed by the Executive Board who is responsible for looking after the students' interests, providing assistance when problems occur and providing information and advice. The student counsellor is part of the Student Facilities Service (*Dienst Studentenvoorzieningen*).
Study Career Centre	Service provided by the Student Facilities Service (*Dienst Studentenvoorzieningen*) to help students with issues involving admission, transfer to another study programme / institut**e** or the termination of their studies.
Students' Charter	The charter containing the rights and obligations of students, divided into an institution-specific section and a study programme-specific section.
Student entrepreneur scheme	Scheme which is intended to help Fontys students who are deemed student entrepreneurs to combine entrepreneurship and study.
Study career counsellor	Counsellor who helps students with issues such as planning their studies, taking the right approach to their studies, making the right choices and the progress of their study careers.
Study career support	Support system that focuses on the individual student's development. The student is encouraged to reflect on **his** own development as a future professional and to take responsibility for this development.
Study check advice	Advice provided to a prospective student who has participated in the study check with regard to **his** choice of Bachelor's.

Study check	The activity offered by Fontys whereby the prospective student is given advice with respect to **his** choice of study programme. The study check consists of at least two components: a digital questionnaire and a consultation to discuss the results of the questionnaire.

Study load	The standardised time investment expressed in units of 28 study load hours related to a study programme.
Study programme	A coherent totality of education components aimed at achieving the well-defined objectives in the area of knowledge, understanding and skills which the person completing the study programme should possess. Every study programme is recorded in the CROHO.
Study programme minor	A minor which can only be taken by students from a specific domain or study programme and which highlights one particular theme.
Study programme profile	The entire set of final qualifications for which the study programme provides training or, in other words, the professional competencies expected of a beginning professional.
Unit of study	Part of a study programme that is concluded with an interim examination as referred to in Section 7.3(2) of the WHW or an additional assessment carried out by the Examination Board, as referred to in Section 7.10(2) of the WHW. Units of study may relate to the assessment of one or more competencies, a component of competencies (knowledge, understanding, skills, attitude) or a combination of competencies or of a minor. Students are awarded the relevant credits on passing the interim examination for the unit of study.
WEB	Adult and Vocational Education Act (*Wet Educatie en Beroepsonderwijs*, WEB; Bulletin of Acts and Decrees 507, 1995, and later supplements and amendments).
WHW	The Dutch Higher Education and Research Act (*Wet op het Hoger Onderwijs en Wetenschappelijk Onderzoek*, WHW; Bulletin of Acts and Decrees 593, 1992, and later supplements and amendments).

Section 2 Admission to a Bachelor's programme

Article 2 Required prior qualifications

1. Only students with diplomas awarded on completing pre-university education (*VWO*) or senior general secondary education (*HAVO*), with profiles, or senior vocational education (*MBO*) in middle management as well as students that have completed specialist training or a vocational training programme designated by a ministerial regulation may be admitted to a Bachelor's programme *(Section 7.24 of the WHW.* Additional conditions for admission apply if a shortened programme is offered. Those conditions are set out in Article 7.
2. Students with a certificate awarded on completing a foundation year or passing the final examination of a higher professional education (*HBO*) or academic higher education (*WO*) study programme are also entitled to be admitted to a Bachelor's programme at a university of applied sciences. Students must, however, also meet any applicable requirements regarding their previous qualifications (paragraph 4) and any other additional requirements imposed (paragraph 5). *(Section 7.28 of the WHW.*
3. All citizens that have access to education offered by research universities or universities of applied sciences in a country that has ratified the Convention on the Recognition of Qualifications concerning Higher Education in the European Region may also be admitted to a Bachelor's programme, without prejudice to the provisions in paragraphs 4 and 5 of this article and the provisions of Article 3. This right to enrolment does not apply if the Executive Board can prove that there is a substantial difference between the general admission requirements in the territory of the country concerned and the general requirements under or pursuant to the WHW. *(Section 7.28 of the WHW.*
4. *The previous qualifications of students seeking enrolment in a Bachelor's programme are subject to the following additional requirements in respect of HAVO and / or VWO diplomas, MBO diplomas and the teacher training programme for primary education.*
    a. *The following additional educational entry requirements apply to students seeking admission on the basis of a HAVO or VWO diploma (Section 7.25(1) of the WHW). Students who do not have the required subject cluster or did not take the right subject may be admitted provided an assessment conducted before the commencement of the study programme demonstrates that, in terms of the subject matter, the student concerned meets similar requirements. (Section 7.25(5) of the WHW.)*
    The requirements to be met by the student are as follows:

	Culture and Society	Economy and Society	Nature and Health	Nature and Technic
havo-profile	-	-	Ph or nl&t	+
vwo-profile	-	Ph	Ph or nl&t	+

Explanation symbols:

+	without a doubt permissible
-	not permissible
nl&t	Nature, Life and technology
Ph	Physics

If the further prior education requirements are not met, it is still possible to meet this by passing the deficiency tests. Further information is available via this link.

***b**. Students who do not have a diploma attesting to this knowledge may be admitted if an admission assessment demonstrates that they possess the knowledge referred to in the previous sentence (Section 7.25(b) of the WHW). The domains that offer direct admission are: see the table below; In 2019-2020, the result of the deficiency study will be provided as advice to the prospective student and discussed in the discussion about the study choice advice.*

Domain	HBO Sector
Construction & infra	*
Finish, wood, and maintainence	*
Technic & processindustry	*
Laybour, laboratory	*
Media & design	*
Information & communicationtechnology	*
Mobility & vehicles	*
Transport, shipping & logistics	*
Trade & entrepreneurship	
Economy & administration	
Safety & sports	*
Grooming	*
Catering industry & backery	*
Toerism & recreation	*
Care & wellbeing	*
Food, nature & living environment	*

** = Direct admission*

5. Enrolment *in a Bachelor's programme is subjected to no additional requirements (Section 7.26 and 7.26a of the WHW)*.
6. Students who are 21 or older at the start of the study programme and do not meet the requirements regarding their previous qualifications and have not been exempted from the requirements may **still be** eligible for exemption after taking an entrance examination. *(Section 7.29 of the WHW.) (Also see Article 3(5).)*
   The aim of this examination is to determine the student's suitability to take part in the Bachelor's programme.
   Students wishing to take the entrance examination must meet the following requirements: *Making a 21+ admission test (DAT test for technical study programs, to be find via this link), followed by an intake interview. With a satisfactory result (with a satisfactory result, the candidate on all components between level 4 (low average) and 9 (very high) follows a conversation and the candidate can be admitted The evidence (result 21+ test, interview report intake interview, certificates / diplomas obtained, lists of marks not completed courses, certificates , etc ...) on the basis of which the student is admitted must be included in the student's file.*

Students will be notified of the results of the entrance examination within two weeks. If the prospective student applies for enrolment on the basis of an experience certificate (issued by an acknowledged Recognition of Prior Learning (RPL) centre), this certificate will be used to determine the student's suitability to take part in the Bachelor's programme as well as their command of the Dutch language.

7. The Executive Board has declared that 'old' HAVO and VWO diplomas with subject combinations chosen by the pupil are at least equivalent to the 'new' diplomas with subject cluster requirements. Consequently, prospective students holding these types of diploma may be admitted. Students must, however, meet any requirements regarding previous qualifications (paragraph 4) and any further additional requirements (paragraph 5). *(Section 7.28 of the WHW.)*
   The institute director has declared that the 'old' HAVO and VWO diplomas with old profiles are equivalent to 'new' diplomas with profile requirements. Consequently, prospective students holding these types of diploma may be admitted. Students must, however, meet any requirements regarding previous qualifications (paragraph 4) and any further additional requirements (paragraph 5). (Section 7.28 of the WHW.)
8. Where a student applies for admission to a study programme based on a diploma other than one of the diplomas referred to above, the institute director will decide whether that diploma is equivalent and if it grants access to the study programme. Students must, however, meet any requirements regarding previous qualifications (paragraph 4) and any further additional requirements (paragraph 5). *(Section 7.28 of the WHW.)*
9. *Students who are admitted by virtue of a diploma as referred to in paragraphs 2, 7 or 8 of this article will be subject to an additional assessment to determine whether they meet the knowledge and skills requirements as referred to in paragraph 4 and 5 of this article. (Section 7.28 of the WHW.)*
   Students must meet the requirements of this assessment prior to enrolment.
10. Admission to the study programme *is not subject to* an admission quota in accordance with Sections 7.53, 7.54, 7.56a and 7.57a of the WHW.

Article 2a Study choice check and study choice advice

1. The study choice check consists of at least the completion of a digital questionnaire and a contact moment with the study programme. ***The following additional activity or activities will also be provided as part of the Study Choice Check:***
   The study choice check for international students as referred to in the Study Choice Advice Rules consists of writing a letter of motivation.
2. Within 4 weeks following registration, the prospective student will receive a link to the digital questionnaire. Within 4 weeks following completion of the questionnaire, the prospective student will receive an invitation to the contact moment with the study programme.
   *International students as referred to in the Study Choice **Check** Rules will receive further information on the study choice check within 4 weeks following registration.*
3. The digital questionnaire can be completed in the period between October 1st 2019 and September 1st 2020.
   The study choice activities for international students will take place in the period between October 1st 2019 *and* May 15th 2020.
4. The contact moments with the study programmes are planned in the period between October 1st 2019 and September 1st 2020.
5. The contact will take place by email or telephone.
6. The study choice advice will be sent to the prospective student by e-mail within ten working days of the contact moment.
7. The study choice advice is non-binding for prospective students who apply by no later than 1 May. Students who apply after 1 May will not be permitted to enrol, except in the case of a situation as referred to in Article 2(2) or in the event of exceptional circumstances as set out in Article 3(3), under a through d of the **Study Choice Check Rules**.
8. The **Study Choice Check Rules** determine the categories of students for whom the study choice advice is not obligatory. *The study choice advice is likewise not binding for those groups of students. A face-to-face contact moment is often not possible for international students.*

Article 3 Requirements regarding foreign diplomas/international students

1. Holders of a foreign diploma may not sit tests for which credits are awarded in the foundation year of a Dutch-taught study programme before having demonstrated to the Examination Board to have an adequate command of the Dutch language. (*Section7.28 of the WHW.)*
   Command of the Dutch language must be at *Nt2, programme II, level*

The certificates for Dutch as a foreign language, Higher Education Language Proficiency Subject Cluster and Academic Language Proficiency Subject Cluster (CNaVT- PTHO and PAT) can be viewed as equivalents, as can the certificates for ***Dutch as a foreign language, Educational start-skilled and Educational Professional (STRT and EDUP****).*
or meet the requirements set by the study programme.

2. The institute director may also decide that a student with a foreign diploma may be admitted after the student has demonstrated that he has an adequate command of the Dutch language. *(Section 7.28 of the WHW.)*
   Command of the Dutch language must be at *Nt2, programme II, level or meet the requirements set by the study programme N / A*
3. Students with a foreign diploma seeking admittance by virtue of an entrance examination as referred to in Article 2, paragraph 6, must be at least 21 years of age.
4. Foreign students from outside the EU who are 18 years of age or older on the date of their first enrolment must have a valid residence permit. (*Section7.32 of the WHW.)*
5. Foreign students with a residence permit are required to earn at least 50% of the available credits each year. The IND will be informed if the student fails to meet this requirement, unless there are special circumstances due to which the student was unable to meet this requirement. Such a notification may be withheld once during the course of each study programme.
6. *According to the Code of Conduct regarding International Students, international students[1] seeking admittance to an English-taught study programme must be able to prove that their command of the English language is at least equal to the following scores:*

IELTS	*6.0*
TOEFL Paper	*550*
TOEFL Computer	*213*
TOEFL Internet	*80*
TOEIC	*670*

(provided the student has passed 'Speaking and writing' and 'Listening and Reading' components.)
Cambridge ESOL *FCE-C – scale 169 – 172, FCE-B – scale 173-175*
Exemption from this requirement can be awarded if the international student's preparatory education was followed in a country where English is the official language and language of instruction.

Article 4 Professional activity requirements

1. *There is no dual-study programme.*
2. *There is no part-time study programme.*

Section 3 Intake interview, exemptions, short track and tailored study programmes

Article 5 Intake interview

1. Students entering a study programme may be offered an intake interview if they have competencies previously acquired elsewhere. Students *can include the evidence of the competencies previously acquired elsewhere in their portfolios or* may use this evidence to substantiate a request for exemption before the Examination Board.
2. Students who re-enrol after an interruption in a study programme in which they were previously enrolled will be required to take an intake **interview** to determine which part of the study programme still has to be completed. No intake **interview** is needed if agreements regarding re-enrolment in the study programme were already made with the Executive Board at the time that the student interrupted his study. If a student enters a study programme during the foundation year, agreements will be made on the period of time the student will be granted before **he** receives advice regarding the continuation of studies.
3. A study programme will be drawn up based on the assessment of the competencies previously acquired and will be submitted to the Examination Board for approval.

Article 6 Exemptions

1. The institute director can exempt a student from the foundation year examination if the student holds a diploma, Dutch or foreign, which is at least equivalent. *(Section 7.30 of the WHW.)*
2. Students who believe they are eligible for an exemption must submit an application to that end to the Examination Board. The Examination Board may grant an exemption from one or more interim examinations on the grounds of a review of an assessment or the holding of a diploma, certificate, accreditation of prior learning or similar document, such as proof of results achieved in a study programme taken at a research university or university of applied sciences and / or proof of

[1]According to the Code of Conduct regarding International Students, 'an international student' is a student with a foreign nationality.

administrative activities, with which the student can show that **he** has already met the requirements of the test in question. Exemptions are recorded in the study progress system. The period of validity of the exemption is stated in the exemption decision. The validity period is 10 years.

3. The Examination Board can grant an exemption from a minor based on the certificate of an accredited Bachelor's or Master's programme or on a document proving that the student completed a minor in an accredited Bachelor's or Master's programme, so long as this minor does not overlap substantially with the student's current Bachelor's programme. Exemptions based on study results from an accredited Bachelor's or Master's programme can only be granted if the student has documented proof of obtaining at least 30 credits in this study programme (for a Bachelor's programme, this requirement refers to the second and third year) and if these results do not overlap substantially with the student's current Bachelor's programme.
   A student who has taken part in the Fontys Empower programme and has successfully completed all components of that programme may, on that basis, be granted an exemption for a minor provided the student submits a request to that effect and this possibility has been set out in Article 15(5).

Article 7 Short-track/tailored study programmes

1. Students who believe they are able to proceed with and / or complete their study programmes at an accelerated pace may submit an application requesting such to the Examination Board. The study career counsellor's advice must be enclosed with the application. The organisation of the study programme must be able to accommodate the short-track option.
2. *For students with a VWO diploma who want to make the transition from TU/e, the intake coordinator in a conversation with the student made a proposal for which courses the student can get an exemption based on results achieved at the TU/e. This proposal is accepted approval submitted to the examination board.*
   A fast-flow semester (TER table half-year foundation year) is specific to the Mechanical Engineering course available with a VWO diploma. Students can participate under the conditions below:
   1. students with a pre-university education (with a minimum of 7.0 for mathematics and physics) or transferring from a technical university degree (with a minimum of 15 credits) are eligible for this semester;
   2. the fast-flow semester consists of 30 ec and is followed instead of the 2 semesters from the regular foundation course;
   3. on the basis of proof of the results achieved in the fast-flow semester (30 EC), the examination committee to grant exemption for the remaining 30 EC from the propaedeutic year;

Section 4 Facilities with reference to study career counselling, functional disability, administrative activities, Top-Class athletes scheme, student entrepreneurship

Article 8 Study career counselling

1. Every student is coached by a study career counsellor.
2. In consultation with the study career counsellor, the student decides how best to work on **his** development and how to shape the learning process.
3. The student consults with the study career counsellor on the progress of the learning process.
4. The study career counsellor conducts support and orientation interviews with the student in the foundation year. Reports can be drawn up of these interviews, copies of which are given to the student. The student must sign these reports to indicate **his** agreement or, if applicable, with the note 'reviewed and not approved'.
5. Students may submit a request to the institute director to be assigned a different study career counsellor if they can give arguments for this.
6. Students enrolled in their foundation year whose mother tongue is not Dutch can apply to the Examination Board to be allowed extra time when they sit tests in the first year of the foundation phase. Extra time to sit tests will only be granted to students who can prove that they use facilities to improve their command of the Dutch language.

Article 9 Special facilities for students with a functional disability

1. Students with a functional disability are legally entitled to effective adjustments, unless such adjustments would burden the **institution** disproportionally. *(Section 7.13 of the WHW.)*
2. These adjusted facilities must be aimed at the removal or restriction of any obstacles and encourage the independence and full participation of the student as much as possible. The

adjusted facilities may relate to the study programme (including internships), the timetables, and type of study programme, the tests and educational tools.

3. A student who seeks to have adjusted facilities must submit a written and substantiated application in good time to the Examination Board. If necessary, the Examination Board will seek an expert's advice (such as a student counsellor) before taking a decision. If the Examination Board deems it necessary before taking a decision, it may confidentially inspect the medical certificate that may be available with the student counsellor, unless the student objects.
   The Examination Board must decide within four work weeks after receipt of the application, unless it requires further inquiry, in which case the student will be informed as to when more clarity can be given with respect to his application.
4. In the case of a protracted or chronic disability, such an application will only have to be made once for the entire study programme; in all other cases once per testing period or academic year. In its decision to grant the facilities, the Examination Board may also rule that these will apply for the entire duration of the student's study or that the student is to consult with his study career counsellor annually to discuss whether the facilities are still adequate.
5. At the beginning of the academic year the institute will inform students regarding the possibilities for special facilities. Students will be informed of their right to consult a student counsellor.

Article 10 Students with board memberships

1. Student can include any board memberships as part of their portfolios. In order to do so, they must describe, in consultation with their study career counsellors, how the board membership can contribute to the acquisition of one or more competencies of their Bachelor's programme.
2. Board memberships can be listed on the diploma supplement. The student must request the listing at least 3 weeks prior to the graduation *ceremony* via the study programme administration.
   At the request of the student's study programme, the Centre for Administrative Activities (CAA) can confirm that the student has been an active board member of a CPC . In the case of board memberships of a PC or IPC, the study programme can request confirmation from the relevant IPC or PC.
3. Students who believe that their board memberships demonstrate that they have the knowledge, understanding and **/ or** skills, etc. that are assessed in particular tests for which credits are awarded may apply for an exemption from such tests from the Examination Board.
4. A student may apply to be included under the Profiling Fund Scheme on the basis of his administrative activities and submit a request to his institute for **an attendance fee** or for a board membership scholarship from the Profiling Fund Board.
   See also **A**rticle 14 of the **Participation Regulations on the participation councils and PC'S.**

Article 11 Top-Class Athletes scheme

Students who have been granted a Top-Class Sport or Talent status are entitled to facilities from the Top- Class **Athletes** Scheme. Facilities regarding the adjustment of tests or test timetables, an adjusted arrangement regarding compulsory attendance, working in groups and an adjusted internship must be sought from the examination committee of the study program.

Advice regarding the continuation of studies may be deferred for students with a Top- Class status (see Article 32).

Note: mention the person responsible, e.g. SLB, who is authorised by the Examination Board, the Top-Class Sport contact person or the Examination Board, and from whom facilities can be requested.

Article 11a Student entrepreneurship

Students who are eligible for the Student Entrepreneurship Scheme may apply to the Examination Board, among others, for facilities regarding the adjustment of tests or test timetables, an adjusted arrangement regarding compulsory attendance for education components, working in groups and an adjusted internship. These facilities should be sought from the examination committee of the study program.
Advice regarding the continuation of studies may be deferred for students with entrepreneur status (see **A**rticle 32)

Section 5 Study programme content

Article 12 Study programme profile – main subjects/differentiations – occupational requirements

1. The study programme is based on a study programme profile. The exit qualifications of the study programme are described in the study programme profile. The study programme profile can be found *in Appendix A program profile Bachelor of Science of the bachelor courses Electrical Engineering, Automotive, Mechatronics and Mechanical Engineering.*
2. The study programme has *no* main subjects.
3. The study programme is based on the following principle: AB.
4. The study programme *does not impose any* specific occupational requirements.

Article 13 Study programme layout

1. Each Bachelor's programme has a foundation year phase with a study load of 60 credits, which is concluded with the foundation year examination. The function of the foundation year is to orientate the student, allowing him or her to make suitable choices.
2. A Bachelor's programme has a study load of 240 credits with a nominal study load of 60 credits per academic year *and consists of a major and a minor. The major has a study load of 210 credits. The minor has a study load of 30 credits. Part-time programmes have a different study load, namely: The part-time Electrical Engineering course no longer contains a minor from cohort 2010 and therefore consists of a major of 240 credits.*

Article 14 Overview of units of study and credits

1. Every study programme consists of a coherent set of units of study, which are components of a study programme concluded with an interim examination. Units of study cannot exceed 30 credits.
2. Only whole credits are awarded for units of study. Below you will find an overview of the distribution of credits. Annex B: Overview Automotive, Annex C: Overview Electrical engineering full-time, Annex D: Overview Electrical engineering part-time, Annex E: Overview Mechatronics, Annex F: Overview Mechanical engineering full-time, Annex G: Overview Mechanical engineering part-time.
3. *Study programmes and tests conducted in a foreign language are subject to the Code of Conduct for Study Programmes taught in a Foreign Language the overview of units of study states which teaching and testing is provided in a foreign language. Education in Semester 7 of the Electrical Engineering, Mechatronics and Mechanical Engineering courses is offered in English.*

4. *For the February 2021 Cohort, the electrical engineering study programme comprises a set of learning outcomes. Each learning outcome has a set of indicators that describe the minimal standard that the student must achieve*

5. *At the beginning of an academic period (a quarter), the student proposes a set of evidence that will meet or exceed the minimal standard that is described in the learning outcome description in Annex C: Overview Electrical engineering full-time and the semester guide. If the examiner agrees that the proposed evidence meets the criteria stated in the indicator, a learning agreement that contains the proposal will be signed. If the examiner does not agree, the student and examiner will modify the proposed evidence until it meets the standard. Once agreement is reached, the learning agreement will be signed.*
6. *A student may choose to only partially fulfil a learning agreement in an academic period. In this case, the evidence is carried over to the next period in which the student will continue to accumulate evidence. If this is in the learning agreement, it does not constitute a resit.*

7. *During the period, the student will receive feedback and feedforward on a weekly basis from a mentor and a project coach (they may be the same person). Feedback and feedforward are used as a form of indicative assessment that the student can use to evaluate their progress towards completing a learning outcome.*
8. *A completed learning outcome shall be assessed at the end of an academic period on the basis of a portfolio. The assessment is based upon the learning agreement and the learning outcome along with the learning outcome indicators.*

9. *The TER table, learning outcomes, indicators, and guidelines for evidence are available in appendix C: Overview Electrical engineering full-time.*

10. *The new curriculum is still being developed and will be supplemented ever year.*

Article 15 Content of minors and other special programmes

Article 16 Education components

1. Below is an overview of the education components that are part of the study programme. Annex B: Overview Automotive, Annex C: Overview Electrical engineering full-time, Annex D: Overview Electrical engineering part-time, Annex E: Overview Mechatronics, Annex F: Overview Mechanical engineering full-time, Annex G: Overview Mechanical engineering part-time.

1. *Students are not restricted in their choice of a minor, whether the minor is a minor specific to a study programme or one offered across Fontys, or an external minor, provided there is no overlap with the major programme (see also paragraph 2).*
   The institute offers the following minors.
   Engineering minor
   Minor Be Creative
   Minor Adaptive Robotics
   Minor Smart Product Development with Additive Manufacturing (SPDwAM)
   Minor Motorsport Engineering
   Minor Electric Driving
   HBO Top program
   See Appendix F for minor schemes.
2. Students who want to take a minor abroad or an external minor must seek the Examination Board's permission regarding their personal choices with respect to the minor prior to its start. Participation in a minor requires students to have passed the foundation year examination, unless the Examination Board grants them permission to take the minor without fulfilling this requirement. The minor must be taken in the third year of study.
3. Enrolment in a minor must be done before the start date as stated on the Fontys minor portal or in the Minor Regulations.
4. High-achieving students can take a minor on top of the regular study programme of 240 credits. This is subject to the following conditions:
   The student must request permission from the Examination Board in advance.
   A minor that has been passed will be mentioned on the diploma supplement.
5. The Fontys Empower reorientation programme is open to students who have hit a roadblock in their studies. The programme has a study load of 30 ECTS credits. The regulations for this reorientation programme can be found on the Pulsed portal via this link.
   A student who has taken part in the Fontys Empower programme and has successfully completed all components of that programme may, on that basis, be granted an exemption for a minor, provided the student requests an exemption from the Examination Board of the programme in which they are enrolled, unless that programme does not offer a minor.
6. *Students who go through the program at an accelerated pace or have serious delays make a tailor-made study program together with their study career advisor. This program must be submitted to the examination committee for approval. The program has no alternative pathways for long-term students.*

Article 16 Education components

2. The education components of the minors are described in the minor regulations. The regulations governing the minors offered across Fontys can be found via this link. The regulations governing minors specific to study programmes are included as appendix F to this TER.
3. Any entry requirements a student must meet before participating in an education component are stated in the overview as referred to in paragraph 1.
4. Participation in education components in the post-foundation year phase is allowed after passing the foundation year examination. The Examination Board may grant permission to a student who has not passed the foundation year examination to participate in education components in the post-foundation year phase. *(Section 7.30 of the WHW.)*
5. *Enrolment in the education components is not required. Enrolment via the student administration is required for students from the February 2021 cohort. The available educational components and their contents will be made available at least a week before the beginning of the semester. The student must enrol for their educational component(s) by the end of the first week of an academic period.*
6. The timetable is announced by way of Fontys Portal no later than 3 weeks prior to the start of classes.
7. Students who have registered for an education component must ensure that they meet the entry requirements of that component. The overview in Article 16, paragraph 1, indicates the education components to which requirements apply for participation as well as the nature of these requirements. If the requirements concern compulsory attendance, students who are eligible for the Top-**Class** athletes scheme or the Student entrepreneur scheme can apply to meet this requirement in a parallel group or for exemption from this obligation (see also Article 11 and 11a).

Article 16a - Evaluation of teaching

The education in the training is evaluated in the following way.
The education is evaluated as described in the quality manual of the institute Engineering. The quality manual is available this link

Section 6 Tests, assessment and study progress

Article 17 Types of tests

1. *The study programme has tests with credits only. The student immediately earns credits on passing the test. A competency examination is also regarded as a test with credits. When an interim examination of a unit of study consists of several component tests, the credits will be awarded as soon as the interim examination of the unit of study is passed.*
2. A test comprises an examination conducted by the examiner of a student's knowledge, understanding, skills or competencies as well as an assessment of the examination results.
3. Tests are conducted in writing or orally or in a fashion that combines both writing and oral delivery (e.g. product and presentation/interview).
4. An oral examination, including an assessment, is conducted by at least two examiners, with one of them acting as the first examiner designated by the (chairman of the) Examination Board. A report must always be drawn up of an oral test to enable an assessment of the quality afterwards. A test may be conducted by a single examiner only following the approval of the Examination Board and provided the student does not object.
   An oral test is held in public. Interested parties who wish to attend an oral test must submit a request to that effect to the examiner(s) at least two weeks before the test is held. The examiner must inform the student who is taking the test. If the student objects, the request to attend the oral test will in any event be rejected. Any rejection by the examiner will be substantiated.
   When the Examination Board offers students the possibility to sit an additional oral test by way of replacement of a regular test, it will always be conducted and assessed by two examiners.

Article 18 Overview of tests

The following tests are part of the study programme:
Annex B: Overview Automotive, Annex C: Overview Electrical engineering full-time, Annex D: Overview Electrical engineering part-time, Annex E: Overview Mechatronics, Annex F: Overview Mechanical engineering full-time, Annex G: Overview Mechanical engineering part-time.

Article 19 Tests and assessments

1. The Examination Board will designate one or more examiners for each test. An examiner can also be an external expert.

Article 20 Content of tests, duration of the test, test aids and test timetables

1. The content of the test, including the learning objectives, is described in the semester guides, n@tschool and / or test matrices and is available for students 3 weeks before the test.

3. The assessment of minors is described in the minor regulations. The examiner of the minor determines whether a student has passed the tests. The Examination Board of the coordinating institute that offers the minor must determine whether the student has passed the minor and ensure that the student receives a certificate. The result achieved for the minor is forwarded to the programme administration of the study programme in which the student concerned is enrolled.

Article 20 Content of tests, duration of the test, test aids and test timetables

2. The examiner determines the period of time allowed to students to take the test as well as any aids that students may use during the test, subject to the guidelines and instructions provided by the Examination Board. This information must be stated on the examination paper.
3. The test timetable will be published through the Fontys Portal no later than 3 *weeks* before the start of the test period in question.

Article 21 Sitting competency examinations

There are no competency examinations.

Article 22 Registration for tests

1. *Students must register for every test in accordance with the procedure described in appendix I. For cohort February 2021 the student is registered for the test at the beginning of an academic period. The student must schedule their test with the examiner.*
2. Students who have failed to act in accordance with the registration procedure cannot sit the test.

Article 23 Proof of identity during tests

Students must prove their identity at every test by showing a legally valid form of ID other than a student ID card.

Article 24 Test marking system

1. The assignments, questions, assessment norms and criteria are determined by the examiners with due regard for the guidelines and instructions provided by the Examination Board. The examiner conducts the test and determines the result on the basis of the determined assessment standards and assessment criteria.
2. If one and the same test is conducted and assessed by more than one examiner, the Examination Board will ensure that these examiners adhere to the same standards and criteria.

Article 25 Test results

1. The test results must be announced in writing to the student within ten days of the date of the test apart from the exceptions laid down in the Teaching and Examination Regulations. The study programme administration is responsible for announcing the test results at the end of every period. The privacy of students will be respected when test results are announced.
   Results will be known within fifteen working days, for projects, reports & portfolios. The examiner must inform the students if this term is not met.
2. Students are entitled to inspect all assessed tests and the accompanying assessment criteria and to be given feedback on the results.
3. Inspection takes place according to the following procedure.
   A student can contact the examiner within 2 weeks of the announcement of the result of the test contacting the examiner (teacher) for inspection of the work made.
4. Feedback is given according to the following procedure.
   A student can contact the examiner within 2 weeks of the announcement of the result of the test contact the examiner (teacher) for feedback on the work done.
5. Students can request proof from the Education Office of the state of affairs regarding their results.

Article 26 Inability to sit tests

1. Students who have acted in accordance with the registration procedure described in Article 22 but who are unable to sit the test for reasons beyond their control, the legitimacy of which reasons is subject to assessment by the Examination Board, may apply to the Examination Board to sit the test within a period of time to be set by the Board.
2. The application referred to in the previous paragraph must be submitted in writing to the chairman of the Examination Board and include the necessary **evidence (see Article 38 (3)).** The Examination Board will then take a decision and inform the student concerned. If the request is granted, the Examination Board will set a date, time and place for the test. Any rejection of the request will be substantiated and the student will be informed of **his** right to appeal. In assessing the request, the Examination Board's primary criteria are the obstruction of the study progress and the student's personal circumstances.
3. If such a request relates to a test of a minor offered across Fontys, the student must direct the request to the coordinating institute responsible for the minor, as described in regulations governing the minor

Article 27 Request for a review

1. Students who do not agree with an assessment can submit a request for a review of the assessment to the Examination Board within 4 working weeks after the date of the assessment (**see Article 38 of these Teaching and Examination Regulations and** Article 44 of the Students' Charter). The Examination Board must take a decision within 4 work weeks at a maximum.

2. Students may also appeal directly to the Examination Appeals Board within 6 calendar weeks after the date of the assessment via www.fontys.nl/studentenloket. (see Article 45 and Article 46 of the Students' Charter).

Article 28 Resits

1. Tests are conducted at least twice an academic year.
   Students can resit components marked with a pass no more than once, and at least once, in which case the highest mark will count.
   Practical tests:
   In many cases, practical tests are only offered once a year due to limited availability of rooms, equipment and supervisors. In these cases it is not possible to retake a missed practicum with accompanying test (in the form of a practical assignment). Repairing an insufficiently assessed practical tests is often possible.
   The module description of the relevant practical includes whether a resit is possible, how this resit is structured and which conditions apply to participation in this resit.
   Projects:
   The didactic principle of projects is that students work together in project groups.
   Active participation in the project groups is therefore essential for a project assessment. It is possible for an individual or a group to resit a project, provided the condition of active participation in the project groups is met.
   Retake takes place by means of a retake formulated by the examiner. Thereby the insufficiently assessed component is repaired by the group or individual student.
   The assignment must be completed within the current academic year.
   For the practical tests below, the resit is only possible in the following academic year: internship or graduation that was carried out for the first time in the spring semester and that must be completely retaken can only be retaken in the autumn.
   For the February 2021 cohort, the student can resubmit their portfolio for reassessment in the two academic periods following a failed assessment.
2. At least two opportunities to take tests that assess the material they have learned will be offered. Following these two test opportunities, the material to be studied for the test may be adapted to the material offered in the teaching block prior to the test. An up-to-date description of the material to be tested can be found via the semester guides, portal and / or at n@tschool.

Article 29 Period of validity of results

1. The period of validity of successfully completed component tests is 10 years.
   include term
   Results achieved for interim examinations can only lapse if the understanding / knowledge / skills to which these interim examinations relate can be shown to be obsolete. Understanding, knowledge and skills that were assessed more than 10 years ago can evidently be shown to be obsolete.
   The period of validity of successfully completed interim examinations is: 10 years.
   The Examination Board may extend this term.
2. In the event of special circumstances as referred to in the Profiling Fund Scheme, the period of validity of interim examinations will as a minimum be extended by the duration of the support granted on the basis of that scheme.
3. If the study programme has been substantially altered, details on how this term can be stated below, whether in the form of a written decision issued to a student or incorporation in the Teaching and Examination Regulations, if it applies to the entire cohort. Not applicable.

Article 30 Final paper - Knowledge bank

Students who write a final paper as part of the study programme must submit the paper digitally, as one document, to enable its filing in one or more digital knowledge bank(s). On submission of the final paper, students must also attach the signed 'Permission form for the filing and making available of a final paper in a digital knowledge bank'. With this form, students give their permission for the final paper to be entered in the knowledge bank and for it to be made available to potential users at the university of applied sciences and elsewhere.
On submission of the digital final paper, the student and / or client and / or organisation offering the internship may indicate their objection to the final paper being entered in the databank. The student may be asked to make a short summary of the thesis that can be included in the knowledge bank.

Article 31 Study progress

The study programme is responsible for recording the test results in the programme administration.
Additionally, students must also keep records of the results in their portfolios.

Article 32 Advice regarding the continuation of studies

1. During the first year of enrolment in the **foundation** phase of a bachelor study programme and, where possible, prior to the start of the second semester, the student is given advice on **his** study

progress. If the study progress is unsatisfactory, the student will receive a written warning and be told that if the study progress continues to be unsatisfactory, he will receive a binding negative advice regarding the continuation of his studies. A reasonable period within which the student must have improved **his** grade point average and the opportunities a study programme offers in that regard are stated in the warning. (*Section 7.8b of the Act.)*
A student who has not received a warning at that stage may yet receive one at a later point in the first year if **he** has fallen behind, and will be given a period within which to improve **his** grade point average.
The student will be given a warning in the following cases:
Less then 19 EC.

2. The study programme must give students advice regarding the continuation of studies in writing before the end of their first year of enrolment (12 months) in the foundation phase. Advice may be related not only to the continuation of the study programme, but also to the main subject the student may take. Advice regarding the continuation of studies can be negative (binding negative study advice), meaning that the student's enrolment in that particular study programme will be terminated and that **he** will not be allowed to re-enrol in the same study programme.
3. Advice regarding the continuation of studies is based on the student's results in the foundation year. The Examination Board advises the institute director on advice regarding the continuation of studies to be given. This advice must take into account the student's personal circumstances. Students must report any personal circumstances to their study career counsellors or student counsellors the moment they occur.
   If the student misses the deadline for reporting special circumstances, the Examination Board will examine whether it was excusable for the student to miss the deadline for reporting those circumstances. Engaging in top-class sports activities by students who have been granted a Top-Class Sport or Talent status are entitled is regarded as a special circumstance, on the basis of which the delivery of advice regarding the continuation of studies **can** be deferred. **A minimum number of credits these students must earn in order to be eligible for such postponement has been established.**
   The practice of running a business of his own by student entrepreneurs who have been awarded student entrepreneur status, as defined in the Fontys **S**tudent entrepreneur scheme, is also regarded as a special circumstance, on the basis of which the delivery of advice regarding the continuation of studies is deferred. However, a minimum number of credits which must be achieved to qualify for that deferral may be specified for student entrepreneurs (see also paragraph 4 of this article).
   If credits can only be earned with a competency examination, students who have failed to sit the competency examination in the foundation year will be given binding negative advice regarding the continuation of studies, unless there are special circumstances, the legitimacy of which circumstances is subject to assessment by the director. In that case, it may be decided to defer the delivery of advice regarding the continuation of studies based on the individual student's portfolio.
4. The full-time bachelor student receives a positive study advice in the following cases:
   if 45 or more credits have been earned.
   The student receives a binding negative study advice in the following cases:
   if fewer than 45 credits have been obtained.
   The standard for BSA is 75% of 31 EC (12 months after registration start) for mechanical engineering students in the fast-flow semester (OER table half-year propaedeutic year).
   For a student entrepreneur as referred to in paragraph 3 of this article, he must have at least 36 must have obtained credits in order to be eligible for a postponement of the study advice.
   For a part-time Bachelor's student, at least 38 credits must be earned
   to have. A student receives a binding negative study advice if fewer than 38 credits
   have been achieved
   The minimum number of credits which that must be achieved to qualify for that deferral for student entrepreneurs is 36.
5. Where there are special circumstances as defined in paragraph 3 of this article which may have had an influence on the credits the student obtained, the delivery of advice regarding the continuation of studies may be deferred until the end of the second year of enrolment or until the end of a shorter period. At the end of the second year or the shorter period, there will be a further review of whether the student has met the criteria for a positive study advice as defined in paragraph 4.
6. Students who seek the termination of their enrolment during the first year of enrolment will be given a warning from the director stating his expectation that they may not be suitable for the study programme. The director must seek the advice from the Examination Board before doing so. The number of months of enrolment students have left before being given advice regarding the continuation of studies must also be determined in the event the student should decide to enrol in the same study programme at a later date (see also Article 35).

Article 33 Additional provisions concerning binding negative advice regarding the continuation of studies

1. An institute wishing to issue binding negative advice regarding the continuation of studies must make provisions that allow for, among other things, a student's personal circumstances and which are aimed at guaranteeing a student's good progress.
2. Binding negative advice regarding the continuation of studies is valid for a period of 2 years.
3. At the student's request, the institute director give permission for a student to re-enrol in spite of the binding negative advice as referred to in Section 7.8b(3) of the WHW.
4. A binding negative advice regarding the continuation of studies refers to the full-time, part-time and dual forms of the study programme, unless otherwise stated.
5. Each binding negative advice regarding the continuation of studies must expressly state that the binding negative advice only refers to the study programme mentioned. Every binding negative study advice regarding the continuation of studies must include a referral, to either another study programme, the student counsellor **or the study choice adviser**.

Section 7 Graduation

Article 34 Examinations - certificates - diploma supplement

1. Students have passed the examination of the foundation year or the study programme if they have passed all units of study which form part of the foundation year or the study programme, as referred to in Article **14**. *(Section 7.10 of the Act.)*
2. Certificates are given at the following occasions:
   - on passing the foundation year examination;
   - on passing the study programme's final examination.
3. The certificate will only be given after it has been established that the student is enrolled and has paid **his** tuition fees for all the enrolment years. *(Section 7.11 of the WHW.)*
4. After successful completion of the examination, the Examination Board awards the certificate. The certificate is dated on the date of the student's final academic activity. The certificate of a study programme comes with a diploma supplement. This diploma supplement may include mention of a student's board activities (**see Article 10). Students who have served as members of the Examination Appeals Board may also request that activity to be included on their diploma supplement.**
   The Examination Board will determine whether a student has passed within a maximum of eight calendar weeks after the student's **final academic activity**.
   If the student wishes for the certificate to be dated later, the student must postpone the completion of **his** final academic activity.
   The certificate is signed on behalf of the Examination Board by the (deputy) chairman, the (deputy) secretary, the candidate and, if applicable, an external expert.
   (Section 7.11 of the WHW). On behalf of the institute, the Examination Board also confers on the student the degree if the student has taken the study programme examination.
5. For the study programme's examination the Bachelor of Science degree is awarded.
6. The award ceremony takes place at a time decided by the institute.
   Students who passed the study programme examination and have requested the postponement of the award of the certificate may be issued a statement that the study programme degree has been conferred on them. *(Section 7.11 of the WHW.)*
7. *The student will receive one of the judicums listed below on his certificate based on more than just performance. The "cum laude" qualification is the highest attainable.*
   The student will receive the cum laude qualification if he has met the following requirements:
   If all unrounded grades for the exam subjects (these are all educational activities from the 7th semester of the degree program) are equal to or greater than 7, the average grade of all unrounded
   marks for all exam subjects is at least an unrounded 8 and at least a rounded 8 for it graduation work has been achieved and the student has passed or completed all the practicals from semester 7. All the results mentioned above must be obtained without a resit to be. If the student has an exemption for one of the educational activities from the 7th semester this is considered a mark of 6 and therefore the student cannot pass "cum laude".
8. The Executive Board reports to DUO the students that have passed the final examination of the study programme.

Article 35 Statement on departure

1. Every student who seeks to terminate **his** enrolment without having passed the study programme's final examination will be invited for an interview.

2. At the student's request, the student may be issued a statement listing any results achieved. *Results of successful tests without credits can be converted into an equivalent of credits based on the study load. (Section 7.11 of the WHW.)*
3. The statement must specify that the interim examination test results will in principle be valid for ten years. The statement can include a reservation in the event of a substantial overhaul of the study programme. See Article 29.

Article 36 Transfer

Specific agreements have been made with one or more universities for the bachelor's program to ensure a smooth transition to a university master's program. The specific information can be found via this link.

Section 8 Irregularities and fraud

Article 37 Irregularities and fraud

1. If irregularities are discovered in connection with a test, as a result of which the Examination Board cannot guarantee the test's quality and any of its results, the Examination Board may forgo having the test checked, or declare a test result void. In such cases, the Examination Board must ensure that an opportunity to resit the test in the near future is offered to the affected students.
2. If a student is guilty of an irregularity committed with respect to (a component of) an examination or fraud, the Examination Board may exclude the student from sitting one or more tests of the study programme for a period to be determined by the Examination Board but which will not exceed one year. If the test has already been assessed, the result will be declared void.
3. In the case of serious fraud, the Examination Board can propose to the Executive Board that the enrolment of the student involved be prematurely terminated *(Section 7.12b of the WHW.)*
4. If the irregularity or fraud is only discovered after the examination, the Examination Board may withhold or claim back the certificate of the study programme or decide that the certificate will not be issued unless the student sits a new test or examination in the components to be determined by the Examination Board and in a fashion to be determined by the Examination Board.
5. Before taking a decision, the Examination Board will hear the student and any other interested parties. A report will be drawn up of this hearing, of which a copy is forwarded to the student. The Examination Board must notify the student of its decision without delay, which notification can be given orally if required but must in any event also be issued in writing. Furthermore, the student is informed of his right of appeal.
6. The Examination Board makes up a report of its decision and the facts it is based on.

Section 9 Examination Board, appeal

Article 38 Examination Board

1. The institute director establishes an Examination Board for each study programme or group of study programmes.
2. The Examination Board's duties and responsibilities are laid down in the WHW. *(Sections 7.12, 7.12b and 7.12c of the WHW).* These include the following duties and responsibilities:
   - responsibility for guaranteeing the quality of testing;
   - responsibility for guaranteeing the quality of the organisation of and the procedures surrounding tests and examinations;
   - to determine objectively and professionally whether a student has passed an examination;
   - to award certificates and the diploma supplement;
   - to determine alternative tracks;
   - to assess applications for exemptions and reviews and to award applications for special facilities;
   - to determine whether an examination has been conducted in a way other than that prescribed in the TER;
   - approval of the details of a foreign minor or external minor;
   - to give advice to the institute director on advice regarding the continuation of studies to be issued;

   The composition of the Examination Board can be found in the Appendix J 'Composition of the Examination Board'
3. An application to the Examination Board can be submitted to the Examination Board via the link: examencommissie-engineering@fontys.nl (see also Article 26(2) and Article 27).

Article 39 Appeals

Students who do not agree with a decision of the Examination Board can lodge an appeal against this decision within six calendar weeks after the date of the decision with the Examination Appeals Board (see

Articles 45 and 46 of the Students' Charter). *(Section 7.61 of the WHW.)*
Notices of appeal should preferably be submitted in digital format via the portal of the Examination Appeals Board. See the website for more information. Students can contact the Student Counselling Office (iStudent@fontys.nl) for help on lodging an appeal.

Section 10 Retention and hardship clause

Article 40 Retention of documentation

1. The Examination Board is responsible for retaining the minutes of its meetings and its decisions for a period of seven years.
2. The Examination Board is responsible for retaining its issued statements, among others, the statement on departure of a student who terminates **his** enrolment without having passed the study programme's final examination, for a period of ten years.
3. The Examination Board will ensure that the following information on each student will remain in the institute's archives for 50 years:
    - information on whether each student has obtained a foundation year certificate and / or a certificate of higher professional education including the list of marks.
4. The institute director is responsible for retaining test papers/assignments, assessment criteria, marking standardisation, pass marks, test matrices and test analyses for a period of seven years.
5. The institute director is responsible for retaining the lists drawn up and signed by the examiners containing the results achieved for a period of ten years.
6. The institute director is responsible for ensuring that all final papers and other kinds of tests in which students demonstrate their command of all aspects of the final attainment level, including assessments, will be kept for a period of seven years.
7. For the purpose of the external assessment of the programme in connection with accreditation, the institute director will ensure retention of a representative set of tests, including assessments, for a period of two years after the assessment.
8. The institute director is responsible for ensuring that the work completed by the student (written and non-written, including digital work) including assessments, with the exception of the work forming part of the representative set of final papers, is either destroyed or returned to the student after the expiry of a term of at least six months following the publication of the result. This term may be extended if necessary in connection with an appeal procedure.

Article 41 Hardship clause

1. The Examination Board can make provisions for serious injustices that occur as a result of the application of these rules; it can also make decisions in cases not provided for by these rules. In order to decide whether the hardship clause must be applied, the Examination Board must weigh the interests of the student concerned and those of the study programme. Cases requiring immediate action may be heard by the chairperson of the Examination Board or **his** deputy after which the other members must be notified as soon as possible.
2. Students must apply in writing, stating reasons, to the Examination Board for the application of the hardship clause in accordance with Article 44 of the Students' Charter. The Examination Board decides on the student's application and communicates this decision in writing, stating reasons, to the student concerned, who is also informed of **his** right of appeal.

Section 11 Final provisions and implementation

Article 42 Entry into force, amendments, publication and official title

1. The TER applies to all students enrolled in the study programme in question during the 2020-2021 academic year, unless otherwise stated below.
2. The general section of these regulations and any amendments thereto will be established by the Executive Board, after having obtained the consent of the students' section of the Central Participation Council. PC's will be given an opportunity to issue advice to the CPC. That general section of the TER constitutes the basis on which the study programme-specific TER for each study programme will be drawn up before being submitted to the Examination Board for their advice and the (joint) PC and IPC for their advice/consent. The (joint) PC advises the institute director and sends its advice to the IPC for informational purposes. The IPC advises the institute director and sends its advice to the (joint) PC. The establishment of and amendments to the study programme-specific TER are effected following a proposal from the institute and require the

consent of the students' section of the competent IPC and the (joint) PC. (*see Sections 10.20 and 7.13 of the WHW.)*

3. The text of the TER can be amended if warranted by changes to the organisation or organisational components with due observance of the provisions of paragraph 4. In the event of an interim change, the procedure as described in paragraph 2 applies.
4. If the interests of an individual student are prejudiced as a result of interim amendments of the regulations, the student may submit a written application to the Examination Board to protest against the amendment of the rules. The Examination Board examines the student's application and bases its decision on a weighing-up of the interest of the individual student on the one hand and the interest of the quality of the study programme on the other.
5. The institute director adopts the study programme-specific TER before 1 June of the academic year preceding the academic year that starts on 1 September. He ensures the publication of the study programme-specific component of these regulations and any amendments thereto by making them available for inspection with the secretariat of the study programme and placing them on the website.
6. *The official title of these rules is 'General Section of the Teaching and Examination Regulations of Fontys'*.
   The official title of the TER of the Bachelor's programme is "Engineering Bachelor TER 2020 – 2021"

Article 43 Transitional provisions

When a study programme is subject to a substantial overhaul, the following transitional provisions will apply.
After the last regular activities of the 'old' programme and the related test or examination have been completed, this test or examination will be held two more times by way of resits. After that, it will be decided which test or examination that is part of the 'new' programme the student must sit to replace the 'old' one. or transitional provisions of the individual study programme.

Article 44 Unforeseen cases

The Examination Board decides in all cases not provided for by the study programme-specific part of the TER, unless the issue is covered by the institute director's competency.

B - Set-up of the study programme and support facilities

1. Set-up, organisation and execution of the study programmes

Information on the set-up, organisation and execution of the study programmes can be found in:

- the Teaching and Examination Regulations (see under A).

2. Facilities for students

Information on facilities for students can be found at:

- the institution-specific section of the Fontys Students' Charter (www.fontys.nl/rules)
- the website of the Students Facilities Department (http://www.fontys.nl/studentenvoorzieningen)
- the website of Fontys Study Abroad
- the website of Fontys connect portal

3. Study support

Information on study support can be found in:

- the Teaching and Examination Regulations (see under A)
- the study programme's digital prospectus

C - Internal complaints procedure

Complaints can be submitted in accordance with the complaints procedure of the institute: https://intern.fontys.nl/forms/meldingsform.14820.htm

Overview of attachments

A. Study programme Bachelor of Science
B. OER tables Automotive
C. OER tables Electrical Engineering
D. OER tables Mechatronics
E. OER tables Mechanical Engineering

F1. Engineering Minor
F2. Minor Be Creative
F3. Minor Adaptive Robotics
F4. Minor SPDAM

G. HBO Top programme
H. Proud Programme
I. Enrolment process exams
J. Composition examination committee

Bachelor's Programmes in Engineering

A Competence-Based Profile Description 2016

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PREFACE

The Engineering Bachelor's profile is the general description of the end qualifications of all engineering programmes and is a key document in linking the universities of applied sciences. At the same time, it describes the starting competences of graduate engineers. The profile is in keeping with the current Bachelor's programmes and provides a framework by which the final levels and the body of knowledge and skills can be legitimated. Considering the diversity in programmes and professional fields they educate for, the Bachelor's profile is as adaptable as possible. It has been formulated to allow universities of applied sciences to emphasise their educational priorities, while clearly stating the minimum level for all programmes.

This publication is a partly revised version of the Bachelor's profile that was published in November 2012. The 2012 publication was the second of its kind and replaced the 2006 competence model for Engineering. A lot has happened in technical HBO education since, and there are major challenges ahead. This applies both to the labour market for higher technical staff due to the ageing of the population and to technical HBO programmes in HTNO (Higher Technical and Natural Science Education). The impending saturation in labour market in this sector is being felt, and there have been shortages of well-trained senior staff in sub-sectors for years. In these times of competition, universities of applied sciences are encouraged to make choices and create profiles of themselves using the programmes they offer. These should not be based on randomly chosen interesting teams or fancy programmes, but on logical regional focal points, which are distributed nationwide. These profiles are created in light of the government's top sectors policy (Ministry of Economic Affairs, Agriculture and Innovation).

The applied technical universities have worked hard, together with the government and businesses, to maintain or even increase enrolment levels. This has been achieved in many places, and the challenge is now to consolidate growth and share lessons learned. The goal is to have a transparent, well-organised, appealing, and high-quality range of courses, as articulated in the *Masterplan Beta en Technologie* (master plan for the exact sciences and technology): *Naar 4 op de 10, meer technologietalent voor Nederland (to 4 out of 10, more technology talent for the Netherlands),* by the Van Pernis Committee[1]. For the engineering programmes, the Engineering domain plays a linking role in creating a state-of-the-art range of engineering programmes. In the HTNO network, the course has been set to achieve an initial reduction in the number of Master's programmes in the Engineering domain.

In 2016 the publication was revised as follows:

- The government's decision to reduce the number of programmes from 36 to 13 leads to a new overview of the Bachelor's programmes in Engineering (see page 10);
- The minimum competence level has been set for each programme and is summarised in an overview (see page 13);

- The Body of Knowledge and Skills (BoKS) has been defined on a national level. Examples of this are provided in this publication. An overview of the BoKS can be found on www.hbo-engineering.nl;
- Some current developments, such as lifelong learning, learning outcomes, and course-independent examination, have been included;
- Changes were made to the structure and outline of the publication.

In the years to come, the Bachelor's profile will be a dynamic document that is adjusted periodically in collaboration with the professional field.

Cohesion between competence, BoKS, and learning outcomes merits attention in the near future and may lead to further adjustments.

The description has been established by the Board of the domain. Subsequently, the Association for Universities of Applied Sciences approved the Bachelor's profile for the engineering programmes, following a positive recommendation from the sector advisory board HTNO.

We hope that the profile will be recognisable and can serve as a functional qualifications framework for the universities of applied sciences in collaboration with the professional field, particularly when it comes to the starting qualifications of the future HBO-educated engineers.

The board of Domein HBO Engineering

1] *Naar 4 op de 10. Meer technologietalent voor Nederland. Masterplan Beta en Technologie*. Van Pernis Committee report, February 2012 (under assignment from the Top Sectors, Platform Beta Techniek, Groene Kennis Cooperatie)

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1. Introduction

What is the Bachelor's Profile?

This document describes a framework for the end qualifications of graduates of Dutch HBO programmes in the Engineering domain. These end qualifications are described as competences, which includes all the knowledge, skills, and professional attitudes of engineers at this level. As part of these competences, a number of knowledge and skills components are specifically highlighted and described in the Body of Knowledge & Skills.

Who are the Target Audiences of the Bachelor's Profile?

The Bachelor's profile has been created for various target groups: teachers and programme managers, the technical business community (professional field), current and prospective students, and other interested parties inside and outside the educational field.

The Importance of the Profile for Degree Programmes

This document sets a national standard for programmes that has been established by the Association for Universities of Applied Sciences It applies to all engineering programmes. The described competences are considered to be the general and highest common denominator for the end qualifications of the various engineering programmes that use the title "Bachelor of Science" on their HBO diplomas. The programmes can derive their own Bachelor's profile, learning objectives, and programme descriptions from this national framework.

This is useful in developing or updating a programme and in positioning the university of applied sciences in a particular region. By explicitly linking the Bachelor's profile to this national document, a university of applied sciences can safeguard the curriculum and the final levels of a programme for accreditation. The comparison between engineering programmes at universities of applied sciences is also relatively simple, provided that they are clearly based on this profile.

The professional context of engineering programmes is that of industrial manufacturing processes using technological knowledge. The Bachelor's profile distinguishes the engineering programmes from those in the five other engineering domains: Built Environment, ICT, Applied Science, Creative Technologies, and Maritime Operations. This classification can mainly be made on the basis of the fact that various programmes are at the "intersection" of two or more domains (e.g. healthcare technology or embedded systems). The distinction between domains is not always clear-cut. At the same time, all technical programmes share a lot of similar activities such as problem analysis, research, design, and some form of manufacturing or production.

The Importance of the Profile for the Business Community

For businesses and future HBO employers, this profile provides insight into the intended final levels and the engineering skills of recent graduates. It is precisely because the range of engineering programmes is so extensive that a generic Bachelor's description provides an overview of the current qualifications of the graduates. In addition to businesses, the document is also of significance for trade organisations, employers' associations and for training funds, which are active in labour market policies and training policies for their member companies and organisations. In the interest of Lifelong Learning, programmes will be set up more flexibly, in collaboration with the business community. The Bachelor's profile also functions as a framework to safeguard the final level.

The Importance of the Profile for Future Students

For prospective students and other interested parties such as deans, this profile provides information about the various engineering programmes. More than ever before, the ageing of the technical labour market is making it more important to provide good information on this subject.

Establishing the Bachelor's Profile

The updated Bachelor of Engineering profile is the result of a collaboration between all the HBO programmes in the Engineering domain of 16 affiliated universities of applied sciences. The Engineering domain is the national platform of and for these programmes. Appendix I describes the creation of this profile, in order to account for and illustrate its broad foundation.

2. Terminology and Definitions

Bachelor's profile : a professional profile for one or more Bachelor's programmes within a professional field.

Professional image : the professional image is the collection of possible professions/positions and related competences of the engineer.

Professional domain : the professional field is part of a context characterised by one distinctive word (or short combination of words).

Professional field : the professional field is a collection of all professions/positions in which the Bachelor of Applied Sciences graduate is likely to find employment.

Professional profile : a professional profile is a national description of the set of competences that a professional needs to possess in order to be able to perform their profession/position adequately. The programmes are expected to aim for developing students' competences up to the level of a starting professional.

BoKS : a description of the specific knowledge and skills for each programme that define the theoretical basis and practical activities of a professional field. Or: the collection of knowledge and skills that students need to master in an Engineering programme to become a competent engineer.

Competence : a competence is a cluster of knowledge, skill, and attitudes that: 1) are required to carry out a particular profession/position in a particular context; 2) can be measured and tested against accepted standards; 3) can be improved by training and development.

Competence profile : see professional profile.

Context : the context is the engineering environment in the manufacturing industry.

CROHO : all programmes funded by the Dutch Ministry of Education, Culture and Science are listed in the Central Register of Higher Education Programmes (CROHO).

Domain competences : see professional profile.

End qualification : an end qualification is a competence at a specific level that a person must meet at the end of the HBO programme as a starting professional (see also qualification).

Engineer : The engineer at the HBO level.

Position : a position is a collection of activities carried out by one or more persons working in a given context to contribute to a product or service, making use of certain competencies.

Behavioural characteristic : a behavioural characteristic is material proof of a competence; a student shows that they possess the competence by acting in a certain way.

Qualification : a qualification is a competence at a specific level that someone needs to have mastered at a certain time (see also end qualification).

Learning outcome : a description of what a student knows, understands, and is able to do after the learning process has been completed.

Course-independent examination : examinations aimed at assessing the students' learning outcomes, in which the applied methods and instruments have not been aligned with the specific flexible programme structure of the student.

Programme profile : description of the way in which the individual programmes define a HBO curriculum, which aims to ensure that students at HBO level develop the competences mentioned in the professional profile.

Product Creation Process : a number of coordinated phases in the realisation of a service or a product, in which a Bachelor of Engineering can play a part (abbreviated to PCP).

Interdisciplinary programme : a programme that combines technique with another sector.

Validation : acknowledging and valuing relevant learning outcomes realised by an individual student outside a programme.

Professional field : see professional field

3. The Professional Engineering Field

Ongoing Technological Developments

Dutch universities of applied sciences have always educated engineers working in diverse national and international fields, generally with a strong focus on technology. With the continuous developments in professional practice and the fields of science and technology, the knowledge domain for technical staff who have completed higher education is developing rapidly.

The technical subjects are both deepening, through nanotechnology and material research, and broadening, because disciplines such as energy, sustainability, healthcare, social welfare, mobility, security, the creative industry, the arts are looking for technological knowledge and solutions. The term “T-shaped” engineer has been used to describe these two dimensions[2]. In recent years, this broadening has become evident through new programmes and specialisations, at the border between technology and other disciplines and sectors. All programmes must be recognisable and transparent in relation to the demand from the labour market, both qualitatively and quantitatively. In the coming years, the labour market for higher educated technical personnel will remain saturated. At the same time the starting qualifications for a number of positions are rising.

Based on the economic position of the Netherlands and an analysis of the labour market, the Dutch government has prepared an agenda for stimulating knowledge and innovation through its top sector policy. It identifies nine sectors in which the business community, research, and education must work together to make a difference, both nationally and internationally. These sectors are: Water, Agriculture & Food, Life Sciences, Chemistry, High Tech Systems & Materials, Energy, Logistics, Creative Industry, and Horticulture & Starting Materials.

In these sectors engineers with different specialisations play an important role. Multidisciplinary work is required across all these sectors and their adjacent fields: a combination of research and application, thought, and action. This requires people with competences such as working together with other technical and non-technical disciplines, creative ability, imagination an innovativeness, and a curious, investigative attitude (Van Pernis report, p. 21). Most employers in technology and industry work together with international partners, suppliers, and customers. As such, an international mindset is essential.

[2] In a combination of (1) broad interest/social context/sensitivity, listening/dialogue/debate/ability to anticipate/reflection/leadership and (2) depth/knowledge/quantification, analysis/construction, solution and result-oriented working (*De ingenieur van de toekomst, KIVINIRIA*, 2009).

4. The Engineering HBO Domain

The Engineering Domain

The Engineering domain is one of the six technical domains in higher professional education, which have been established by the Association for Universities of Applied Sciences. The other five domains are:

- Applied Science
- Built Environment
- ICT
- Maritime Operations
- Creative Technologies

Naturally, there is some overlap between the Engineering professional field and these other five domains. Some examples: Embedded Systems is situated at the intersection of Engineering and ICT. Installation Technology and sustainable Energy Technology is a combination of Engineering and Built Environment. Healthcare Technology and Nanotechnology connect the Engineering domain with Applied Science.

Engineering Programmes in 2016

Table 1 lists the programmes that are part of the Engineering domain.

Table 1: Programmes that are part of the Engineering domain

1.	Automotive
2.	Aviation
3.	Electrical Engineering
4.	Engineering
5.	Industrial Product Design
6.	Logistics Engineering
7.	Aeronautical Engineering
8.	Mechatronics
9.	Care & Technology
10.	Maritime Technology
11.	Industrial Engineering & Management
12.	Applied Mathematics
13.	Mechanical Engineering

National Coordination with the Professional Field

Safeguarding professional developments in the programmes at the national level is done through national coordination with employers and professional organisations and through networks of the Dutch universities of applied sciences with businesses. The most relevant organisations at the national level are:

FME : employers' association of the technology industry;

Uneto-VNI : employers' association of the installation sector and electrotechnical retail;

De Koninklijke Metaalunie : employers' association of the steel sector;
Ingenieursvereniging KIVI-NIRIA : professional association of engineers and technology students;

NLIngenieurs (previously ONRI) : Dutch sector organisation of consultancy, management, and engineering firms.

These employers' association and sector organisations also play an important role in developing engineering positions and aligning them with international technological developments and the international business context.

International Reference Frameworks

With the introduction of the Bologna Process in 2005, a European Higher Education Area was created, with three successive degrees: Bachelor's, Master's, and PhD. It was the starting point for the Board of the Engineering domain to describe the first version of the qualifications for the engineer that had to comply with the generically formulated Dublin descriptors for the Bachelor's degrees.

5. The Professional Profile of the Engineer

5.1 Introduction

In this chapter the domain competences and the Body of Knowledge & Skills for Engineering are named and explained. The context for these competences consists of those professional fields that concentrate on the technological development and construction of products and systems using scientific knowledge.

Alongside these domain competences there are two other important standards that beginning HBO graduate professionals must meet:

- Dublin descriptors (see Appendix II)
- HBO standard (see Appendix II)
- European Qualifications Framework (EQF)

The domain competences defined in this chapter are linked to these and to other national and international standards in Appendix III

The Engineering domain profile consists of eight domain competences:

1. Analysis
2. Design
3. Realisation
4. Control
5. Management
6. Consultation
7. Research
8. Professionalisation

The domain competences will be further defined and specified into behavioural characteristics in the following paragraphs. The behavioural characteristics are formulated in such a way that they apply to starting Bachelor's graduate professionals.

Before further detailing these competence levels and the domain competences (see § 5.3 and § 5.4), the structure of the overall competence profile is first defined (see § 5.2). After all, this determines the relationship between the competences, behavioural characteristics, and competence levels as well as how they are connected.

5.2 The Structure of the Engineering Competence Profile

The competence profile contains an unambiguous structure that allows for changes at various aggregation levels:

- National Bachelor of Engineering level: all engineering programmes in the Netherlands;
- National level for each programme/CROHO: all programmes with the same CROHO;
- Programme/CROHO of one specific university of applied sciences.

At the national level the eight competences for HBO Engineering domains are fixed. These domain competences form the framework for all affiliated HBO Engineering programmes.

Each domain competence consists of one or more behavioural characteristics. These behavioural characteristics are also defined in this national Bachelor of Engineering profile. A behavioural characteristic is material proof of a competence; a student shows that he possesses the competence by acting in a certain way.

At the national level, minimum competence levels are assigned to the domain competences, and a Body of Knowledge & Skills (BoKS) is defined. The result is the national programme profile. The national profiles of two different Engineering programmes will share the same domain competences, but differ in competence levels and BoKS.

Lastly, a programme within a specific university of applied sciences can create a profile for itself by giving it a certain focus. This can be done by raising competence levels as well as by a specific interpretation of a BoKS. For example, a programme with a strong focus on product design is likely to choose to train the HBO Bachelor for level III for the competences “Analysis” and “Design”.

5.3 Definition of the Competence Levels

In addition to the final level of a new Bachelor’s graduate (level III), a number of other lower levels have been formulated: 0, I, and II, of which level 0 is the pre-HBO level (also called intake level).

These levels are further explained in Table 2. The following factors affect these levels[3]:

a. The size and complexity of the task;
b. The complexity of the professional context;
c. The degree of independence and responsibility.

Table 2 further details these factors, noting that level I in HBO exceeds the final level of an MBO programme (see also Appendix IV) [4].

Table 2: Definition of the Competence Levels

Level		Nature of the task	Nature of the context	Degree of independence
0	Intake level (HAVO-5/MBO-4 final level)			

I		Straightforward, structured, involves direct application of familiar methods according to established standards	Familiar: straightforward, single discipline	Directional guidance
II		Complex, structured, involves application of familiar methods in dynamic situations	Familiar: complex, single discipline, professional practice with guidance	Guidance if necessary
III		Complex, unstructured, involves improving methods and adapting standards to the circumstances	Unfamiliar: complex, multidisciplinary, professional practice	Independent

The guideline for reaching a certain competence level is that at least two out three factors should be at that level, e.g. “nature of the task” and “degree of independence”.

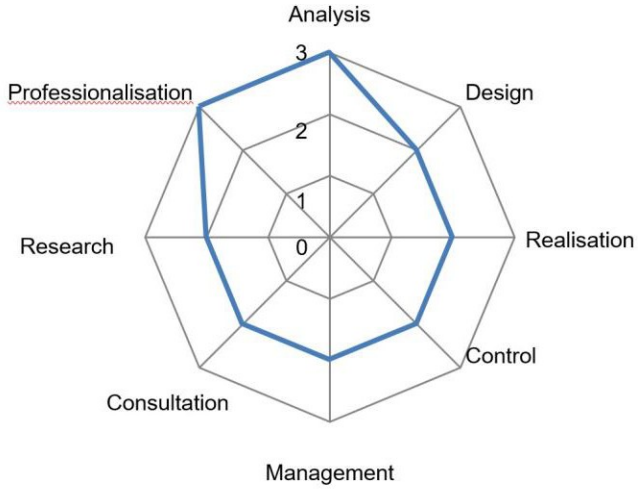


Figure 1: Competence Web for Industrial Engineering & Management

For every Engineering programme the minimum level for each of the eight competences has been set. The sum of all competence levels must be at least 18. Furthermore, a domain competence cannot be omitted (the minimum is level I). For the broad Engineering programme, the basic principle is that the minimum level of each competency is 2. It is the responsibility of the programme to determine the competence profile in such a way that it comprises a total of at least 18 points. However, if a broad Engineering programme uses outgoing student profiles that correspond with one of theprograms listed in table 3, then the competence profile that applies to the corresponding programme should be used. By way of illustration: if a student participates in a broad Engineering programme and graduates in the Electrical Engineering outgoing student profile, then this student at least meets the competence profile of the Electrical Engineering programme.

The extensive competence profiles can be found on www.hbo-engineering.nl . Table 3 gives an overview in summary.

[3] Source: HvA (2005). Cahier 1 – competentiegericht opleiden.

[4] Source: Rotterdam University of Applied Sciences (September 2011). Handreiking opstellen van toetsbare eindkwalificaties.

Table 3: A Summary of Competence Profiles

	Analysis	Design	Realisation	Control	Management	Consultation	Research	Professionalisation	**Total**
Automotive	3	2	2	2	2	2	2	3	**18**
Aviation	3	3	2	2	2	2	2	3	**19**
Electrical Engineering	3	3	3	2	2	1	2	2	**18**
Engineering	2	2	2	2	2	2	2	2	**16 +2**
Industrial Product Design	3	3	3	1	2	2	2	2	**18**
Logistics Engineering	3	3	1	1	2	3	3	2	**18**
Aeronautical Engineering	3	3	2	2	2	2	2	3	**19**
Mechatronics	3	3	2	2	2	2	2	2	**18**
Care & Technology	3	2	2	1	2	2	3	3	**18**
Maritime Technology	3	3	2	2	2	2	2	3	**19**
Industrial Engineering & Management	3	2	2	2	2	2	2	3	**18**
Applied Mathematics	3	3	2	1	1	2	3	3	**18**
Mechanical Engineering	3	3	2	2	1	2	2	3	**18**

This document primarily describes the Bachelor's level (EQF level 6, see also Appendix II). The domain competences defined here and the competence levels also lend themselves to the description of other qualification levels such as:

- Associate's Degree (AD): an AD programme is in principle part of a Bachelor's programme, but has a lower final level (EQF level 5).
- Professional Master's: refers to a HBO Master's (EQF level 7). To this end, a fourth level of competence could be defined.

5.4 Definition of the Domain Competences

This paragraph specifies how each competence relates to Engineering activities and the accompanying behavioural characteristics.

1. Analysis

Analysing an Engineering task entails identifying the problem or client needs, choosing the right design strategies or solutions and unambiguously identifying the requirements, objectives, or conditions. A range of methods is employed for this, such as mathematical analysis, computer modelling, simulation, and experiments.

Conditions in fields as business economy, commerce, society, health, safety, environment, and sustainability are also taken into account.

The engineer shows this through the following behavioural characteristics:

a. Selecting relevant aspects in relation to the research question;

b. Indicating the possible influence on business-economic, social, and professional aspects;
c. Formulating a clear problem definition, objective, and assignment based on the demands of the client;
d. Drafting and documenting a programme of technical and non-technical requirements;
e. Modelling an existing product, process, or service.

2. Design

Realising an Engineering design and working together with both engineers and non-engineers. The design can be for an appliance, a process, or a method and can be more than just the technical design, where the engineer has an understanding of the impact of their design on the social environment, health, safety, environment, sustainability (e.g. cradle-to-cradle) and commercial considerations. The engineer uses his knowledge of design methods in realising a design and knows how to apply them. The design itself is a full and correct implementation of the programme of requirements.

The engineer shows this through the following behavioural characteristics:

a. Being able to devise and choose a concept solution (architecture) based on the specified requirements;
b. Creating detailed designs based on the selected conceptual solution (architecture).
c. Taking into account the design's feasibility and ability to be tested;
d. Checking the design against the programme of requirements;
e. Selecting the proper design tools.
f. Drawing up documentation for the product, service, or process.

3. Realisation

The realisation and delivery of a product or service or the implementation of a process that meets the set requirements. To this end, the engineer develops practical skills to solve engineering problems through research and tests. These skills include knowledge of the use and limitations of materials, computer simulation models, engineering processes, equipment, practical skills, technical literature, and sources of information. The Bachelor's student is also able to foresee the (largely non-technical) effects of their work, such as in the fields of ethics, social environment, and sustainability.

The engineer shows this through the following behavioural characteristics:

a. Using the appropriate materials, processes, methods, norms, and standards;
b. Assembling components into an integral product, service, or process;
c. Verifying and validating a product, service, or process against the requirements;
d. Documenting the realisation process.

4. Control

Allowing a product, service, or process to function at optimum level in its application context or working environment, while taking into account aspects regarding safety, environment, and technical and economic lifetime.

The engineer shows the following behavioural characteristics:

a. Implementing, testing, integrating, and commissioning a new product, service. or process;
b. Contributing to management systems and/or maintenance plans, both corrective (monitoring, signalling, optimising) and preventive (anticipating);
c. Testing the performance of a product, service, or process against quality criteria;
d. Providing feedback with regard to changes in circumstances and/or performance of a product, service, or process.

5. Management

The engineer directs organisational processes and guides the employees involved towards the objectives of the business unit or project they are leading.

The engineer shows this through the following behavioural characteristics:

a. Starting up a project: quantifying the required time and budget, assessing and weighing risks, setting up the project documentation, and organising resources (people and materials);
b. Monitoring and managing activities with regard to budget, time, quality, information, and organisation;
c. Task and process-oriented communication;
d. Supervising employees, stimulating collaboration, and delegating tasks;
e. Communicating and collaborating with others in a multicultural, international, and/or multidisciplinary environment and meeting the requirements of participating in a work organisation.

6. Consultation

The engineer provides well-substantiated advice on designing, improving, or applying products, processes, and methods and brings about profitable transactions involving goods or services.

The engineer shows this through the following behavioural characteristics:

a. Understanding the needs of internal and external clients;
b. Clarifying what the client requires;
c. Translating the client's needs into technically and economically feasible solutions in consultation with relevant parties;
d. Being able to substantiate advice and persuade the client;
e. Maintaining good relationships with client.

7. Research

The engineer has a critical and investigative attitude. They use the appropriate methods and techniques for gathering and assessing information in order to carry out applied research. These methods may be: literature research, designing and executing experiments, interpreting data, and computer simulations. This requires consulting data sets, standards, and safety standards.

The engineer shows this through the following behavioural characteristics:

a. Drawing up the objectives of a requested study on the basis of the research question;
b. Independently selecting and obtaining (scientific) literature and other sources of information in order to further explore the hypothesis, thereby validating the reliability of the various sources of information;
c. Summarising, structuring, and interpreting the results and drawing conclusions related to the research question;
d. Reporting results in accordance with the applicable standards in the professional field;
e. Using the obtained results to critically evaluate the approach chosen and provide recommendations for future research.

8. Professionalisation

Acquiring and maintaining the skills required to effectively carry out the engineering competences. These skills may also be relevant in a broader setting. Among other things, this encompasses having an international orientation and a perspective on new developments, such as in comparison to social norms, values, and ethical dilemmas.

The engineer shows the following behavioural characteristics:

a. Independently determining and implementing a learning objective and learning strategy and using the results to achieve the learning objective;
b. Being flexible in all kinds of professional situations;
c. Taking accepted norms and values into account when weighing a decision in professional and ethical dilemmas;
d. Being constructive in giving and receiving feedback both in regards to behaviour and content;
e. Being able to reflect on one's own actions, thoughts, and results;
f. Being able to use various forms and means to communicate in Dutch and English.

5.5 Body of Knowledge & Skills

In this document the BoKS is defined as the cluster of knowledge and skills covered in an Engineering programme. Students must master the knowledge and skills to become competent professionals. A national BoKS has been defined for each programme. An overview of the BoKS can be found at www.hbo-engineering.nl

The programme helps students to acquire the knowledge and skills. The programme also assesses whether they command them at the level required for the profession. The knowledge and skills can be split into roughly three parts:

Basics: the elementary knowledge, laws, skills and methods that form the fundamentals for every graduate within their professional field. These basics are the most obvious parts of the BoKS to synchronise at the national level.

Visions: the most important theory and methodology in Engineering practice and science, which build upon the basics.

Trends: the current and future developments and movements in practice and science. This allows the student to understand the developments at the leading edge of Engineering and science.

These components did not guide the structure of a BoKS, but helped to identify the BoKS components.

Due to the rapid developments in the fields, the BoKS develops and evolves more quickly than its engineering competences. This provides universities of applied

sciences and programmes the freedom to make choices in specific visions and trends as well as in examples and sources.

5.6 The Relationship between Competences and the BoKS

Together with the BoKS, the domain competences form the programme profile. The knowledge and skills described in the BoKS are helpful in developing the competences. The type of BoKS components that assist in reaching a specific competence level – and how – can be further specified in the programme profile.

This chapter shows how a specific Engineering programmes can be realised by means of the following:

- Connecting a minimum level to each of the eight domain competencies;
- Implementing a Body of Knowledge & Skills (BoKS).

To give a possible interpretation of the above, we used a random programme as an example. Table 4 presents a possible description of a BoKS. It is stressed that the interpretation given here is incomplete and is only provided as an example. All BoKS components defined here should be viewed from that perspective.

Table 4: Example of a Possible BoKS

BoKS component	Associated domain competences
Mathematics: algebra, differentiation, geometry, integration	1. Analysis; 2. Design; 7. Research; 8. Professionalisation
Mechanics: dynamics, statics, ..	…
Design methodologies: ...	…
Statistics: distributions, testing, ..	…
Literature study	…
Systems Engineering: …	…
Publishing results: publication standards, publication methods	…
Communication: presentation, reporting, conferencing, ..	…

6. New Developments: Learning Outcomes

The world of training HBO professionals is always in motion. The domain competences recorded in this Bachelor's profile form a robust and validated basis for safeguarding the final levels. That also applies to programmes that are increasing the flexibility of part-time education in response to the trend of Lifelong Learning. Course-independent teaching and examination requires working with learning outcomes. A learning outcome is a description of what a student knows, understands, and is able to do after the learning process is completed. While competences are a more general classification of the qualification level of the starting engineer, learning outcomes are more concrete and relate to the learning results that students achieve in an educational unit. Learning outcomes are explicitly related to final levels, because the sum of learning outcomes leads to certification. It is up to each programme to formulate their own learning outcomes in collaboration with the professional field. This must be done within a framework, to ensure that the learning outcomes are interchangeable and recognised nationwide. Two examples to clarify the relationship between a particular learning outcome and the domain competences:

Example A of a learning outcome:

The student can design an electronic interface using a technical specification, build it as a prototype, test it, and demonstrate that it satisfies all demands.

Contributes to the development of the domain competences: Analysis, Design, Realisation, and Research.

Example B of a learning outcome:

The student is able to use existing risk analysis techniques to create a risk analysis of an electronic problem and formulate a concrete recommendation based on this.

Contributes to the development of the domain competences: Analysis, Consultation, and Research.

7. References

This document has been compiled based on the following documents:

- *Naar 4 op de 10. Meer technologietalent voor Nederland*. Masterplan Beta en Technologie. Van Pernis Committee report, February 2012 (under assignment from the Top Sectors, Platform Beta Techniek, Groene Kennis Coöperatie).
- *Profiel van de Bachelor of Engineering, generieke competenties voor sturende, voortbrengende en ondersteunende processen in het domein van de Bachelor of Engineering*, ISBN 90-810570-1-4, 2006.
- *Bachelor of Applied Science, een competentiegerichte profielbeschrijving*, December 2008.
- *Bachelor of ICT, domeinbeschrijving*, ISBN 978-90-81 4684-1-1, 2009.
- *Cahier 1 – competentiegericht opleiden*, HvA, 2005.
- *Handreiking opstellen van toetsbare eindkwalificaties*, Rotterdam University of Applied Sciences, Sep. 2011.
- *Procedure op- en vaststelling landelijke opleidingsprofielen bacheloropleidingen hogescholen, see http://www.verenigingh ogescholen.nl/profielenbank/*
- *Kwaliteit als Opdracht*, HBO-raad, 2009.
- EUR-ACE: Framework standard for the Accreditation of engineering programmes, 05-11-2008.
- *The European Qualifications framework for lifelong learning*, http://ec.europa.eu/dgs/education_culture.
- *A Tuning Guide to Formulating Degree Programme Profiles. Including Programme Competences and Programme Learning Outcomes, 2010 see* http://nvao.com/page/downloads/A_Tuning_Guide_to_Formulating_Degree_Programme_Profiles_20 10.pdf

8. Appendices

I. Process Description and Consultation of the Professional Field

In updating and compiling the Bachelor's Profile, the aim was to achieve broad support among both the various Engineering programmes at universities of applied sciences and representatives from the professional field.

The document was created in collaboration with the universities of applied sciences that provide Engineering programmes and a number of external partners (trade organisations and businesses). Both the Domain Board and the permanent consultation partners, FME, Koninklijke Metaalunie, and Uneto-VNI, OTIB, were represented in this group. The Advisory Board of the Engineering domain served as a sounding board two times. The domain chair frequently discussed the progress and interim results in the *Sectoraal Advies College Techniek* (technical sector advisory board) of the Association for Universities of Applied Sciences.

Coordination with Universities of Applied Sciences

At the start of the revision of the Bachelor's Profile, the 16 participating universities of applied sciences in the domain took part in an evaluation of the 2006 profile and establishing the programme of requirements for the new document. In the autumn of 2011 and the spring of 2012, the interim concepts were discussed in workshops with the universities of applied sciences during the theme days of the Engineering domain. In addition, members have been able to respond individually to an interim concept that has been distributed among the programme representatives. Through the universities of applied sciences, professional field committees were involved in the development of the final concept.

Coordination with the Professional Field

The following organisations are involved in the realisation and validation of the Bachelor Profile:

Trade organisations
FME

Koninklijke Metaalunie
Uneto-VNI

Businesses

Professional field committees of the programmes concerned have been consulted. National business representatives on the Advisory Board and companies were also consulted via the trade organisations.

Professional associations
KIVI

Sounding board organisations
Hobéon

The consultation platforms and the associated professional committees are involved in the review.

A steering committee consisting of:

Thjeu Houben	Chair of the Board of HBO-Engineering
Martin Rodenburg	member of the Board
Sietse Dijkstra	member of the Board
Willie Berentsen	FME
Marianne van Loenhout	Koninklijke Metaalunie
Anne Marie Heij	Koninklijke Metaalunie
Peter Smulders	OTIB

Author's version 2012

Frank Buskermolen – The Hague University of Applied Sciences Marieke van het Erve – FME

Marc van Kempen – Saxion University of Applied Sciences Jolling Lodema – Windesheim University of Applied Sciences Emile van de Logt – Rotterdam University of Applied Sciences Hans Oerlemans – Utrecht University of Applied Sciences

Godelieve Bun – Utrecht University of Applied Sciences

Author's version 2016

Mariëlle Taks – Fontys Universities of Applied Sciences

Hans Oerlemans – Utrecht University of Applied Sciences

II. National and International Reference Frameworks

II.1 Dublin Descriptors

In general terms, the qualifications for the HBO Bachelor's level were described in 2004 in the Dublin descriptors by the "Bologna Group on Qualifications Frameworks".

Knowledge and understanding

Have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study.

Applying knowledge and understanding

Can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study.

Making judgements

Have the ability to gather and interpret relevant data (usually within their field of study) to inform judgements that include reflection on relevant social, scientific or ethical issues.

Communication

Can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

Learning skills

Have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy.

II.2 The HBO Standard

Explanation of the HBO standard (From: *"Kwaliteit als opdracht"*, Association for Universities of Applied Sciences, 2009, pages 16-18):

A Thorough Theoretical Basis

A certain amount of basic knowledge is part of any standard. For new students a proficiency in Dutch, English, calculus, and maths is a prerequisite. This knowledge is expected to increase during the programme. However, programme specific knowledge of the professional domain for which education is being provided comes first and

foremost. Determining and maintaining this knowledge is of crucial importance to universities of applied science. Competence-based learning has been an important innovation in higher education, but the implementation sometimes was accompanied by an underestimation of knowledge. Integrating knowledge, skills, and attitudes is part of educating starting qualified professionals. A stronger focus on knowledge will change the direction of competence-based learning from what it was several years ago. It is about the necessity for students to have the theoretical background that provides them with the basis to be able to look critically and creatively at their own discipline. As such, this knowledge base is intrinsically linked with the HBO Bachelor's level.

Inquisitive Capability

Professional Bachelor's programmes are not just about translating high-level acquired knowledge into a practical situation. In our modern society it is crucial that HBO graduates have an inquisitive capacity that leads them to reflection, evidence-based practice, and innovation. The Abrahamsen committee states that:

"*… the abilities to analyse problems, to synthesize, to propose solutions and to communicate about various challenges (…), also in a multidisciplinary environment, are becoming more and more important. These abilities are not only important in research environments but also in industry and the society at large. This, in combination with the knowledge and the understanding of real life processes in industry, will give industry additional innovative power. Practical and professional experience of students, by preference from the start of their study in combination with applied research, will allow these competences to develop."*

(Bridging the gap between theory and practice, possible degrees for a binary system, Report Committee Review Degrees for the Dutch Ministry of Education, Culture and Science, 2005, p. 48.)

Professional Craftsmanship

Craftsmanship is integral to the programmes provided by universities of applied sciences. For many people the professional Bachelor's degree programme is the highest form of vocational training they attend. This means that our Bachelor's programmes must teach the specific skills and knowledge needed for the role of professional in the professional field. A necessary condition to achieve this is a good relationship between the programme and the professional field. Teachers with recent practical experience and guest lecturers can provide the right context for this.

Internships show students how the acquired knowledge and exercises and the reality of the profession in practice can conflict. Having an international orientation is a part of craftsmanship, as is possessing an entrepreneurial attitude.

Professional Ethics and Social Orientation

Bachelor's graduates are not one-sided practitioners; they are professionals who have to make connections with social and sometimes ethical issues, who have a cultural skillset, who — in the truest sense — have enjoyed academic education. It is becoming increasingly important to train healthcare professionals who can reflect critically on the

value of life, to train economists who ask themselves questions about the relationship between short-term profit maximisation and longer-term confidence in the economic system, and to prepare engineers for a working life where attention to sustainability becomes a more central focus. We are talking about knowing the meaning of acquired knowledge and skills in their social context. Students may be expected to have the capability to critically evaluate knowledge by moral standards.

II.3 European Qualifications Framework (EQF)

The European Qualifications Framework (EQF) is a reference network that links national frameworks in a European context.

The proposal for the European Qualifications Framework was formulated by the European Commission in September 2006. This recommendation outlines a common framework to be used in Europe to facilitate comparisons between qualifications and qualification levels in order to promote occupational and geographical mobility and participation in lifelong learning.

EQF describes the regular educational levels in a European context. The framework distinguishes between eight levels, of which the following five are most relevant for higher vocational training:

- Level 5, “higher education short cycle”, corresponds with the Associate’s Degree (AD) level;
- Level 6, “first cycle”, corresponds with the Bachelor’s Degree level;
- Level 7, “second cycle”, corresponds with the Master’s Degree level;
- Level 8, corresponds with the PhD (Dr) level.

EQF is a reference network that links national frameworks in a European context. It is non-mandatory and describes educational levels, but it is not a system for recognition or ratification. That is done by other national institutions. EQF is meant to compare and translate national educational systems.

It also helps students and professional that move between universities in the EU. National and sectoral institutions are the main users of the EQF.

For each EQF level, characteristic expectations have been defined for the learning outcomes and achievements of graduates. The focus is on what someone knows and is able to do, not on the duration of the programme or other characteristics. In EQF this is described in terms like knowledge, skills, and competences. The description of the Bachelor’s level (level 6), i.e. the “first cycle in the European Higher Education Area”, was endorsed by the education ministers in Bergen in May 2005, as part of the Bologna Process.

At the Bachelor’s level, the EQF describes the three components of knowledge, skills, and competences as described below in the first row. In the second row it lists the specifications of learning achievements at level six, the Bachelor’s level.

EQF level six provides an indication of the complexity and depth in terms of advanced knowledge and skills and complex problems or complex activities of projects in an unpredictable environment. This description is similar to the competence levels II and III in the Bachelor of Engineering. The way in which these levels have been defined is also similar, specifically on the basis of the complexity of both the task and the context as well as the degree of autonomy in the execution.

II.4 EUR-ACE

EUR-ACE stands for “Standards for the Accreditation of Engineering Programmes” and focuses on engineering programmes. Engineering associations in Europe have drawn up a standard for the accreditation of engineering curricula. This does not serve as a guideline for the design of this Bachelor's profile, but, for the sake of completeness, indicates part of the European context from the perspective of the professional organisations. For detailed information, please refer to the source text itself.

The text below is taken from the EUR-ACE document[5] and describes the six main themes for engineering programmes. Only the description for the first cycle is quoted here. We deliberately opted to quote the English text.

The six Programme Outcomes of accredited engineering degree programmes are:

- Knowledge and Understanding
- Engineering Analysis
- Engineering Design
- Investigations
- Engineering Practice
- Transferable Skills

Knowledge and Understanding

The underpinning knowledge and understanding of science, mathematics and engineering fundamentals are essential to satisfying the other programme outcomes. Graduates should demonstrate their knowledge and understanding of their engineering specialisation, and also of the wider context of engineering.

First Cycle graduates should have:

Knowledge and understanding of the scientific and mathematical principles underlying their branch of engineering;

- A systematic understanding of the key aspects and concepts of their branch of engineering;
- Coherent knowledge of their branch of engineering including some at the forefront of the branch;
- Awareness of the wider multidisciplinary context of engineering.

[5] Source: EUR-ACE: Framework standard for the Accreditation of engineering programmes, 05-11-2008

Engineering Analysis

Graduates should be able to solve engineering problems consistent with their level of knowledge and understanding, and which may involve considerations from outside their field of specialisation.

Analysis can include the identification of the problem, clarification of the specification, consideration of possible methods of solution, selection of the most appropriate method, and correct implementation.

Graduates should be able to use a variety of methods, including mathematical analysis, computational modelling, or practical experiments, and should be able to recognise the importance of societal, health and safety, environmental and commercial constraints.

First Cycle graduates should have:

- The ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods;
- The ability to apply their knowledge and understanding to analyse engineering products, processes and methods;
- The ability to select and apply relevant analytic and modelling methods.

Engineering Design

Graduates should be able to realise engineering designs consistent with their level of knowledge and understanding, working in cooperation with engineers and non-engineers. The designs may be of devices, processes, methods or artefacts, and the specifications could be wider than technical, including an awareness of societal, health and safety, environmental and commercial considerations.

First Cycle graduates should have:

- The ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements;
- An understanding of design methodologies, and an ability to use them.

Investigations

Graduates should be able to use appropriate methods to pursue research or other detailed investigations of technical issues consistent with their level of knowledge and understanding. Investigations may involve literature searches, the design and execution of experiments, the interpretation of data, and computer simulation. They may require that databases, codes of practice and safety regulations are consulted.

First Cycle graduates should have:

- The ability to conduct searches of literature, and to use databases and other sources of information;
- The ability to design and conduct appropriate experiments, interpret the data and draw conclusions workshop and laboratory skills.

Engineering Practice

Graduates should be able to apply their knowledge and understanding to developing practical skills for solving problems, conducting investigations, and designing engineering devices and processes. These skills may include the knowledge, use and limitations of materials, computer modelling, engineering processes, equipment, workshop practice, and technical literature and information sources. They should also recognise the wider, non-technical implications of engineering practice, ethical, environmental, commercial and industrial.

First Cycle graduates should have:

- The ability to select and use appropriate equipment, tools and methods;
- The ability to combine theory and practice to solve engineering problems;
- An understanding of applicable techniques and methods, and of their limitations;
- An awareness of the non-technical implications of engineering practice.

Transferable Skills

The skills necessary for the practice of engineering, and which are applicable more widely, should be developed within the programme.

First Cycle graduates should be able to:

- Function effectively as an individual and as a member of a team;
- Use diverse methods to communicate effectively with the engineering community and with society at large;
- Demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice;
- Demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations;
- Recognise the need for, and have the ability to engage in independent, life-long learning.

III. The Relationship Between the Domain Competences and the National and International Reference Frameworks

The domain competences correspond to the national standards and international references described in Appendix II. The Dublin descriptors and the HBO standard have been determining factors for establishing the Engineering profile. The Dublin descriptors describe the internationally accepted level of the Bachelor's. The national level of the Bachelor's is described in the HBO standard. One of the requirements the Dutch government has set for accreditation, is that the level of HBO programmes should be in line with national and international accepted levels of the Bachelor's degree[6].

The national programme profiles, which are derived from the professional profiles, encompass the Dublin descriptors and the HBO standard. This implies that, if the student meets the programme profile, he also meets both the internationally and nationally accepted level of the HBO Bachelor's.

In addition, this Appendix gives a general outline of how the domain competences are related to EUR-ACE and the European Qualifications Framework (EQF).

III.1 Domain Competences in Relation to Dublin Descriptors

Table 5: Dublin Descriptors

	Dublindescriptoren				
Domeincompetenties	'Knowledge & & understanding'	'Applying knowledge & understanding'	'Making judgements'	'Communication'	'Learning Skills'
1. Analyseren	x	x	a, b	c, d	
2. Ontwerpen	x	x	a, e	f	
3. Realiseren	x	a, b	c	d	
4. Beheren	x	x	c	d	
5. Managen	x	a	b	c, d, e	
6. Adviseren	x	d	c	a, b, d, e	
7. Onderzoeken	x	a	b	c, d, e	e
8. Professionaliseren	x	x	a, b, c	d, f	x

Een 'x' houdt in dat alle gedragskenmerken van de betreffende domeincompetentie bijdragen aan de invulling van de Dublindescriptor.
Een letter (bijv. 'a') geeft aan dat het specifieke gedragskenmerk van die domeincompetentie bijdraagt aan invulling van de Dublindescriptor.

[6] http://www.vereniginghogescholen.nl/profielenbank/: Procedure for defining national Bachelor's programme profiles for universities of applied sciences (adopted by the General Assembly of the Association of Universities of Applied Sciences on 15- 10-2010).

III.2 Domain Competences in Relation to the HBO Standard

Table 6: The HBO Standard

	hbo-standaard			
Domeincompetenties	Gedegen theoretische basis[9]	Onderzoekend vermogen	Professioneel vakmanschap	Beroepsethiek en maatschappelijke oriëntatie
1. Analyseren	x	x	x	b
2. Ontwerpen	x		x	x
3. Realiseren	x		x	
4. Beheren	x	c, d	x	
5. Managen	x		x	
6. Adviseren	x	a, b, c, d	x	
7. Onderzoeken	x	x		
8. Professionaliseren	x		x	c, d, e

Een 'x' geeft aan dat er een directe relatie bestaat tussen de hbo-standaard en de betreffende domeincompetentie.
Een letter (bijv. 'a') geeft aan dat het specifieke gedragskenmerk van die domeincompetentie een relatie heeft met de hbo-standaard.

III.3 Domain Competences in Relation to the European Qualifications Framework (EQF)

Table 7: Relationship to the Bachelor of Engineering level description

KNOWLEDGE	SKILLS	COMPETENCES
Is described as theoretical and/or factual.	- *cognitive (involving the use of logical, intuitive and creative thinking);* - *practical (involving manual dexterity and the use of methods, materials, tools and instruments).*	*In the context of EQF, competence is described in terms of responsibility and autonomy.*
	Level 6:	
advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study	- manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts; - take responsibility for managing professional development of individuals and groups.

III.4 Domain Competences in Relation to EUR-ACE

In order to arrive at an international programme benchmark, the international reference frameworks for Engineering programmes are also relevant. For example, in Europe guidelines have been adopted by FEANI, the federation of national engineering associations (www.feani.org), of which KIVI-NIRIA is also a member.

The EUR-ACE initiative proposes a European engineering standard and describes the six main themes for engineering programmes. This description is relevant and useful for comparison and coordination at European level. However, it is not a standard with a formal status that replaces the national coordination with professional field organisations in the Netherlands. See also Appendix II.

Table 8: The six main themes of Engineering programmes

	EUR-ACE-thema					
Domeincompetenties	'Knowledge & Understanding'	'Engineering Analysis'	'Engineering Design'	'Investigations'	'Engineering Practice'	'Transferable Skills'
1. Analyseren	x	x				
2. Ontwerpen	x		x			
3. Realiseren	x				x	
4. Beheren	x		b		a, c	d
5. Managen	x					x
6. Adviseren	x					
7. Onderzoeken	x			x		
8. Professionaliseren	x					x

Een 'x' houdt in dat alle gedragskenmerken van de betreffende domeincompetentie een relatie hebben met het EUR-ACE-thema. Een letter (bijv. 'a') geeft aan dat het specifieke gedragskenmerk van die domeincompetentie een relatie heeft met de hbo-standaard.

VI. Overview of Dutch engineering programmes

This appendix gives an overview of all Engineering programmes taught at Dutch universities of applied science as of September 2016.

	Automotive	Aviation	Electrical engineering	Engineering	Industrial Product Design	Logistics Engineering	Aeronautical Engineering	Maritime Technology	Mechatronics	Care & Technology	Industrial Engineering & Management	Applied Mathematics	Mechanical Engineering
Avans University of Applied Sciences			x						x	x	x		x
Windesheim University of Applied Sciences			x	x	x	x					x		x
Fontys Universities of Applied Sciences	x		x		x	x			x	x	x	x	x
The Hague University of Applied Sciences			x		x				x	x	x	x	x
Hanze University of Applied Sciences, Groningen			x		x						x		x
Inholland University of Applied Sciences			x				x				x	x	x
Rotterdam University of Applied Sciences	x		x		x	x		x		x	x		x
Utrecht University of Applied Sciences			x								x		x
Amsterdam University of Applied Sciences		x		x		x						x	
Arnhem and Nijmegen University of Applied Sciences	x		x		x						x		x
HZ University of Applied Sciences				x		x					x		
NHL University of Applied Sciences			x					x			x	x	x
Saxion University of Applied Sciences			x		x				x		x		x
Stenden University of Applied Sciences													x
Zuyd University of Applied Sciences				x						x			

Automotive Degree Programme

Source: National Automotive Programme profile

Until recently, the aim has been to have an Automotive Engineer (AE) who is capable of thinking in terms of the entire vehicle. Thinking in terms of the entire vehicle means: being fully focused on the vehicle as the end product. This means that the AE must be able to understand the integration of components into an entire vehicle and how they interact, i.e. the “car architecture” of systems and components. The fact that they focus on a single component or system for the purpose of developing a graduation thesis project fits in perfectly with the professional itself. The AE is therefore seen as someone who can bring several technologies together into a working unit in an application-oriented way.

What this means is that the Automotive Engineers is distinguished by their ability to approach design tasks for parts and subsystems of cars integrally and translate them into a product or process design. Automotive Engineers bring together knowledge from several disciplines (ICT, electronics, materials science, mechanical engineering, process control systems) and incorporate this into designs and constructions that are not only technically sound, but that can also be produced and sold. They are also able to test these designs both physically in laboratories and virtually with computer models. The Automotive HBO students then graduate as a System/Development/Test Engineers with an emphasis on applied research, construction, testing, and design.

In recent years, in addition to this “hard core” Automotive Engineering in the curriculum, more and more attention has been paid to the production and manufacturing environment, so that the manufacturability and logistics aspects are also addressed. This is certainly a good development considering that many (SME) manufacturing companies are in the Netherlands. Again we see that the AE is active as an integrator, but now of the manufacturing process. They combine disciplines that have knowledge of Robotics, Electrical Engineering, ICT, Production Methods, Mechanical Engineering, etc. However, they also add knowledge of logistic processes to enable the production of vehicle components or entire vehicles.

We can conclude from the above that AEs with this range of backgrounds and profiles can be employed in many places in the industry and because of their integral view of technology, they are not limited to the boundaries of the automotive sector.

Fontys University of Applied Sciences - Electrical Engineering Programme

Profile Within the HBO Engineering Domain

The Electrical Engineering profile within the Engineering domain has been defined using four professional and four general domain competencies: analysis, design, realisation, control, management, consultation, research, and professionalisation.

The level of each competence can vary from 1 to 3 depending on the nature of the task, the nature of the context, and the degree of independence. When defining the programme profile, it has been stipulated in the domain that each competency must be classified at least at level 1 and that the sum of all levels must be at least 18. Programmes can establish profiles for themselves by scaling up one or more competences.

The document Landelijk eindnveau HBO-Elektrotechniek from 13 January 2014 examines which competences are regarded as core competences associated with the Electrical Engineering programme.

Analysis

Analysing an Engineering task entails identifying the problem or client needs, choosing the right design strategies or solutions and unambiguously identifying the requirements, objectives, or conditions. A range of methods is employed for this, such as mathematical analysis, computer modelling, simulation, and experiments. Conditions in the fields of society, health, safety, environment, and sustainability are also taken into account.

The engineer shows this through the following behavioural characteristics:

a) Selecting relevant aspects in relation to the research question;
b) Indicating the possible influence on business-economic, social, and professional aspects;
c) Formulating a clear problem definition, objective, and assignment based on the demands of the client;
d) Drafting and documenting a programme of technical and non-technical requirements;
e) Modelling an existing product, process, or service.

The student must demonstrate these behavioural characteristics at ***level III.***

Nature of the task:

Complex, unstructured, involves improving methods and adapting standards to the circumstances

Nature of the context:

Unfamiliar: complex, multidisciplinary, professional practice

Degree of independence:

Independent

Reasoning: This competence is a basic skill of an HBO Electrical Engineer. With this competence they can diagnose problems and use the theory and skills they have learned to determine how to arrive at a solution. In professional practice, graduates are given complex unstructured issues, where analysis is the basis for finding a solution. In collaboration with other colleagues, the graduate will have to contribute in a multidisciplinary setting on how to identify the problems and which path to follow in order to arrive at a solution.

Design

Realising an Engineering design and working together with both engineers and non-engineers. The design can be for an appliance, a process, or a method and can be more than just the technical design, where the engineer has an understanding of the impact of their design on the social environment, health, safety, environment, sustainability (e.g. cradle-to-cradle) and commercial considerations. The engineer uses their knowledge of design methods in realising a design and knows how to apply them. The design itself is a full and correct implementation of the programme of product requirements.

The engineer shows this through the following behavioural characteristics:

a) Being able to devise and choose a concept solution (architecture) based on the specified requirements;
b) Creating detailed designs based on the selected conceptual solution (architecture);
c) Taking into account the design's feasibility and ability to be tested;
d) Checking the design against the programme of requirements;
e) Selecting the proper design tools;
f) Drawing up documentation for the product, service, or process.

The student must demonstrate these behavioural characteristics at ***level III.***

Nature of the task:

Complex, unstructured, involves improving methods and adapting standards to the circumstances

Nature of the context:

Unfamiliar: complex, multidisciplinary, professional practice

Degree of independence:

Independent

Reasoning: Design is an inherent part of the HBO Electrical Engineering field. As a designer, it is essential to go through the entire process from specification to realisation and delivery in a structured manner. In many cases it will be about designing new hardware or modifying it, but often the emphasis is also on designing the system as a whole (e.g. within industrial automation). The use of design tools, both for the creation of the design and testing (for the realisation) is an important competence, because structural changes to the design at a later stage are often either costly or impossible.

Realisation

The realisation and delivery of a product or service or the implementation of a process that meets the set requirements. To this end, the engineer develops practical skills to solve engineering problems through research and testing. These skills include knowledge of the use and limitations of materials, computer simulation models, engineering processes, equipment, practical skills, technical literature, and sources of information. The Bachelor's student is also able to foresee the (largely non-technical) effects of their work, such as in the fields of ethics, social environment, and sustainability.

The engineer shows this through the following behavioural characteristics:

a) Using the appropriate materials, processes, and methods;
b) Assembling components into an integral product, service, or process;
c) Verifying and validating a product, service, or process against the requirements;
d) Documenting the realisation process.

The student must demonstrate these behavioural characteristics at ***level III.***

Nature of the task:

Complex, unstructured, involves improving methods and adapting standards to the circumstances

Nature of the context:

Unfamiliar: complex, multidisciplinary, professional practice

Degree of independence:

Independent

Reasoning: Realisation is a logical sequel to the competence of design, although the Electrical Engineer thinks about the realisation at an early stage (design for manufacturing, design for assembly, design for testability). System tests are an important aspect (signal integrity, EMC, temperature tests, etc.), and results often require creative solutions from the engineer.

Control

Allowing a product, service, or process to function at optimum level in its application context or working environment, while taking into account aspects regarding safety, environment, and technical and economic lifetime.

The engineer shows this through the following behavioural characteristics:

a) Implementing, testing, integrating and commissioning a new product, service or process;
b) Contributing to management systems and/or maintenance plans, both corrective (monitoring and signalling) and preventive (anticipating);
c) Testing the performance of a product, service, or process against quality criteria;

d) Providing feedback with regard to changes in circumstances and/or performance of a product, service, or process.

The student must demonstrate these behavioural characteristics at ***level II.***

Nature of the task:

Nature of a task: complex, structured, adapts known methods to varying situations;

Nature of the context:

Known; complex, monodisciplinary, supervised in practice;

Degree of independence:

Guidance if necessary

Reasoning: The Electrical Engineer is often part of a team, which tends to be a project team. They are responsible for the agreed upon quality of a product or service. This means contributing to the formulation of specifications and performing performance tests, but certainly managing the documentation thereof (e.g. technical specifications, test results, manuals,) as well in accordance with the standards used in the company. Another aspect is to integrate the system, sub-system, or service in a responsible way and to guarantee its quality (e.g. by supporting and facilitating overall system testing), optimisation, and providing documentation for other supporting processes (e.g. calibration and adjustment procedures). Troubleshooting and diagnostics in the entire system, at initial installation but also at a later stage, are indispensable qualities, as is the creative search for solutions to identified problems together with others.

Management

The engineer directs organisational processes and guides the employees involved towards the objectives of the business unit or project they are leading.

The engineer shows this through the following behavioural characteristics:

a) Designing up a project: quantifying the required time and budget, assessing and weighing risks, setting up the project documentation, and organising resources (people and materials);
b) Monitoring and managing activities with regard to budget, time, quality, information, and organisation;
c) Task and process-oriented communication;
d) Coaching staff by inspiring, persuading, motivating, showing respect, stimulating, and delegating;
e) Communicating and collaborating with others in a multicultural, international, and/or multidisciplinary environment and meeting the requirements of participating in a work organisation.

The student must demonstrate these behavioural characteristics at ***level II.***

Nature of the task:

Nature of a task: complex, structured, adapts known methods to varying situations;

Nature of the context:

Known; complex, monodisciplinary, supervised in practice;

Degree of independence:

Guidance if necessary

Reasoning: The recently graduated Electrical Engineer is not a manager. However, they usually work in project teams and the ability to function as project leader of a single-discipline team after a certain induction period is taken for granted. Management skills are therefore important.

Consultation

The engineer provides well-substantiated advice on designing, improving, or applying products, processes, and methods and brings about profitable transactions involving goods or services within the Engineering domain.

The engineer shows this through the following behavioural characteristics:

a) Understanding the needs of internal and external clients;
b) Clarifying what the client requires;
c) Translating the client's needs into feasible solutions in consultation with relevant parties;
d) Being able to substantiate advice and persuade the client;
e) Maintaining good relationships with client.

The student must demonstrate these behavioural characteristics at ***level I.***

Nature of the task:

Straightforward, structured, involves direct application of familiar methods according to established standards

Nature of the context:

Familiar: straightforward, single discipline, in-school situation

Degree of independence:

Directional guidance

Reasoning: Consulting is not a core competence for an Electrical Engineer. They should, however, be able to advise interested parties on the further steps to be taken in their design at the electrotechnical level.

Research

The use of appropriate methods and techniques for gathering information in order to conduct applied research. These methods may be: literature research, designing and executing experiments, interpreting data, and computer simulations. Databases, norms, standards, and safety regulations can be consulted for this purpose.

The engineer shows this through the following behavioural characteristics:

a) Drawing up the objectives of a requested study on the basis of the research question;

b) independently selecting and obtaining (scientific) literature and other sources of information in order to further explore the hypothesis, thereby correctly estimating the reliability of the various sources of information;
c) Summarising, structuring, and interpreting the results and drawing conclusions

related to the research question;

d) Reporting results in accordance with the applicable standards in the professional field;
e) Using the obtained results to provide recommendations for future research.

The student must demonstrate these behavioural characteristics at ***level II.***

Nature of the task:

Nature of a task: complex, structured, adapts known methods to varying situations;

Nature of the context:

Known; complex, monodisciplinary, supervised in practice;

Degree of independence:

Guidance if necessary

Reasoning: The Electrical Engineer uses the appropriate methods and techniques for gathering and assessing information in order to conduct research. This involves application-oriented research, such as investigating various solutions to a planned product design, but also investigating measurement results related to the validation of the design, investigating possibilities for optimisation or improvement of a design, etc.

Professionalisation

Acquiring and maintaining the skills required to effectively exercise other engineering competences. These competences may also apply in a broader context and include keeping informed of the latest developments, including in relation to ethical dilemmas and socially accepted norms and values.

The engineer shows this through the following behavioural characteristics:

a) Independently determining and implementing a learning objective and learning strategy and using the results to achieve the learning objective;
b) Being flexible in all kinds of professional situations;
c) Taking accepted norms and values into account when weighing a decision in professional and ethical dilemmas;
d) Being constructive in giving feedback with regard to behaviour and content;
e) Reflecting on one's own thoughts and actions;
f) Being able to use various forms and means to communicate in Dutch and English.

The student must demonstrate these behavioural characteristics at ***level II.***

Nature of the task:

Nature of a task: complex, structured, adapts known methods to varying situations;

Nature of the context:

Known; complex, monodisciplinary, supervised in practice;

Degree of independence:

Guidance if necessary

Reasoning: Electrical engineers should promote the interest of the community through their activities in a company. They must be aware of the effects their actions have on the quality of life in society.

Graduates interact cooperatively in a (design/R&D) group, and they support all necessary team-binding agreements and activities.

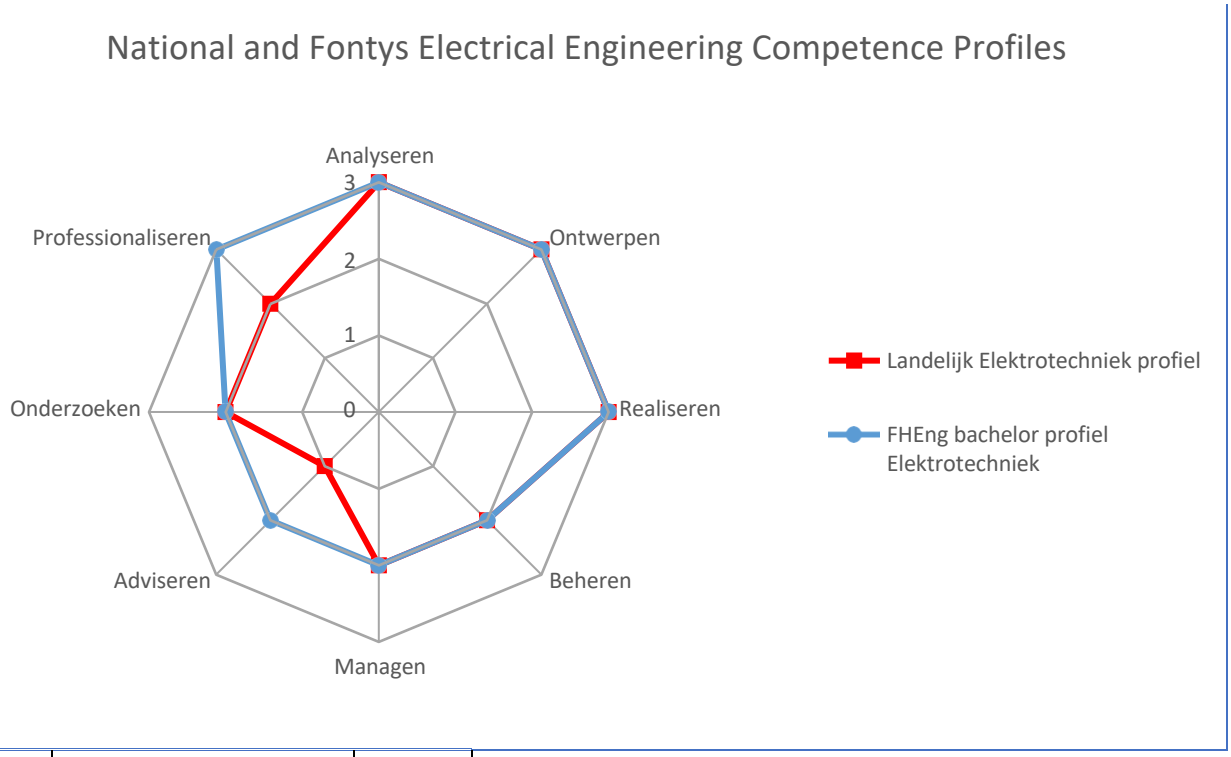
Fontys Electrical Engineering Profile

The Electrical Engineering programme, internationally known as Electrical and Electronic Engineering, is concerned with the research, analysis, design, and construction of electrical engineering systems, based on a mix of analogue, digital, and electromagnetic techniques. Work is done on a wide range of electro-related issues, products, processes, and/or services. An Electrical Technician usually starts with a problem situation to solve an electrical issue. This solution can result in a new design, but also in the research, redesign, and improvement/optimisation of existing products, systems, processes, and services. The Electrical Engineer uses relevant methodologies such as the V model. The engineer works on both the component level (semiconductors, chips, microprocessors, etc.) and system level. Electrotechnical engineers also work in technical/commercial positions and in environmental and consultancy organisations. Typical areas of knowledge that are part of the Electrical Engineering programme include mathematics, analogue electronics, embedded programming, digital techniques (FPGA), process control systems technology, signal processing, power electronics, sensors, electromagnetism, measurement, and simulation. In support of this, an Electrical Engineer has basic skills in the field of communication, system engineering, and project management. There are professional opportunities as a designer, researcher, or project leader in direct Electrical Engineering or at the intersections with other disciplines including mechatronics and computer science. Career opportunities exist both at SMEs and at larger companies such as Philips, ASML, Vanderlande Industries, and suppliers such as Neways, Prodrive, ADEAS, and NXP. The Bachelor's degree in Electrical Engineering also provides access to various Master's programmes.

The Electrical Engineering programme is taught in the Brainport region with various world players in the field of technical innovation, such as ASML (machines for chip makers), Vanderlande (automated transport systems), Thermo Fischer Scientific (electron microscopes), NXP (development of intelligent chips), VDL (several high-tech companies), and various other companies. What many of these companies have in common is that new developments can only succeed if the combination of the fields of physics, mechanical engineering, electrical engineering, and computer science is optimised. On the one hand, this requires engineers for whom systems thinking is the basis of their actions and, on the other hand, engineers who are experts in their field. The expertise is reflected in the learning path of the curriculum, the implementation is pursued in the projects, etc. It is precisely because of the region in which the Electrical Engineering programme is taught that it was decided to choose a profile that deviates from the national profile.

Each competence of the Engineering Bachelor’s profile has 3 levels. The Engineering domain recommends that, within a programme, the sum of the levels to be achieved is at least 18, which means that not all competences have to be obtained at the highest level. However, the minimum level of each competence is 1. This recommendation has been adopted by the Electrical Engineering programme, but has been applied more strongly to two competencies: Consultation and Professionalisation. This makes the sum of the individual levels to be reached equal to 20. The Electrical Engineering programme has deliberately placed the competences of Advising and Professionalisation at a higher level than the Engineering domain, because companies in the region indicate these are qualities that future electrical

technicians should have. Particularly because of the complexity within which the companies in the region work, they require a Bachelor's graduate to be able to advise clients, colleagues, and managers in a well-considered and well-founded manner about the work they have carried out within their project, which is complex by definition. For the Professionalisation competence, a Bachelor's graduate must be independent in being able to master the complex problems that our environment demands of them. These problems are, by definition, multidisciplinary. The competences to be obtained are described in the radar chart and table below.



1	Analysis	3
2	Design	3
3	Realisation	3
4	Control	2
5	Management	2
6	Consultation	2
7	Research	2
8	Professionalisation	3
		20

What is the Mechatronic Engineer capable of?

The Mechatronic Engineer is an expert in the field of intelligent moving systems. They oversee the technical system and are therefore able to define the boundaries, objectives, and requirements of the system. This is achieved by systematically dissecting a complex system, using their knowledge of electronic and mechanical components, and mathematical modelling techniques. The engineer can create the complete technical documentation of the system, consisting of the design, test results, installation, maintenance plan, and user manual. They are aware of current regulations and standards and know how to apply them.

In this way, the Mechatronic Engineer can also design a system architecture based on the functions and requirements. Furthermore, they have the research skills, professional expertise, and creativity to develop multiple design concepts based on this architecture. On the basis of the design that has been approved according to the requirements, they can select, configure, and validate components. They then integrate (if necessary in collaboration with experts from other disciplines) all components into a working mechatronic system, including interfaces. This system is tested according to the requirements of the client. In doing so, they can make recommendations to the client about the improvement of electromechanical systems.

Who is the Mechatronic Engineer?

The Mechatronic Engineer not only knows a lot about technical systems, they are also able to operate in different social systems. International and/or multidisciplinary teams are not an issue; with an open mind they take the different standards and values in the various cultures and professional disciplines into account.

Using a question as their foundation, they focus on design-oriented research in an independent and critical way. They consult scientific sources and use their knowledge to work on mechatronic concept solutions.

Depending on their overview of the system, the mechatronic engineer can divide the project into logical units; they work in a planned manner. By working according to their planning, they make adjustments where necessary, in order to achieve the goals in the areas of quality, finances, and planning.
The Mechatronic Engineer is critical of the process and of their own performance and can shape their own development by reflecting on this.

Fontys University of Applied Sciences - Mechanical Engineering Programme

Profile Within the HBO Engineering Domain

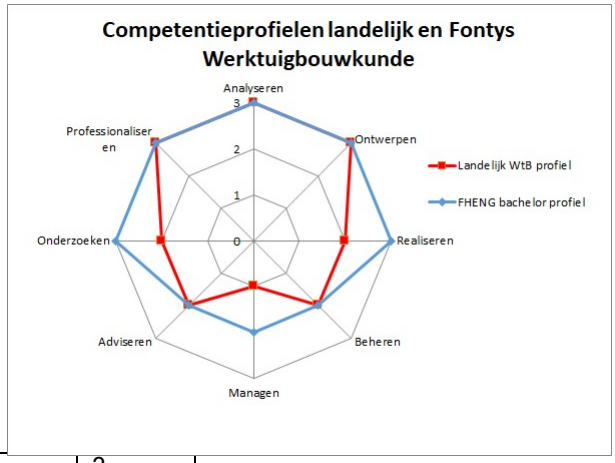
The Mechanical Engineering profile within the Engineering domain has been defined using eight domain competences. It concerns the following competences: analysis, design, realisation, control, management, consultation, research, and professionalisation.
The level of each competence can vary from 1 to 3 depending on the nature of the task, the nature of the context, and the degree of independence. When defining the programme profile, it has been stipulated in the domain that each competency must be classified at least at level 1 and that the sum of all levels must be at least 18. Programmes can establish profiles for themselves by scaling up one or more competences.
In the national consultations on 5 June 2013, it was determined which competences are regarded as core competences associated with the Mechanical Engineering programme.
There was wide consensus with regard to the analysis and design competences. The Mechanical Engineering programme is all about designing products, processes, or systems. An analysis of the situation or problem is always conducted first. Every Mechanical Engineering graduate must have a broad knowledge of design strategies and be able to draw up a plan of requirements. In this respect, the graduate must be able to operate independently as a starting professional. The Mechanical Engineer also applies their acquired knowledge and skills to arrive at a technical design, taking into account various environmental factors, such as sustainability, safety, and commerce. Every Mechanical Engineering graduate can be expected to conduct these partly complex processes with a high degree of independence. The analysis and design competences are therefore set at level 3.
In view of the HBO standard (from *kwaliteit als opdrach*t, 2009) and the Dublin descriptors, the professionalisation competence has also been set at level 3. Every graduate will have to be able to acquire new knowledge and skills as a starting professional from the very beginning. The *leren-leren* (learning to learn) aspect is, just like the ability to reflect, of great importance for every Bachelor's student, including a Mechanical Engineer.
The management competence relates to organisational processes concerning a project or assignment. Although management can be of great importance to the success of an assignment or process, it will not, generically speaking, be an activity in which a starting professional will have a leading role. For that reason level 1 is sufficient.
The other competences have all been set at level 2. They have not been identified as core competences of the Mechanical Engineering programme, but each graduate is expected to be able to demonstrate more than just the basic level (1).
A brief explanation of the level 2 consideration for the other competences:
Realisation. As a starting professional it will often be about applying known working methods and strategies, where the context can be complex and where guidance will still be present in practice. That is why level 2 was chosen.

Management. A Mechanical Engineer will need to be highly aware of their products' performance, taking into account safety, technical lifespan, and economic factors. Given the nature of the products, level 1 is not sufficient. Level 3 would create the expectation that each graduate would be able to tackle these aspects independently, even in complex situations. That is why level 2 was chosen.
Consultation. Any Mechanical Engineer will have to be able to give well-founded advice within a certain context. On the basis of the knowledge and experience gained, it should be possible to give advice in a sub-area of a project or in a somewhat complex situation. Level 1 would be too low and level 3 would imply that more complex assignments could be subject to sound advice across the board. That is why level 2 was chosen.
Research. A Mechanical Engineer will have to be able to provide information on applicability and reliability. Conducting tests, whether or not through the use of simulation, and analysing the obtained data are also part of this competence. In accordance with the HBO standard, every graduate may be expected to master this competence to a significant extent. Level 3 would imply

that independent research projects can be carried out in a complex situation. Given the nature of assignments or projects, this will not always be the case in practice. That is why level 2 was chosen.
All this ultimately resulted in the following profile for the Mechanical Engineering programme. Based on this classification, the Body of Knowledge & Skills (BoKS) can be determined for the Mechanical Engineering programme.

Fontys Mechanical Engineering Profile
Mechanical Engineering focuses on the design, production, and maintenance of mechanical installations in the broadest sense of the word. Mechanical Engineering is used in both products and processes and has a very diverse field of application. Examples of practical applications can be found in mechanical engineering, automotive, biomedical products, offshore, aerospace, food industry, robotics and automation, energy technology, and many other sectors.
Typical areas of knowledge that form part of the Mechanical Engineering programme are mathematics, statics, dynamics, materials science, design techniques, CAD/CAM, production techniques, thermodynamics, fluid mechanics, process control systems engineering, and tribology.
In support of this, a Mechanical Engineer has basic skills in the field of communication, cost price calculation, and project management. Job profiles for which this field requires mechanical engineers include: designer, structural engineer, work planner, engineer, lead engineer, systems engineer, project leader, sales engineer, etc. The labour market perspective of the Mechanical Engineer has been very favourable for many years. The Bachelor's degree in Mechanical Engineering also provides access to various Master's programmes.

It is precisely because of the region in which the Mechanical Engineering programme is taught that it was decided to choose a profile that deviates slightly from the national profile. In the areas of competence, education focuses on competence level 3 instead of the national level 2. In addition, the management competence is focused on competence level 2 instead of the national level 1. This is expressed in specific modules and topics in the curriculum focused on research skills. With regard to management, additional attention is paid to project management and system engineering where these competences are reflected in project education. With regard to realisation, additional attention is paid to the ability to create complex designs and tools and to implement and validate designs in practice. For this purpose, extensive laboratories are present in which continuous investments are made.



1	Analysis	3
2	Design	3
3	Realisation	3
4	Control	1
5	Management	2
6	Consultation	2
7	Research	3
8	Professionalisation	3
		20

The curriculum of Fontys Mechanical Engineering specifically focuses on the design of precision systems, complex thermal systems, innovation, and integral design, taking into account various technical and non-technical disciplines. The use of complex design software is a common thread throughout the programme.

B. OER tables Automotive

Education Automotive full-time English language year 1 cohort 2020							
progress name	**Educational unit**	**ects**	**subject code**	**Test form**	**Assessment Individual or group**	**Rating scale**	**Standardization / compensation**
4320PAE	AE20APJ1	4	AE20APJ1P	project appraisal	I	1-10	minimal 5,5
			AE20APS1	exercises	I	O-V	APS1 is conditional for obtaining ects APJ1
	AE20APJ2	4	AE20APJ2P	project appraisal	I	1-10	minimal 5,5
			AE20APS2	exercises	I	O-V	APS2 is conditional for obtaining ects APJ2
	AE20APJ3	4	AE20APJ3P	project appraisal	I	1-10	minimal 5,5
			AE20APS3	exercises	I	O-V	APS3 is conditional for obtaining ects APJ3
	AE20APJ4	4	AE20APJ4P	project appraisal	I	1-10	minimal 5,5
			AE20APS4	exercises	I	O-V	APS4 is conditional for obtaining ects APJ4
	AE20APU1	2	AE20APU1	exam	I	1-10	minimal 5,5
	AE20APU2	1	AE20APU2	exam	I	1-10	minimal 5,5
	AE20APU3	2	AE20APU3	exam	I	1-10	minimal 5,5
	AE20APU4	1	AE20APU4	exam	I	1-10	minimal 5,5
	AE20ADT1	1	AE20ADT1	exam	I	1-10	minimal 5,5
	AE20ADT2	2	AE20ADT2	exam	I	1-10	minimal 5,5
	AE20ADT3	1	AE20ADT3	exam	I	1-10	minimal 5,5
	AE20ADT4	2	AE20ADT4	exam	I	1-10	minimal 5,5
	AE20APR1	1	AE20APR1	exercises	I	O-V	minimal voldoende
	AE20APR2	1	AE20APR2	exercises	i	O-V	minimal voldoende
	AE20APR3	1	AE20APR3	exercises	i	O-V	minimal voldoende
	AE20APR4	1	AE20APR4	exercises	I	O-V	minimal voldoende
	AE20AMD1	2	AE20AMD1T	exam	I	1-10	Minimal 5,5 for theory. Conditional practicum
			AE20AMD1P	opdrachten	i	O-V	
	AE20AMD2	1	AE20AMD2T	exam	I	1-10	Minimal 5,5 for theory. Conditional practicum
			AE20AMD2P	practical	I	O-V	
	AE20AMD3	2	AE20AMD3	exam	I	1-10	minimal 5,5
	AE20AMD4	2	AE20AMD4	exam	I	1-10	minimal 5,5
	AE20AMM1	1	AE20AMM1	exam	I	1-10	minimal 5,5
	AE20AMM2	2	AE20AMM2	exam	I	1-10	minimal 5,5
	AE20AHF3	2	AE20AHF3	exam	I	1-10	minimal 5,5
	AE20AHF4	2	AE20AHF4	exam	I	1-10	minimal 5,5
	AE20ACE1	2	AE20ACE1	exam	I	1-10	minimal 5,5
	AE20ACE2	2	AE20ACE2T	exam	I	1-10	Minimal 5,5 for theory. Conditional practicum
			AE20ACE2P	practical	I	O-V	
	AE20ACE3	1	AE20ACE3	exam	I	1-10	minimal 5,5
	AE20ACE4	2	AE20ACE4	exam	I	1-10	minimal 5,5
	AE20MAT1	2	AE20MAT1	exam	I	1-10	minimal 5,5
	AE20MAT2	2	AE20MAT2	exam	I	1-10	minimal 5,5
	AE20MAT3	2	AE20MAT3	exam	I	1-10	minimal 5,5
	AE20MAT4	2	AE20MAT4	exam	I	1-10	minimal 5,5

In the context of didactic developments/improvements, certain parts of the programme of study can be offered in a different way. The study load can change. Changes, which are made known before the start of the programme, are indicated in the semesters study guides, on the Engineering/Automotive portal, and on N@tSchool.

C. OER tables Electrical Engineering

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE1	EEBAD1	Analog Design 1	4.00	EEBAD11P	Assignment	Duo	O-V-G	n/a	EEBAD1 = (EEBAD11T + EEBAD12T)/2 and EEBAD11T ≥ 5.5 and EEBAD12T ≥ 5.5 and EEBAD11P ≥ V and EEBAD12P ≥ V
				EEBAD11T	W ritten Exam	Individual	1,0-10,0	n/a	
				EEBAD12P	Assignment	Duo	O-V-G	n/a	
				EEBAD12T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEBDD1	Digital Design 1	4.00	EEBDD11P	Assignment	Individual	O-V-G	n/a	EEBDD1 = (EEBDD11T + EEBDD12T)/2 and EEBDD11T ≥ 5.5 and EEBDD12T ≥ 5.5 and EEBDD11P ≥ V and EEBDD12P ≥ V
				EEBDD11T	W ritten Exam	Individual	1,0-10,0	n/a	
				EEBDD12P	Assignment	Individual	O-V-G	n/a	
				EEBDD12T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEBMA1	Mathematics 1	5.00	EEBMA11T	W ritten Exam	Individual	1,0-10,0	n/a	EEBMA1 = (EEBMA11T + EEBMA12T)/2 and EEBMA11T ≥ 5.5 and EEBMA12T ≥ 5.5
				EEBMA12T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEBSCO1	Study and Career Orientation 1	2.00	EEBSCO11P	Assignment	Individual	O-V-G	n/a	EEBSCO1 = V if EEBSCO11P ≥ V and EEBSCO12P ≥ V
				EEBSCO12P	Assignment	Individual	O-V-G	n/a	
	EEBSD1	Software Design 1	3.00	EEBSD11P	Assignment	Individual and Duo	O-V-G	n/a	EEBSD1 = (EEBSD11T + EEBSD12T)/2 and EEBSD11T ≥ 5.5 and EEBSD12T ≥ 5.5 and EEBSD11P ≥ V and EEBSD12P ≥ V
				EEBSD11T	W ritten Exam	Individual	1,0-10,0	n/a	
				EEBSD12P	Assignment	Individual and Duo	O-V-G	n/a	
				EEBSD12T	W ritten Exam	Individual	1,0-10,0	n/a	
	EECDU11	Dutch	1.00	EECDUT11P	Assignment	Individual and Group	O-V-G	n/a	EECDUT11P ≥ V
	EECPROJ11	Project 1-1	5.00	EECPROJ11	Project	Individual and Group	1,0-10,0	n/a	EECPROJ11 ≥ 5,5
	EECPROJ12	Project 1-2	6.00	EECPROJ12	Assignment	Individual and Group	1,0-10,0	n/a	EECPROJ12 ≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE2	EEBAD2	Analog Design 2	4.00	EEBAD21P	Assignment	Duo	O-V-G	n/a	EEBAD2 = (EEBAD21T + EEBAD22T)/2 and EEBAD21T ≥ 5.5 and EEBAD22T ≥ 5.5 and EEBAD21P ≥ V and EEBAD22P ≥ V
				EEBAD21T	W ritten Exam	Individual	1,0-10,0	n/a	
				EEBAD22P	Assignment	Duo	O-V-G	n/a	
				EEBAD22T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEBDD2	Digital Design 2	4.00	EEBDD21P	Assignment	Individual	O-V-G	n/a	EEBDD2 = (EEBDD21T + EEBDD22T)/2 and EEBDD21T ≥ 5.5 and EEBDD22T ≥ 5.5 and EEBDD21P ≥ V and EEBDD22P ≥ V
				EEBDD21T	W ritten Exam	Individual	1,0-10,0	n/a	
				EEBDD22P	Assignment	Individual	O-V-G	n/a	
				EEBDD22T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEBMA2	Mathematics 2	5.00	EEBMA21T	W ritten Exam	Individual	1,0-10,0	n/a	EEBMA2 = (EEBMA21T + EEBMA22T)/2 and EEBMA21T ≥ 5.5 and EEBMA22T ≥ 5.5
				EEBMA22T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEBMMS2	Measurements, Modelling and Simulation 2	5.00	EEBMMS21P	Assignment	Duo	O-V-G	n/a	EEBMMS2 = (EEBMMS21T + EEBMMS22P)/2 and EEBMMS21T ≥ 5.5 and EEBMMS22P ≥ 5.5 and EEBMMS21P ≥ V
				EEBMMS21T	W ritten Exam	Individual	1,0-10,0	n/a	
				EEBMMS22P	Assignment	Individual	1,0-10,0	n/a	
	EEBSCO2	Study and Career Orientation 2	1.00	EEBSCO21P	Assignment	Individual	O-V-G	n/a	EEBSCO2 = V if EEBSCO21P ≥ V and EEBSCO22P ≥ V
				EEBSCO22P	Assignment	Individual	O-V-G	n/a	
	EEBSD2	Software Design 2	3.00	EEBSD21P	Assignment	Individual and Duo	O-V-G	n/a	EEBSD2 = (EEBSD21T + EEBSD22T)/2 and EEBSD21T ≥ 5.5 and EEBSD22T ≥ 5.5 and EEBSD21P ≥ V and EEBSD22P ≥ V
				EEBSD21T	W ritten Exam	Individual	1,0-10,0	n/a	
				EEBSD22P	Assignment	Individual and Duo	O-V-G	n/a	
				EEBSD22T	Assignment	Individual and Duo	1,0-10,0	n/a	
	EECPROJ21	Project 2-1	4.00	EECPROJ21	Project	Individual and Group	1,0-10,0	n/a	EECPROJ21 ≥ 5.5
	EECPROJ22	Project 2-2	4.00	EECPROJ22	Project	Individual and Group	1,0-10,0	n/a	EECPROJ22 ≥ 5.5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE3	EEAAD3	Analog Design 3	4.00	EEAAD3P	Assignment	Individual and Duo	O-V-G	n/a	EEAAD3 = EEAAD3T and EEAAD3T ≥ 5.5 and EEAAD3P ≥ V
				EEAAD3T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEACOM3	Communication 3	2.00	EEACOM3	Assignment	Individual	1,0-10,0	n/a	EEACOM3 ≥ 5.5
	EEACSA1	Career Supporting Activity 1	1.00	EEACSA1	Assignment	Individual	O-V-G	n/a	EEACSA1 ≥ V
	EEACT1	Control Theory 1	5.00	EEACT1P	Assignment	Individual	O-V-G	n/a	EEACT1 = EEACT1T and EEACT1T ≥ 5.5 and EEACT1P ≥ V
				EEACT1T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEAES	Embedded Systems	5.00	EEAESP	Assignment	Individual and Duo	O-V-G	n/a	EEAES = EEAEST and EEAEST ≥ 5.5 and EEAESP ≥ V
				EEAEST	W ritten Exam	Individual	1,0-10,0	n/a	
	EEAPROJ4	Project 4	3.00	EEAPROJ4	Project	Individual and Group	1,0-10,0	n/a	EEAPROJ4 ≥ 5.5
	EEAPROJ5	Project 5	3.00	EEAPROJ5	Project	Individual and Group	1,0-10,0	n/a	EEAPROJ5 ≥ 5.5
	EEASEN3	System Engineering 3	2.00	EEASEN3	Assignment	Individual and Group	1,0-10,0	n/a	EEASEN3 ≥ 5.5
	EEBFEC	Fields, Energy & Conversion	5.00	EEBFECP	Assignment	Duo	O-V-G	n/a	EEBFEC = EEBFECT and EEBFECT ≥ 5.5 and EEBFECP ≥ V
				EEBFECT	W ritten Exam	Individual	1,0-10,0	n/a	

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE4	EEACOM4	Communication 4	3.00	EEACOM4	Assignment	Individual	O-V-G	n/a	EEACOM4 ≥ V
	EEACSA2	Career Supporting Activity 2	1.00	EEACSA2	Assignment	Individual	O-V-G	n/a	EEACSA2 ≥ V
	EEADD3	Digital Design 3	5.00	EEADD3P	Assignment	Individual	O-V-G	n/a	EEADD3 = EEADD3T and EEADD3T ≥ 5.5 and EEADD3P ≥ V
				EEADD3T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEAEMBC	Embedded Connectivity	5.00	EEAEMBCP	Assignment	Individual and Duo	O-V-G	n/a	EEAEMBC = EEAEMBCT and EEAEMBCT ≥ 5.5 and EEAEMBCP ≥ V and EEAEMBCPr ≥ V
				EEAEMBCPr	Project	Group	O-V-G	n/a	
				EEAEMBCT	W ritten Exam	Individual	1,0-10,0	n/a	
	EEAPROJ6	Project 6	3.00	EEAPROJ6	Project	Individual and Group	1,0-10,0	n/a	EEAPROJ6 ≥ 5.5
	EEAPROJ7	Project 7	3.00	EEAPROJ7	Project	Individual and Group	1,0-10,0	n/a	EEAPROJ7 ≥ 5.5
	EEASP1	Signal Processing 1	4.00	EEASP1P2	Assignment	Individual and Duo	O-V-G	n/a	EEASP1 = EEASP1T and EEASP1T ≥ 5.5 and EEASP1P ≥ V
				EEASP1T	W ritten Exam	Individual	1,0-10,0	n/a	
	EEATEL1	Telecom 1	3.00	EEATEL1P	Assignment	Individual and Duo	O-V-G	n/a	EEATEL1 = EEATEL1T and EEATEL1T ≥ 5.5 and EEATEL1P ≥ V1
				EEATEL1T	W ritten Exam	Individual	1,0-10,0	n/a	
	EECAD4	Analog Design 4	3.00	EECAD4P1	Assignment	Individual and Duo	O-V-G	n/a	EECAD4 = EECAD4T and EECAD4T ≥ 5.5 and EECAD4P1 ≥ V and EECAD4P2 ≥ V
				EECAD4P2	Assignment	Individual and Duo	O-V-G	n/a	
				EECAD4T	W ritten Exam	Individual	1,0-10,0	n/a	

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE5	EESTAGE	Internship	30.00	EESTAGE	Execution and report	Individual	1,0-10,0	P-certificate and at least 3 expo projects finished and if the internship is during autumn: in S3 no more then 1 theory resit and all the practicals finished and in S4 all the modules done and did an exam for it if the internship is during spring: in S3 all the modules done and did an exam for it and in S4 no more then 1 theory resit and all the practicals finished	All partial marks ≥ 5.5 No compensation possible

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE7	EAAPE	Advanced Power Electronics	4.00	EAAPE	W ritten Exam	Individual	1,0-10,0	n/a	EAAPE ≥ 5.5
	EACSA7	Career Supporting Activity	2.00	EACSA7	Assignment	Individual	1,0-10,0	Select EAGC7B, EACS7 or MAEMC7	EACSA7 ≥ 5.5
	EADSD	Digital System Design	4.00	EADSDP	Assignment	Individual	O-V-G	n/a	EADSD = EADSDT and EADSDT ≥ 5.5 and EADSDP ≥ V
				EADSDT	W ritten Exam	Individual	1,0-10,0	n/a	
	EAGC7A	GLOW completion A	2.00	EAGC7A	Assignment	Group	1,0-10,0	Be Creative minor (GLOW project) and select EMBSE or EAGC7A	EAGC7A ≥ 5.5
	EAGC7B	GLOW completion B	2.00	EAGC7B	Assessment	Group	1,0-10,0	Be Creative minor (GLOW project) and select EAGC7B, EACS7 or MAEMC7	EAGC7B ≥ 5.5
	EAPRS7	Project S7	10.00	EAPRS7	Project	Individual	1,0-10,0	n/a	EAPRS7 ≥ 5.5
	EBACS	Advanced Control Systems	4.00	EBACSP	Assignment	Individual	O-V-G	n/a	EBACS = EBACST and EBACSP ≥ V and EBACST ≥ 5.5
				EBACST	W ritten Exam	Individual	1,0-10,0	n/a	
	EBAES	Advanced Embedded Systems	4.00	EBAESP	Assignment	Individual and Group	1,0-10,0	n/a	EBAES ≥ 5.5
	EBATEL/IoT	Advanced Telecom / IoT	4.00	EBATEL/IoT	Assignment	Individual	1,0-10,0	n/a	EBATEL/IoT ≥ 5.5
	EBMBSE	Model Based System Engineering	2.00	EBMBSE	Assignment	Individual and Group	1,0-10,0	Select EBMMSE or EAGC7A	EBMBSE ≥ 5.5
	EBST	Sensor Technology	4.00	EBST	Assignment	Individual and Duo	1,0-10,0	n/a	EBST ≥ 5.5
	MAEMC7	Electromagnetic Compatibility 7	2.00	MAEMC7P1	Practical Assignment	Individual and Duo	1,0-10,0	Select EAGC7B, EACS7 or MAEMC7	MAEMC7 = (MAEMC7P1 + MAEMCP2 + MAEMCP3)/3 and MAEMC7 ≥ 5.5
				MAEMC7P2	Practical Assignment	Individual and Duo	1,0-10,0	Select EAGC7B, EACS7 or MAEMC7	
				MAEMC7P3	Practical Assignment	Individual and Duo	1,0-10,0	Select EAGC7B, EACS7 or MAEMC7	
	W ABI	Business Innovation	4.00	W ABIP	Assignment	Group	O-V-G	n/a	WABI = WABIT and WABIT ≥ 5.5 and WABIP ≥ V
				W ABIT	W ritten Exam	Individual	1,0-10,0	n/a	
	W API	Product Innovation	4.00	W API	W ritten Exam	Individual	1,0-10,0	n/a	WAPI ≥ 5.5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE8	EEAFSTU	Graduation internship	30.00	EEAFSTU	Execution, report and defence	Individual	1,0-10,0	P-certificate and S3 up until S6 finished and no more than 2 theory resits for S7	All partial marks ≥ 5.5 Final mark ≥ 5.5 No compens

TER Table Electrical Engineering Full-time (Cohort February 2021)

Semester (Feb. 2021 Intake)	unit of study	name of learning outcome	credits	Educational activities	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EE1	EEAAN1	DC Analog Circuits Design	3	Practical lessons, theory lessons, project activities, and self study	EEAAN1T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEAAN1T ≥ 5,5
EE1 & EE2	EEAAN2	AC Analog Circuit Design	5	Practical lessons, theory lessons, project activities, and self study	EEAAN2T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEAAN2T ≥ 5,5
EE1 & EE2	EEAAN3	Active Analog Circuit Design	4	Practical lessons, theory lessons, project activities, and self study	EEAAN3T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEAAN3T ≥ 5,5
EE1	EEASW1	Functional Programming and Software Design	6	Practical lessons, theory lessons, project activities, and self study	EEASW1T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEASW1T ≥ 5,5
EE1	EEASW2	Object Oriented Programming and User Interface Design	6	Practical lessons, theory lessons, project activities, and self study	EEASW2T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEASW2T ≥ 5,5
EE1	EEAPM1	Project Management Skills 1	4	Theory lessons, practical work in projects, self study, and workshops	EEAPM1T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEAPM1T ≥ 5,5
EE1	EEALO1	Learning and Orientation 1	4	Theory lessons, self reflection, research, and self study	EEALO1T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEALO1T ≥ 5,5
EE1	EEACS1	Communication Skills 1	4	Theory lessons, practice in project and lesson contexts, and self study	EEACS1T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEACS1T ≥ 5,5
EE2	EEADCD1	Digital Circuit Design	6	Practical lessons, theory lessons, project activities, and self study	EEADCD1T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEADCD1T ≥ 5,5
EE2	EEADSD1	Digital System Design	6	Practical lessons, theory lessons, project activities, and self study	EEADSD1T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEADSDT ≥ 5,5
EE2	EEAPM2	Project Management Skills 2	4	Theory lessons, practice in project and lesson contexts, and self study	EEAPM2T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEAPM2T ≥ 5,5
EE2	EEALO2	Learning and Orientation 2	4	Practical lessons, theory lessons, project activities, and self study	EEALO2T	Portfolio-assessment	Individual	1,0-10,0	n/a	EEALO2T ≥ 5,5

EE2	EEACS2	Communication Skills 2	4	Practical lessons, theory lessons, project activities, and self study	EEACS2T	Portfolio contribution	Individual	1,0-10,1	n/a	EEACS2T ≥ 5,5

Learning outcomes

EEAAN1: DC Analog Circuit Design (3 EC)

Description of the LOC

LOC	You can design, simulate, create and characterise a DC network of multiple types of passive components, arranged in combinations that combine serial and parallel connections, and results in a specified input-output response. You should also be able to model and describe the transient response when the input voltage or current is switched on or off.
Indicators	
Design	Given a simple resistive sensor (or other similarly simple component), you can identify at least two different circuit types in which to place the sensor. You can choose appropriate component values for the circuit. You can identify and use important time response characteristics of a passive network (transient response).
Simulate	You can simulate the voltages and currents in a network of impedances that is excited by a DC source.
Create/implement	You can design a simple PCB layout and solder the components to the board in a way that meets industry standards for PCB layout and soldering
Characterise	You can calculate and measure the voltages and currents in a network of impedances that is excited by a DC source. You can compare your measurements with your simulations and calculations, and explain any observed differences. You can describe the functioning (in practice and mathematically) of individual passive component types. A practical description should include how the component works and what the consequences are for placing the component in an example circuit. A mathematical description should include the formula and how (graphically or in text) those formula relate to the behaviour of an example circuit.

Guidelines for evidence per indicator

Short description of the type of evidence that may be required per indicator.

	Product	*Document*	*Demo*	*Other*
Design		Demonstrates transient signal in network and explains its origin	Identifies values of components from the packaging	
Simulate			Explains and shows working simulation	
Create/ Implement	Working PCB print made, populated	File of PCB layout	Explains and shows working network in lab	The student demonstrates the ability to

	without soldering mistakes			logically find and correct faults in their circuits
Characterise		Algebraic derivation of the circuit response	Demonstrates and explains the exponential behaviour of capacitors and inductors.	Student demonstrates competent use of measurement apparatus, signal generators, and power supplies

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	DC circuits, voltage dividers, current dividers, oscilloscopes, multimeters power supplies, function generator, exponential functions, algebraic manipulation
Skills:	Measurement, use of instruments, soldering, layout software, simulation software

EEAAN2: AC Analog Circuit Design (5 EC)

Description of the LOC

LOC	You can design, simulate, create and characterise an AC network of multiple types of passive components, arranged in combinations that combine serial and parallel connections, and results in a specified input-output response. You can describe the transfer function in terms of functions using complex numbers and create a bode plot. You can calculate and define the resonant properties of circuits with reactive components.
Indicators	
Design	You can design a variety of filters: low pass, high pass, and band pass filters that have desired transfer functions. You can design a sensor circuit that has an AC component in its response (e.g., a capacitive sensor). You can design a resonant circuit with a chosen resonance frequency and transfer function.
Simulate	You can simulate the voltages and currents in a network of impedances that is driven by an AC source. The results should be displayed in a graph that can be interpreted independently.
Create/Implement	You can implement the circuits from the design phase.
Characterise	You can identify and use important time and frequency response characteristics of a passive network of impedances. You can calculate, and measure the voltages and currents in a network of impedances that is excited by an AC source using complex numbers and matrices where appropriate. You can compare your measurements with your simulations and calculations, and explain any observed differences.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	*Document*	*Demo*	*Other*
Design		Design report	Explains and shows working network in lab	
Simulate		Working simulation and Bode plot of the filter		
Create/ Implement			Demonstrates working filter	
Characterise		Algebraic derivation of the circuit response and an analytical Bode plot. Analytical response is compared to simulation and experimental measurements	Demonstrates and explains cut off frequencies and phase change and resonance response of circuit	Student demonstrates competent use of measurement apparatus and signal generators, and power supplies

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	AC circuits, DC circuits, voltage dividers, current dividers, oscilloscopes, multimeters power supplies, function generator, complex numbers, exponential functions, goniometry, algebraic manipulation, basic matrices
Skills:	Measurement, use of instruments, soldering, layout software, simulation software

EEASW1: Functional Programming and Software Design (6 EC)

Description of the LOC

LOC	You can design, implement and test a sequential responsive (embedded) software system in C/C++ with specified functionality and appropriate modularity
Indicators	
Design	You write well-structured and well-documented software, making use of flow charts, informative variable names, and comments. The student demonstrates a modular approach to programming by defining functions that carry out specific tasks and makes use of external libraries.
Create/Implement	You can use the correct variable types and operators, as well

	as writing conditional code execution blocks, loops, functions, pointers, and arrays in C++. You can program simple embedded systems, such as an Arduino, making use of the right programmatic structures. The code should be able to read and write the input and outputs of the embedded system (digital analog and PWM) and communicate with a PC via a serial port.
Characterise/Test	You can demonstrate that the code performs its intended purpose

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	Document	Demo	Other
Design	Flow chart	Flowcharts, Document that supports the choices for implementation and evidences modularity		Motivation for using a library in comparison to your own implementation
Create/ Implement	Code and explanation	Document that supports the choices made in the code	Demonstration of the code (e.g., with Arduino)	
Characterise/ Test	Code and explanation		Demo of working code	

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Flowcharts, functional decomposition, going from abstract (or generic) to specific solutions, the use of pseudocode, debugging, code validation, use of external libraries, modularity
Skills:	Analysis, logical thinking, realisation

EEASW2: Object Oriented Programing and User Interface Design (6 EC)

Description of the LOC

LOC	*Y*ou can design, implement and test a software system in C/C++ with specified functionality by applying object-oriented concepts. You can design and implement an intuitive user interface (e.g., one that can be used by another user without instruction).
Indicators	
Design	You can design a program that includes simple classes and structures, makes use of classes and structures from external libraries, and communicate with an application programming interfaces. You can design a user interface that can be used by another user without instruction.
Create/implement	You can implement an application that instantiates and uses classes and structures, and communicates with an application

	programming interface. You can implement a user interface using standard user interface elements, positioned following standard guidelines.
Characterise/Test	You can demonstrate that your code works as intended

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	Document	Demo	Other
Design	Flow chart of application with class design			
Create/ Implement	A program that uses classes using serial communication between Arduino and PC with a graphical user interface	Code with comments	Demonstration with explanation	
Characterise/ Test		A test document	Demonstration that the code functions as intended	

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Modularity, APIs, classes
Skills:	Analysis, development, realisation

EEAPM1: Project Management Skills 1 (4 EC)

Description of the LOC

LOC	You are able to work with peers in project teams in a structured way and realise project goals together.
Indicator	
Planning	You can plan your project (including activities, duration of activities and project phases). You can recognize potential bottlenecks and plan to minimize their influence. You can evaluate the group's progress and adjust both your own and the group's planning appropriately.
Group management	You can, together with your group, formulate a code of conduct and agreements. You can assign team roles and tasks. You can hold a series of effective meetings, including agendas that are available before the start of the meeting, minutes taken during the meetings, and action points distributed to everyone after each meeting.
Process management	You can make individual and group choices over the course of the project that are supported by evidence and/or logical arguments. You can define or redefine the specifications, design, and planning for your part of the project as a result of individual and group choices.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	Document	Demo	Other
Planning		A plan with individual tasks and deadlines listed. Change list of changes to planning		
Group Management		A code of conduct. A meeting agenda, a set of minutes and action points A reflection on the project meetings		Mentor observation of meetings
Process Management	Table of specifications of your module linked to goals	Reflection on planning and changes to planning		

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Modularity (as a concept), brainstorming, mind-mapping, logical thinking, definition of requirements, structured design method(s)
Skills:	Interviewing, teamwork, reviewing, decision making, presentation, selling

EEACS1: Communication Skills 1 (4 EC)

Description of the LOC

LOC	You are able to communicate professionally and effectively to, for example, peers, mentors, and experts.
Indicators	
Structure	You can structure your communication (written, oral, etc) in a logical manner. You contribute in meetings to effectively and efficiently communicate the results of your work.
Detail	You can determine the right level of detail to communicate, depending on the intended audience. When appropriate, you can accurately cite references to support your results. You can defend choices and outcomes in an oral presentation(s) during the question and answer session and during demonstrations.
Means	You can determine and use the appropriate means to communicate information, including language choice (mail, oral, presentation, report, etc)
Feedback/reflection	You can give constructive feedback to others, and you can receive and make use of feedback from others. In addition,

	you should demonstrate that you can ask follow-up questions to clarify feedback that you receive. You reflect on feedback and adjust your behavior and/or plans when it is applicable.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	*Document*	*Demo*	*Other*
Structure	Video Conversation, meeting	A logically structured report A measurement report	Pitch	
Detail	Video with clear structure and well communicated ideas	Report with correct use of language and appropriate level of detail	Presentation that is easy to follow	
Means	A logbook	Reflection-- The student motivates their choice of medium and language and detail.		
Feedback	Peer reviews Response to feedback	Peer review document Reflection	Concrete plan	

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Presentation techniques, use of presentation software, meeting skills, communication skills, giving and receiving feedback, report structure, knowledge and use of technical terms in the right circumstances.
Skills:	Written and oral communication skills in NL and EN

EEALO1: Learning and Orientation 1 (4 EC)

Description of the LOC

LOC	You have an effective study strategy and you are able to identify your strengths and weaknesses. You can describe the relationship between your studies, the field of engineering, and the professional roles that fit your personality.
Indicator	
Learning strategies	You can identify and explain your personal learning strategy. You can use your learning strategy independently to successfully achieve your learning goals.
Self-awareness	You can reflect on your behaviour and express this in both verbal and written formats. You can identify your own strengths and weaknesses, and you

	can identify the areas of future study that interest you. You can use your reflections and your awareness of your strengths and weaknesses to develop a plan to improve your chances of success.
Future-oriented	You have familiarized yourself with the engineering profession and the sorts of roles and jobs that are common to the profession. You have investigated the learning outcomes, themes, and differentiations that are available within electronic and electrical engineering. You can reflect on how each of these themes and choices fit your preferences and personality.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	Document	Demo	Other
Learning strategies		A reflection on learning strategy		
Self-awareness	A SWOT analysis	A plan that follows up on the outcome of the SWOT analysis		
Future-oriented		A reflection on the themes of electrical engineering and which suits them best.		

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	SWOT, reflection, mind-mapping, logical thinking,
Skills:	Analysis, investigation, self-reflection

EEAAN3: Active Analog Circuit Design (4 EC)

Description of the LOC

LOC	You can design, simulate, create and characterise an active electronic circuit with a specified response, making use of either discrete or integrated circuits as required by the design (e.g., a pre-amplifier, low voltage power supply).
Indicators	
Design	You can design an electronic circuit using one or more active components, e.g., operational amplifiers
Simulate	You can simulate the transfer response of an active circuit.
Create/Implement	You can implement an active electronic circuit using one or more operational amplifiers and/or a transistor amplifier in either voltage or current amplifier configurations.
Characterise/Test	You can calculate, and measure the transfer response of an active electronic circuit. You can compare your measurements with your simulations and calculations, and explain any observed differences. You can measure and explain the concept of input and output

	impedance, and describe why the concept is useful. You can describe the concept of stability in relation to amplifiers.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	Document	Demo	Other
Design	Schematic design			
Simulate	Working simulation		Demonstration with explanation	
Create/ Implement	Working circuit		Demonstration with explanation	
Characterise/ Test	Working circuit	Small report on circuit and its characterization	Demonstration with explanation A demonstration of the measurement of the input/output impedance of a device.	

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Measurement tools, software modeling and analysis, gain, virtual grounds, DC and AC coupling
Skills:	Analysis, realisation, design, optimisation

EEADCD1: Digital Circuit Design (6 EC)

Description of the LOC

LOC	You can design, simulate, create and test a sequential digital system in a structured manner. The system functionality should be comparable to a simple CPU (Central Processing Unit).
Indicators	
Design	You can develop a complex sequential system (register and controller).
Simulate	You can demonstrate that the system has the correct functionality via a simulation.
Create/Implement	You can, making use of a programming language to describe it, realise a complex sequential system.
Characterise/Test	You can determine that the system fulfills the functional and timing specification. You can explain how the system functions and why the timing is important.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	Document	Demo	Other
Design	Complexity: minimum 1 controller, 3 registers, and an alu. A simple CPU for instance. Functional description	Document the development steps used to implement the system.		
Simulate	The results from a successful simulation	Printed plot with commentary	Live demo with explanation	
Create/ Implement	Implemented in an FPGA	VHDL (verilog)	Live demo with the analysis explained	
Characterise/ Test	Static timing analysis performed using a tool at the maximum clock frequency.	The result from the tool.	Demo of the prototype system in an FPGA	

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Development, Functional decomposition, iteration, verification, timing VHDL, Quartus, ModelSim
Skills:	Development, Analysis

EEADSD: Digital System Design (6 EC)

Description of the LOC

LOC	You can design, simulate, create and test a combinatorial digital sub-system with specified functionality, e.g. the combinatorial sub-systems of a simple CPU (Central Processing Unit).
Indicators	
Design	You can apply development steps (functional decomposition and iteration) to a complex combinatorial system.
Simulate	You can demonstrate that the block functions correctly via simulation.
Create/Implement	You can code the system using a programming language. You can realise and demonstrate a system.
Characterise/Test	You can determine that the system fulfills the functional and timing specification. You can explain how the system functions and why the timing is important.

Guidelines for evidence per indicator

Short description of the type of evidence that may be required per indicator.				
	Product	*Document*	*Demo*	*Other*
Design	A system or module is realised using functional decomposition and iteration. Required complexity: 4+ bits and 4+ mathematical functions.	The development steps are documented.		
Simulate	A working simulation	A printed output with commentary	Live demo with an explanation	
Create/ Implement	Realisation in an FPGA Functional description		Live demo with an explanation *VHDL (verilog)*	
Characterise/ Test	A static timing analysis performed via a tool	Ouput of the timing analysis Analysis showing input/output of device matches the design	*Demonstration of a working prototype with explanation*	

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Development, Functional decomposition, iteraction, verification, timing VHDL, Quartus, ModelSim
Skills:	Development, analysis

EEAPM2: Project Management Skills 2 (4 EC)

Description of the LOC

LOC	You can work with a group to create a realisable (sub-) design from a given use case. Your work should take into account stakeholder feedback and involve a realistic plan for implementation.
Indicators	
Planning	You can plan your module and the whole project (including activities, duration of activities and project phases). You can identify dependencies in your module and between different modules. You can adapt your planning to minimize the dependencies. You can identify potential risks to the project's success and describe a mitigation strategy. You can evaluate the group's progress and adjust both your own and the group's planning appropriately. Your initial planning includes review moments for each module.
Group Management	You can, together with your group, organize meetings with the project customer. You can, together with the customer, agree on a common set of project goals and specifications. You can document these goals, distribute them to stakeholders for feedback. You can adjust your goal and plan based on stakeholder feedback.

	You can provide constructive feedback during review sessions, and you can act on the feedback that you receive. You can hold effective meetings, including an agenda that is available before the start of the meetings, minutes taken during the meetings, and action points distributed to everyone after the meetings.
Process management	You prepare and update documents for your module that allow the customer to keep track of the project's progress. You can adjust your planning, module specifications, and design in response to customer and group member feedback. You can provide feedback to the group and customer about the consequences to the planning and the project goals due to adjustments. You can supply the group planner with sufficient information to allow them to keep the group plan up to date.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	Document	Demo	Other
Planning	A plan with bottlenecks, risks, and deadlines Block diagram of entire (sub)-system Block diagram with inputs and outputs specified per module	A change list in response to review		
Group management		Meeting minutes Specification or summary document for customer	Brainstorm session with customer	
Process management	A plan of approach for an individual module	A change list in response to review Reflection on planning and execution		

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Feedback, planning, modularity, iteration, planning software, excel
Skills:	Analysis, realisation, planning

EEACS2: Communication Skills 2 (4 EC)

Description of the LOC

LOC	You can effectively communicate a process, its progress, and its results to peers and stakeholders. Your communication should take into account societal concerns about the process and its outcome.
Indicators	
Structure	You clearly communicate the current status of a project or your task within a project. You state what has been completed, what is currently being worked on, and what the next steps are. You are able to communicate risks, and opportunities effectively. The communication can be among others, a document or a presentation.
Detail	In your communication, you are prepared to supply additional detail when requested (e.g., in the form of appendices or extra presentation slides). You actively try to anticipate the type of questions that will be asked and prepare answers. You can accurately cite references and you can evaluate the trustworthiness of your sources. In communication, you can explore alternative design/execution options to defend your choices and outcomes. In doing this, you can adjust your level of communication, depending on your audience's knowledge. In addition, you can differentiate important points (risks, achievements) from execution details. You clearly express the ethical considerations of a project in a culturally sensitive way.
Means	You use a variety of means to convey information: diagrams where appropriate, pictures, audio-visual material, among others. You can incorporate literature (datasheets, scientific reports, or other documents) in your communication to support design decisions, conclusions, and recommendations.
Feedback/reflection	You can give useful feedback on the project's impact on society citing relevant examples. You modify your behaviour in response to feedback. You are able to consider multiple points of view and demonstrate a willingness to accommodate wider concerns in the execution of the project.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	*Document*	*Demo*	*Other*
Structure	*Presentation video*	*A final and/or interim report with appropriate appendices*		
Detail		*A final and/or interim presentation with back up slides*		
Means	*Presentations* *Videos* *pitches*	*Reports* *Emails* *Posters*		
Feedback/reflection	*Presentation includes*	*Final/Interim report includes*		

	consideration of societal impact	*explicit consideration of societal impact*		

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Presentation techniques, use of presentation software, meeting skills, report writing skills, communication skills, giving and receiving feedback, report structure, knowledge and use of technical terms in the right circumstances.
Skills:	Written and oral communication skills in NL and EN

EEALO2: Learning and Orientation 2 (4 EC)

Description of the LOC

LOC	You are able to find relevant information using techniques beyond a simple google search (e.g, scholarly databases, libraries, patent libraries, social media). You are able to evaluate the accuracy of the information you find using a variety of techniques.
Indicators	
Research Methods	You are able to track a fact or idea to its source. You are able to use this information to evaluate the accuracy of the fact or idea by this process.
Analysis	You are able to break down a technical or scientific study to identify conclusions that are supported by data within the study, conclusions that are supported by data that is referenced, and conclusions that are speculative or not supported.
Critical thinking	You are able to assemble multiple lines of evidence to support a conclusion. You are able to evaluate the strengths and weaknesses of your different lines of evidence.

Guidelines for evidence per indicator *Short description of the type of evidence that may be required per indicator.*				
	Product	*Document*	*Demo*	*Other*
Research Methods	*Presentation*	*Research report* *Reflection*		
Analysis	*Presentation*	*Paper summary* *Reflection*		
Critical thinking	*Presentation*	*Research report* *Reflection*		

LOC Contents *Summary: concepts, tools, skills, and required BoKs elements.*	
Concepts and tools:	Research methods, critical thinking, analysis
Skills:	Analysis, critical thinking, presentation, writing

D. OER tables Mechatronics

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM1	MCABAM1	Basic Mechanics 1	3.00	MCABAM1P	Practical Assignment	Individual	O-V-G	n/a	MCABAM1 = MCABAM1T ≥ 5,5 and MCABAM1P ≥ V
				MCABAM1T	W ritten Exam	Individual	1,0-10,0	n/a	
	MCABES1	Basic Electronics 1	4.00	MCABES1	W ritten Exam	Individual	1,0-10,0	n/a	MCABES1 ≥ 5,5
	MCADIS1A	Digital and Software Engineering 1A	3.00	MCADIS1AP	Portfolio	Individual	O-V-G	n/a	MCADIS1A = MCADIS1AT ≥ 5,5 and MCADIS1AP ≥ V
				MCADIS1AT	W ritten Exam	Individual	1,0-10,0	n/a	
	MCADIS1B	Digital and Software Engineering 1B	3.00	MCADIS1BP	Portfolio	Individual	O-V-G	n/a	MCADIS1B = MCADIS1BT ≥ 5,5 and MCADIS1BP ≥ V
				MCADIS1BT	W ritten Exam	Individual	1,0-10,0	n/a	
	MCAFEE1	Fundamentals of Electrical Engineering 1	3.00	MCAFEE1P	Practical Assignment	Individual	O-V-G	n/a	MCAFEE1 = MCAFEE1T ≥ 5,5 and MCAFEE1P ≥ V
				MCAFEE1T	W ritten Exam	Individual	1,0-10,0	n/a	
	MCAMEG1	Mechanical Engineering 1	3.00	MCAMEG1P	Practical Assignment	Individual	O-V-G	n/a	MCAMEG1 = MCAMEG1T ≥ 5,5 and MCAMEG1P ≥ V
				MCAMEG1T	W ritten Exam	Individual	1,0-10,0	n/a	
	MCBPRJ0	Project 0	3.00	MCBCOM1AP	Practical Assignment	Individual	NB-B	n/a	MCBPRJ0 = MCBSIM0 ≥ V and MCBCOM1AT ≥ V and MCBCOM1AP = B and MCBPDV1A ≥ V
				MCBCOM1AT	Assignment	Individual	O-V-G	n/a	
				MCBPDV1A	Portfolio	Individual	O-V-G	n/a	
				MCBSIM0	Project	Individual and Group	O-V-G	n/a	
	MCBPRJ1	Project 1	5.00	MCASYE1	Practical Assignment	Individual	NB-B	n/a	MCBPRJ1 = MCBSIM1 ≥ 5.5 and MCBCOM1BT ≥ V and MCBCOM1BP ≥ V and MCBSYE1 = B and MCBPDV1B ≥ V
				MCBCOM1BP	Practical Assignment	Individual	O-V-G	n/a	
				MCBCOM1BT	Assignment	Individual	O-V-G	n/a	
				MCBPDV1B	Portfolio	Individual	O-V-G	n/a	
				MCBSIM1	Project	Individual and Group	1,0-10,0	n/a	
	MCCMAT1	Mathematics 1	3.00	MCCMAT1	W ritten Exam	Individual	1,0-10,0	n/a	MCCMAT1 ≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM2	MCAACS2	AC Signals 2	3.00	MCAACS2	Written Exam	Individual	1,0-10,0	n/a	MCAACS2 ≥ 5,5
	MCAGIS2	Grafisch Software Engineering 2	3.00	MCAGIS2P	Portfolio	Individual	O-V-G	n/a	MCAGIS2 = MCAGIS2T ≥ 5,5 and MCAGIS2P ≥ V
				MCAGIS2T	Written Exam	Individual	1,0-10,0	n/a	
	MCAMBS2	Model Based Simulations 2	4.00	MCAMBS2	Written Exam	Individual	1,0-10,0	n/a	MCAMBS2 ≥ 5,5
	MCAMEG2	Mechanical Engineering 2	4.00	MCAMEG2	Written Exam	Individual	1,0-10,0	n/a	MCAMEG2 ≥ 5,5
	MCCMAT2A	Mathematics 2A	3.00	MCCMAT2A	Written Exam	Individual	1,0-10,0	n/a	MCCMAT2A ≥ 5,5
	MCCMAT2B	Mathematics 2B	3.00	MCCMAT2B	Written Exam	Individual	1,0-10,0	n/a	MCCMAT2B ≥ 5,5
	MCCPRJ3	Project 3	5.00	MCASYE2BP	Practical Assignment	Individual	NB-B	n/a	MCBPRJ3 = MCBSIM3 ≥ 5.5 and MCBCOM2BT ≥ V and MCBCOM2BP ≥ V and MCBSYE2BT ≥ 5.5 and MCBSYE2BP = B and MCBPDV2B ≥ V
				MCASYE2BT	Written Exam	Individual	1,0-10,0	n/a	
				MCBCOM2BP	Practical Assignment	Individual	O-V-G	n/a	
				MCBCOM2BT	Assignment	Individual	O-V-G	n/a	
				MCBPDV2B	Portfolio	Individual	O-V-G	n/a	
				MCBSIM3	Project	Individual and Group	1,0-10,0	n/a	

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM3	MCAACT3	Actuators 3	3.00	MCAACT3	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5
	MCACOM3	Communication Skills 3	1.00	MCACOM3	Assignment	Individual and Group	O-V-G	n/a	≥ V
	MCADYN3A	Dynamics 3A	3.00	MCADYN3A	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5
	MCADYN3B	Dynamics 3B	3.00	MCADYN3B	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5
	MCAESY3	Embedded Systems 3	3.00	MCAESY3P	Assignment	Group	O-V-G	n/a	MCAESY3 = MCAESY3T ≥ 5,5 and MCAESY3P ≥ V
				MCAESY3T	W ritten Exam	Individual	1,0-10,0	n/a	
	MCAICE3	Introduction Control Engineering 3	3.00	MCAICE3P	Practical Assignment	Duo	O-V-G	n/a	MCAICE3 = MCAICE3T ≥ 5,5 and MCAICE3P ≥ V
				MCAICE3T	W ritten Exam	Individueel	1,0-10,0	n/a	
	MCAPDV3	Personal Development 3	1.00	MCAPDV3	Opdracht	Individual	O-V-G	n/a	≥ V
	MCAPRJ4	Project 4	3.00	MCAPRJ4	Project	Individual and Group	1,0-10,0	n/a	≥ 5,5
	MCAPRJ5	Project 5	3.00	MCAPRJ5	Project	Individual and Group	1,0-10,0	n/a	≥ 5,5
	MCASYE3	Systems Engineering 3	1.00	MCASYE3	Assignment	Individual and Group	1,0-10,0	n/a	≥ 5,5
	MCBCSY3	Control Systems 3	3.00	MCBCSY3P	Assignment	Individual	O-V-G	n/a	MCBCSY3= MCBCSY3T ≥ 5,5 and MCBCSY3P ≥ V
				MCBCSY3T	W ritten Exam	Individual	1,0-10,0	n/a	
	MCBELS3	Electronics 3	3.00	MCBELS3T	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM4	MCACEN4A	Control Engineering 4A	2.00	MCACEN4AP	Practical Assignment	Duo	O-V-G	n/a	MCACEN4A = MCACEN4AT ≥ 5,5 and MCACEN4AP ≥ V
				MCACEN4AT	W ritten Exam	Individual	1,0-10,0	n/a	
	MCACEN4B	Control Engineering 4B	3.00	MCACEN4BP	Practical Assignment	Duo	O-V-G	n/a	MCACEN4B = MCACEN4BT ≥ 5,5 and MCACEN4BP ≥ V
				MCACEN4BT	W ritten Exam	Individual	1,0-10,0	n/a	
	MCADEF4	Deformations 4	2.00	MCADEF4	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5
	MCADPR4	Design Principles 4	3.00	MCADPR4	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5
	MCAETS4	Ethics 4	1.00	MCAETS4	Assignment	Individual and Group	O-V-G	n/a	≥ V
	MCAMAT4	Mathematics 4	2.00	MCAMAT4	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5
	MCAOOP4	Object Oriented Programming 4	3.00	MCAOOP4	Project	Individual and Group	1,0-10,0	n/a	≥ 5,5
	MCAPDV4	Personal Development 4	1.00	MCAPDV4	Assignment	Individual	O-V-G	n/a	≥ V
	MCAPRJ6	Project 6	3.00	MCAPRJ6	Project	Individual and Group	1,0-10,0	n/a	≥ 5,5
	MCAPRJ7	Project 7	3.00	MCAPRJ7	Project	Individual and Group	1,0-10,0	n/a	≥ 5,5
	MCASYE4	Systems Engineering 4	1.00	MCASYE4	Assignment	Individual and Group	1,0-10,0	n/a	≥ 5,5
	MCBSDD4	Sequential Digital Design 4	3.00	MCBSDD4P	Assignment	Duo	O-V-G	n/a	MCBSDD4 = MCBSDD4T ≥ 5,5 and MCBSDD4P ≥ V
				MCBSDD4T	W ritten Exam	Individual	1,0-10,0	n/a	
	MCBSNS4	Sensors 4	3.00	MCBSNS4T	W ritten Exam	Individual	1,0-10,0	n/a	≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM5	MCASTAGE	Internship	30.00	MCASTAGE	Execution and report	Individual	1,0-10,0	SVC	≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
M6	n/a	Minor	30.00	n/a	n/a	Individual	O-V-G	SVC	≥ V

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM7_AAS	MAEMC7	Electromagnetic Compatibility 7	2.00	MAEMC7P1	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	MAEMC7 = (MAEMC7P1 + MAEMC7P2 + MAEMC7P3)/3 ≥ 5,5 MAEMC7P1 ≥ 5,5 MAEMC7P2 ≥ 5,5 MAEMC7P3 ≥ 5,5
				MAEMC7P2	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	
				MAEMC7P3	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	
	MAGC7A	GLOW completion A	2.00	MAGC7A	Assignment	Individual	1,0-10,0	Be Creative minor (GLOW project)	≥ 5,5
	MAGC7B	GLOW completion B	2.00	MAGC7B	Assignment	Individual	1,0-10,0	Be Creative minor (GLOW project)	≥ 5,5
	MAPRS7	Project Semester 7	10.00	MAPRS7	Project	Individual and Group	1,0-10,0	Internship	≥ 5,5
	MBAES7	Advanced Embedded Systems 7	4.00	MBAES7P	Practical Assignment	Duo	O-V-G	n/a	MBAES7 = MBAES7T ≥ 5,5 and MBAES7P ≥ V
				MBAES7T	Assignment	Individual	1,0-10,0	n/a	
	MBMSY7	Mechatronic Systems 7	4.00	MBMSY7P	Assignment	Group	O-V-G	n/a	MBMSY7 = MBMSY7T ≥ 5,5 and MBMSY7P ≥ V
				MBMSY7T	W ritten Exam	Individual	1,0-10,0	n/a	
	MBSYE7	System Engineering 7	2.00	MBSYE7	W ritten Exam	Individual	1,0-10,0	N/a or MBSYE7 or MAGC7A	≥ 5,5
	MCAIS7	Autonomous and Intelligent Systems 7	4.00	MCAIS7P1	Assignment	Group	1,0-10,0	n/a	MCAIS7 = (MCAIS7T + MCAIS7P1 + MCAIS7P2) /3 ≥ 5,5 MCAIS7T ≥ 5,5 MCAIS7P1 ≥ 5,5 MCAIS7P2 ≥ 5,5
				MCAIS7P2	Assignment	Group	1,0-10,0	n/a	
				MCAIS7T	W ritten Exam	Individual	1,0-10,0	n/a	
	MCDAM7	Design for Adaptive Manufacturing 7	4.00	MCDAM7P	Assignment	Group	1,0-10,0	n/a	MCDAM7 = (MCDAM7P + MCDAM7T) ≥ 5,5 MCDAM7P ≥ 5,5 MCDAM7T ≥ 5,5
				MCDAM7T	W ritten Exam	Individual	1,0-10,0	n/a	

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM7_AMC	MAACE7	Applied Control Engineering 7	4.00	MAACE7P	Practical Assignment	Duo	O-V-G	n/a	MAACE7 = MAACE7P ≥ V and MAACE7T ≥ 5,5
				MAACE7T	W ritten Exam	Individual	1,0-10,0	n/a	
	MADMD7	Dynamic Modelling & Design 7	4.00	MADMD7P	Practical Assignment	Duo	O-V-G	n/a	MADMD7 = MADMD7P ≥ V and MADMD7T ≥ 5,5
				MADMD7T	W ritten Exam	Individual	1,0-10,0	n/a	
	MAEMC7	Electromagnetic Compatibility 7	2.00	MAEMC7P1	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	MAEMC7 = (MAEMC7P1 + MAEMC7P2 + MAEMC7P3)/3 ≥ 5,5 MAEMC7P1 ≥ 5,5 MAEMC7P2 ≥ 5,5 MAEMC7P3 ≥ 5,5
				MAEMC7P2	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	
				MAEMC7P3	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	
	MAGC7A	GLOW completion A	2.00	MAGC7A	Assignment	Individual	1,0-10,0	Be Creative minor (GLOW project)	≥ 5,5
	MAGC7B	GLOW completion B	2.00	MAGC7B	Assignment	Individual	1,0-10,0	Be Creative minor (GLOW project)	≥ 5,5
	MAOBS7	Observers for State Space Systems 7	4.00	MAOBS7P	Practical Assignment	Duo	O-V-G	n/a	MAOBS7 = MAOBS7T ≥ 5,5 and MAOBS7P ≥ V
				MAOBS7T	W ritten Exam	Individual	1,0-10,0	n/a	
	MAPRS7	Project Semester 7	10.00	MAPRS7	Project	Individual and Group	1,0-10,0	Internship	≥ 5,5
	MBAES7	Advanced Embedded Systems 7	4.00	MBAES7P	Practical Assignment	Duo	O-V-G	n/a	MBAES7 = MBAES7T ≥ 5,5 and MBAES7P ≥ V
				MBAES7T	Assignment	Individual	1,0-10,0	n/a	
	MBSYE7	System Engineering 7	2.00	MBSYE7	W ritten Exam	Individual	1,0-10,0	N/a or MBSYE7 or MAGC7A	≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM7_IE	MBAIS7 / MBAES7 / MAOBS7	Selective module 2 (period 2)	4.00	See module	See module	See module	See module	See module requirements	See module
	MAEMC7	Electromagnetic Compatibility 7	2.00	MAEMC7P1	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	MAEMC7 = (MAEMC7P1 + MAEMC7P2 + MAEMC7P3)/3 ≥ 5,5 MAEMC7P1 ≥ 5,5 MAEMC7P2 ≥ 5,5 MAEMC7P3 ≥ 5,5
				MAEMC7P2	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	
				MAEMC7P3	Practical Assignment	Individual and Duo	1,0-10,0	N/a or MAEMC7 or MAGC7B	
	MAPRS7	Project Semester 7	10.00	MAPRS7	Project	Individual and Group	1,0-10,0	Internship	≥ 5,5
	MBDAM7 / MBMSY7 / MAACE7 / MADMD7	Selective module 1 (period 1)	4.00	See module	See module	See module	See module	See module requirements	See module
	MBSYE7	System Engineering 7	2.00	MBSYE7	Written Exam	Individual	1,0-10,0	N/a or MBSYE7 or MAGC7A	≥ 5,5
	WABI	Business Innovation	4.00	WABIP	Assignment	Group	O-V-G	n/a	WABI = WABIT ≥ 5.5 and WABIP ≥ V
				WABIT	Written Exam	Individual	1,0-10,0	n/a	
	WAPI	Product Innovation	4.00	WAPI	Written Exam	Individual	1,0-10,0	nvt	≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EM8	GRADPRO	Graduation Project	30.00	GRADPRO	GRADPRO	Individual	1,0-10,0	SVC	≥ 5,5

Mechatronics 2020/2021	Criteria S12 (P-phase)	Criteria S3 (Core phase)	Criteria S4 (Core phase)	Criteria S5 (Internship)	Criteria S6 (Minor)	Criteria S7 (Specialization)
To S12 (P-phase)	Admission Requirements					
To S34 (Core phase)	≥ 30 EC					
To S5 (Internship)	≥ 105 EC					
To S6 (Minor)	= 60 EC					
To S7 (Specialization)	≥ 105 EC			= 30 EC or repairable		
To S8 (Graduation Internship)	= 60 EC	Option 1: = 60 EC Option 2: max. 1 subject open		= 30 EC		Option 1: = max. 2 subjects open Option 2: = max. 1 subject open

Internship:

105 EC over 2 years of study. Best result is Propedeuse completed and 45 EC or more in year 2.
Additional rules:

- Internship before Semester 7
- Semester 7 will only be given in the fall semester
- If you want to swap Internship with Minor in the same study year, you should always submit a request at the board of exam

Graduation:

Option 1: 2 subjects open in S7
Option 2: 1 subject open in S7 and 1 subject open in S3 or S4

E. OER tables Mechanical Engineering

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW 1	MEACAD	CAD & Drawings	3.00	MEACADP1	Practical Assignment	Individual	O-V-G	nvt	MEACADP1 = V MEACADP2 = V
				MEACADP2	Practical Assignment	Individual	O-V-G	nvt	
	MEAPERSD	Personal Development	1.00	MEAPERSD	Assignment	Individual	O-V-G	n/a	≥ V
	MEAPM1	Fundamentals of engineering materials and manufacturing	5.00	MEAPM1P1	Practical Assignment	Group	O-V-G	n/a	MEAPM1 = (MEAPM1T1 + MEAPM1T2) / 2 ≥ 5,5 whereby MEAPM1T1 and MEAPM1T2 ≥ 5,5 Grade for MEAPM1 will be assigned in case MEAPM1P1 has been concluded successfully.
				MEAPM1T1	W ritten Exam	Individual	1,0-10,0	n/a	
				MEAPM1T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MEARGT	RGT support	1.00	MEARGT	Assignment	Individual and Group	O-V-G	n/a	MEARGT ≥ V
	MEBEP1	Introduction Energy Theory	3.00	MEBEP1P	Practical Assignment	Group	O-V-G	n/a	MEBEP1 = (MEBEP1T1 +MEBEPT2) / 2 ≥ 5,5 whereby MEBEP1T1 and MEBEP1T2 ≥ 4,5. Grade forMEBEP1 will be assigned in case MEBEP1P has been concluded successfully.
				MEBEP1T1	W ritten Exam	Individual	1,0-10,0	n/a	
				MEBEP1T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MEBPPR	Manufacturing Practical	2.00	MEBPPR1	Practical Assignment	Individual	O-V-G	n/a	Grade (V) for MEBPPR will be awarded in case both MEBPPR1 and MEBPPR2 have been concluded satisfactory.
				MEBPPR2	Practical Assignment	Individual	O-V-G	n/a	
	MEBW I1	Introduction math	5.00	MEBW I1T1	W ritten Exam	Individual	1,0-10,0	n/a	MEBW I1 = (MEBW I1T1 + MEBWI1T2) / 2 ≥ 5,5 whereby MEBWI1T1 and MEBWI1T2 ≥ 5,5
				MEBW I1T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MECCM1	Statics	3.00	MECCM1T1	W ritten Exam	Individual	1,0-10,0	n/a	MECCM1 = (MECCM1T1 + MECCMT2) / 2 ≥ 5,5 whereby MECCM1T1 ≥ 4,5 and MECCM1T2 ≥ 4,5
				MECCM1T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MECPP2	Project & Professionalization 2	5.00	MECPP2P	Project	Individual and Group	1,0-10,0	n/a	Grade for MECPP2 is based on the MECPP2P grade and is rewarded(≥ 5,5) in case MECPP2T1 and MECPP2T2 are concluded satisfactory.
				MECPP2T1	Assignment	Individual	O-V-G	n/a	
				MECPP2T2	Practical Assignment	Individual	O-V-G	n/a	
	MEDPP1	Intro project Mechanical Eng	2.00	MEDPP1P	Project	Group	O-V-G	n/a	MEDPP1 ≥ V

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW 2	MEACM2	Mechanics of Materials	5.00	MEACM2T1	W ritten Exam	Individual	1,0-10,0	n/a	MEACM2 = (MEACM2T1 + MEACM2T2) / 2 ≥ 5,5 whereby MEACM2T1 and MEACM2T2 ≥ 4,5
				MEACM2T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MEAEP21	Fluid Mechanics	3.00	MEAEP21P	Practical Assignment	Group	O-V-G	n/a	MEAEP21 = MEAEP21T ≥ 5,5. Grade for MEAEP21 is awarded in case MEAEP21P is concluded satisfactory.
				MEAEP21T	W ritten Exam	Individual	1,0-10,0	n/a	
	MEAMR1	Electronics, Logic & Measurement	5.00	MEAMR1P1	Practical Assignment	Individual	1,0-10,0	n/a	MEAMR1 = (0,35 x MEAMR1T1 + 0,15 x MEAMR1P1 + 0,35 x MEAMR1T2 + 0,15 x MEAMR1P2) ≥ 5,5 whereby MEAMR1T1 and MEAMR1T2 ≥ 4,5 and MEAMR1P1 and MEAMR1P2 ≥ 5,5
				MEAMR1P2	Practical Assignment	Individual	1,0-10,0	n/a	
				MEAMR1T1	W ritten Exam	Individual	1,0-10,0	n/a	
				MEAMR1T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MEAMS	Modelling and Simulation	4.00	MEAMS	MEAMS	Duo	1,0-10,0	n/a	MEAMS ≥ 5,5
	MEBPP3	Project & Professionalization 3	8.00	MEBPP3P1	Project	Individual and Group	1,0-10,0	n/a	MEBPP3 = (MEBPP3P1 + MEBPP3P2) / 2 Grade for MEBPP3 is awarded in case MEBPP3T1 and MEBPP3T2 exams are concluded satisfactory. MEBPP3P1 and MEBPP3P2 ≥ 4,5
				MEBPP3P2	Project	Individual and Group	1,0-10,0	n/a	
				MEBPP3T1	Assignment	Individual	O-V-G	n/a	
				MEBPP3T2	Assignment	Individual	O-V-G	n/a	
	MEBW I2	Advanced Math	5.00	MEBW I2T1	W ritten Exam	Individual	1,0-10,0	n/a	MEBW I2 = (MEBW I2T1 + MEBWI2T2) / 2 ≥ 5,5. MEBWI2T1 and MEBWI2T2 ≥ 5,5
				MEBW I2T2	W ritten Exam	Individual	1,0-10,0	n/a	

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW 3	MEACM3	Dynamics	3.00	MEACM3P1	Practical Assignment	Individual	O-V-G	nvt	Grade for MEACM3T1 will be awarded in case MEACM3P1 is concluded successfully. MEACM3T1 ≥ 5,5
				MEACM3T1	W ritten Exam	Individual	1,0-10,0	nvt	
	MEAEP22	Heat transfer	3.00	MEAEP22P	Practical Assignment	Group	O-V-G	MEBEP1	MEAEP22 = MEAEP22T ≥ 5,5. Grade for MEAEP22 will be awarded in case MEAEP22P is concluded successfully.
				MEAEP22T	W ritten Exam	Individual	1,0-10,0	MEBEP1	
	MEAPM2	Selection of engineering materials and heat treatment	5.00	MEAPM2P1	Practical Assignment	Group	O-V-G	n/a	MEAPM2 = (MEAPM2T1 + MEAPM2T2) / 2 ≥ 5,5 whereby MEAPM2T1 and MEAPM2T2 ≥4,5. Grade for MEAPM2 will be awarded in case both practicals are concluded successfully.
				MEAPM2P2	Practical Assignment	Group	O-V-G	n/a	
				MEAPM2T1	W ritten Exam	Individual	1,0-10,0	MEAPM1, MEACM1	
				MEAPM2T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MEAW I4	Spatial Functions	1.00	MEAW I4	W ritten Exam	Individual	1,0-10,0	MEAWI1, MEAWI2	MEAWI4 ≥ 5,5
	MEBDG1	Dynamic System Behaviour	4.00	MEBDG1T1	Assignment	Duo	1,0-10,0	MEAMS	MEBDG1T1 ≥ 5,5
	MEBMR2	Measurement & Control	5.00	MEBMR2P1	Practical Assignment	Duo	1,0-10,0	n/a	Final grade MEBMR2 = (0,35 x MEBMR2T1 + 0,35 x MEBMR2T2 + 0,15 x MEBMR2P1 + 0,15 x MEBMR2P2) ≥ 5,5 whereby MEBMR2T1 and MEAMR2T2 ≥ 4,5. MEBMR2P1 and MEBMR2P2 ≥ 5,5
				MEBMR2P2	Practical Assignment	Duo	1,0-10,0	n/a	
				MEBMR2T1	W ritten Exam	Individual	1,0-10,0	MEAMR1, MEAW I2, MEAMS	
				MEBMR2T2	W ritten Exam	Individual	1,0-10,0	n/a	
	MEBW I5	Lineair Algebra	1.00	MEBW I5	W ritten Exam	Individual	1,0-10,0	MEAWI1, MEAWI2	MEBWI5 ≥ 5,5
	MECPP4	Project & professionalization 4	8.00	MECPP4P1	Project	Individual and Group	1,0-10,0	n/a	MECPP4 = (MECPP4TP1 + MECPP4TP2) / 2 ≥ 5,5 Grade for MECPP4 is awarded in case MECPPT1 and T2 are concluded satisfactory.
				MECPP4P2	Project	Individual and Group	1,0-10,0	n/a	
				MECPP4T1	Assignment	Individual	O-V-G	n/a	
				MECPP4T2	Assignment	Individual	O-V-G	n/a	

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW 4	MEAEP3	Applied Thermodynamics	5.00	MEAEP3P	Practical Assignment				
				MEAEP3T1	W ritten Exam	Individual	1,0-10,0	MEBEP1	
				MEAEP3T2	W ritten Exam				
	MEAPM3	Forming, DoE and AM	5.00	MEAPM3P1	Practical Assignment	Duo	O-V-G	MEAPM1, MEAPM2, MEACM1	Grade MEAPM3 = (MEAPM3T1 + MEAPM3T2) / 2 ≥ 5,5 whereby MEAPM3T1 and MEAPM3T2≥ 4,5. Grade for MEAPM3 is awarded in case MEAPM3P1, MEAPM3P2 and MEAPM3P3 are concluded successfully.
				MEAPM3P2	Practical Assignment	Duo	O-V-G	MEAPM1, MEAPM2, MEACM1	
				MEAPM3P3	Practical Assignment	Duo	O-V-G	MEAPM1, MEAPM2, MEACM1	
				MEAPM3T1	W ritten Exam	Individual	1,0-10,0	MEAPM1, MEAPM2, MEACM1	
				MEAPM3T2	W ritten Exam	Individual	1,0-10,0	MEAPM1, MEAPM2, MEACM1	
	MEAW I3	Probability & Statistics	1.00	MEAW I3	W ritten Exam	Individual	1,0-10,0	n/a	MEAWI3 ≥ 5,5
	MEBCM4	Machine Elements	5.00	MEBCM4P1	Assessment	Individual	O-V-G	MEACM2	MEBCM4T = (MEBCM4T1 + MEBCM4T2) / 2 ≥ 5,5 whereby MEBCM4T1 and MEBCM4T2 ≥ 5,5. Grade for MEBCM4 is awarded in case MEBCM4P1, P2 and P3 are concluded successfully.
				MEBCM4P2	Practical Assignment	Individual	O-V-G	MEACM2	
				MEBCM4P3	Practical Assignment	Duo	O-V-G	MEACM2	
				MEBCM4T1	W ritten Exam	Individual	1,0-10,0	MEACM2	
				MEBCM4T2	W ritten Exam	Individual	1,0-10,0	MEACM2	
	MEBHE1	Research Methodologies	5.00	MEBHE1P	Assignment	Individual	O-V-G	nvt	Grade HE1 is only assigned if HE1P is sufficient HE1P ≥ 5.5
				MEBHE1T	Assignment	Individual and Duo	1,0-10,0	nvt	
	MEBPP5	Project & professionalization 5	9.00	MEBPP5P1	Project	Individual and Group	1,0-10,0	n/a	EBPP5 = (MEBPP5P1 + MEBPP5P2) / 2 with MEBPP5P1 and MEBPP5P2 ≥ 5,5. Grade for MEBPP5 is awarded in case MEBPP5T1 and MEBPP5T2 are concluded satisfactory.
				MEBPP5P2	Project	Individual and Group	1,0-10,0	n/a	
				MEBPP5T1	Assignment	Individual	O-V-G	n/a	
				MEBPP5T2	Assignment	Individual	O-V-G	n/a	

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW5	MEIntern	Internship	30.00	MEIntern	Execution and report	Individual	1,0-10,0	See criteria table	All partial grades >= 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW7_ET	MBSYE7	System Engineering 7	2.00	MBSYE7	Written Exam	Individual	1,0-10,0	n/a	≥ 5,5
	WADFX	Design for Excellence	2.00	WADFX	Assignment	Group	1,0-10,0	n/a	WADFX ≥ 5,5
	WAEP12	Thermal Design	4.00	WAEP12T	Written Exam	Individual	1,0-10,0	WAEP22, WAEP3	WAEP12 ≥ 5,5
	WAEP13	Applied Energy Technology	4.00	WAEP13P	Assignment	Group	O-V-G	n/a	WAEP13P ≥ V WAEP13T ≥ 5,5 Grade for WAEP13 will be awarded in case WAEP13P is concluded sufficiently.
				WAEP13T	Written Exam	Individual	1,0-10,0	n/a	
	WAPM13 / WADG2 / WABI	Selective module (period 2)	4.00	See module	See module	See module	See module	See module requirements	See module
	WAPRS7	Project S7	10.00	WAPRS7	Project	Individual and Group	1,0-10,0	n/a	WAPRS7 ≥ 5,5
	WBEP14	Sustainable Energy Systems	4.00	WBEP14T	Written Exam	Individual	1,0-10,0	WAEP22, WAEP3	WAEP14T ≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW7_IE	MBSYE7	System Engineering 7	2.00	WASYE7	Written Exam	Individual	1,0-10,0	n/a	≥ 5,5
	WABI	Business Innovation	4.00	WABIP	Assignment	Group	O-V-G	n/a	WABI = WABIT ≥ 5.5 and WABIP ≥ V Grade for WABI will be awarded in case WABIP is concluded sufficiently.
				WABIT	Written Exam	Individual	1,0-10,0	n/a	
	WACM5 / WACM10 / WAEP13 / WAEP14	Selective module 1 (period 1)	4.00	See module	See module	See module	See module	See module requirements	See module
	WADFX	Design for Excellence	2.00	WADFX	Assignment	Group	1,0-10,0	n/a	WADFX ≥ 5,5
	WADG2 / WAPM13 / WAEP12	Selective module 2 (period 2)	4.00	See module	See module	See module	O-V	See module requirements	See module
	WAPI	Product Innovation	4.00	WAPI	Written Exam	Individual	1,0-10,0	n/a	≥ 5,5
	WAPRS7	Project S7	10.00	WAPRS7	Project	Individual and Group	1,0-10,0	n/a	WAPRS7 ≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW7_PE	MBSYE7	System Engineering 7	2.00	MBSYE7	Written Exam	Individual	1,0-10,0	n/a	≥ 5,5
	WACM10	FEM	4.00	WACM10	Assignment	Individual	1,0-10,0	WACM2	WACM10 ≥ 5,5
	WACM5	Design Principles for precision	4.00	WACM5	Written Exam	Individual	1,0-10,0	WACM2	WACM5 ≥ 5,5
	WADFX	Design for Excellence	2.00	WADFX	Assignment	Group	1,0-10,0	n/a	WADFX ≥ 5,5
	WADG2	Dynamic Behaviour of High-tech System	4.00	WADG2T1	Assignment	Group	1,0-10,0	WAMR2, WADG1	WADG2 = (WADG2T1 + WADG2T2) / 2 ≥ 5,5 waarbij WADG2T1 en WADG2T2 ≥ 5,5 moeten zijn.
				WADG2T2	Written Exam	Individual	1,0-10,0	WAMR2, WADG1	
	WAPM13	Production & Materials for Precision	4.00	WAPM13	Written Exam	Individual	1,0-10,0	n/a	WAPM13 ≥ 5,5
	WAPRS7	Project S7	10.00	WAPRS7	Project	Individual and Group	1,0-10,0	n/a	WAPRS7 ≥ 5,5

semester	unit of study	name unit of study	credits	name of test	type of test	assessment type	assessment scale	prerequisites	norm/compensation
EW8	MEGRAD	Graduation	30.00	MEGRAD	Execution, report and defence	Individual	1,0-10,0	See criteria table	Final grade = 0,3 x execution + 0,3 x report content + 0,2 x report style + 0,2 x presentation/defence. All partial grades ≥ 5,5

Entrance level requirements Mechanical Engineering 2020-2021

	Criteria w.r.t. S12 (P-fase)	Criteria w.r.t. S3 (main phase)	Criteria w.r.t. S4 (main phase)	Criteria w.r.t. S5 (internship)	Criteria w.r.t. S6 (minor)	Criteria w.r.t. S7 (differentiation)
To S12 (P-phase)	Entry requirements pre-education					
To S34 (main phase)	≥45 ECTS (within 12 months after first entrance date)					
To S5 (internship)	≥80 ECTS (Propedeutics not required but advised) and ≥25 ECTS in S3 in case of internship fall (S4 ≥25 ECTS in case S5-S6 are switched)					
To S6 (minor)	=60 ECTS					
To S7 (differentiation)	1) ≥80 ECTS (Propedeutics not required but advised), 2) S3 ≥ 25 ECTS, 3) entrance requirements of the S7 modules according to OER for the differentiation of choice have to be met. Note that participation and at least partially completion of S4 is mandatory					
To S8 (graduation)	= 60ECTS	= 60ECTS		= 30ECTS		Participated in S7 gevolgd and at least participated in all modules

Fontys School of Engineering

Academic year 2020-2021

Engineering Minor

1. Study load table, standards and Completing the minor

The study load table for the engineering minor in semester 6 consists of two elements

1	Project component: this module has a study load of		280 SBU
2	Theory component consisting of 5 modules each of 112 SBU		
	In total		560 SBU
Total		+	840 SBU

The project must be completed with a grade > 5.5. For the theory modules, each module must be ended with a pass grade > 5.5. How the final grade for a module is determined appears in the module descriptions.

The Engineering Minor is considered completed once all modules are concluded with a pass grade! At that point you have fulfilled your minor obligations.

Once the Engineering minor is fully completed, you will receive a minor certificate. For students of Engineering, the minor will be automatically ticked off in Progress (v pass). Students from other study programmes are required to submit the original certificate to the company office or secretariat of their study programme, as proof of completion. The staff will prepare a copy and tick off the minor.

In the event of disputes about the minor, complaints can be submitted to the central Examination Board Chamber at Fontys Engineering. In other words not the Examination Board of your own study programme.

2. The minor: choice of subjects

During this minor, we aim to offer you a range of choices that you can select based on your own preferences. Students at Fontys School of Engineering and Automotive must announce their choices in advance, via Progress. Other students announce their choice via a registration form at the Engineering company office.
The coordinator will then allocate you to the various modules based on your choices, if you have sufficient prior knowledge for each module. If this is not the case, we will contact you to discuss other possibilities.
A number of projects and/or theory modules are taught in English. These have an English module description. The examinations for these modules are also held in English.

Projects
In the projects, we work in multidisciplinary teams of around 6 people. The companies want 'value for money'. We assume that you will apply a project-based approach, according to the principles of Method-based Design. This approach is described in the reader 'Method-based Design – the problem of innovative concepts'. Each project will be tackled in a systematic a structured manner, so that the product is developed in an innovative approach.

Below are the theory modules that are open to **everyone**:

Subject	Code	Lecturer
Business Economics	MNHE4	Haasnoot
Customer Oriented Innovation	MNHE20	Peter van Kollenburg
Vision	MNVSN	Kerstjens
Extra options for Electrical Engineering students		
Elec. Magn. Compatibility	MNEMC	Piet Slenders
Small Signal Audio Design	MNSSD	Guido Tent
System Identification	MNSYI	Aslan
Extra options for Mechatronics students		
System Identification	MNSYI	Aslan
Lean Manufacturing	MNPM10	Hutten
Drive Technics	MNCM6	Geraerdts
Dynamic Behaviour	MNCM7	Geraerdts
Extra options for Automotive students		
Elec. Magn. Compatibility	MNEMC	Piet Slenders
Drive Technics	MNCM6	Geraerdts
Dynamic Behaviour	MNCM7	Geraerdts
Extra options for Mechanical Engineering		
System Identification	MNSYI	Aslan
Lean Manufacturing	MNPM10	Hutten
Drive Technics	MNCM6	Geraerdts
Dynamic Behaviour	MNCM7	Geraerdts

3. Overview of examination moments

For each module (both project and theory) in semester S6, the module descriptions in this guide include a description of how the module must be completed and how your work will be assessed. (If in doubt contact the module coordinator, certainly in the case of retakes.) A large number of modules rely on written examinations in the official examination periods

Note!

There is no enrolment for the written exams.

Extended examination time

Physically or sensory challenged students (for example with dyslexia) are offered an opportunity to take the examinations subject to a special regime. This may for example include extra time. If you wish to be considered for this possibility, you must submit a written request to the examination board in good time. Student counsellors can advise you and have sample letters available.

These facilities are however not available for interim examinations.

The examination timetables for the completion of a teaching period are always announced on the Friday of week 5 of the teaching period in question.
The grades, assessments, etc. on completing teaching periods will be communicated via portal.fontys.nl.
Following publication of the grades, students will have 2 teaching weeks following the final publication date to submit a request to the lecturer to view the examination paper. After this period, the grades are considered definitive.

	Code	Duration min	March/ April	June/ July	Oct/ Nov	Jan/ Feb
Elec. Magn. Compatibility	EMC	100		Reg		Resit
Business Economics	HE4	100		Reg		Resit
Customer Oriented Innovation	HE20	none				
Lean Production	PM10	100		Reg		Resit
Small Signal Audio Design	SSD	100		Reg		Resit
System identification	SYI	100		Reg		Resit
Vision	VSN	none				
Drive Technics	CM6	150		Reg		Resit
Dynamic Behaviour	CM7	100		Reg		Resit

4. Module description Minor Engineering Projects

4.1. Module description 'Minor Engineering Projects '

Module-identification

Module name:	Minor Engineering Projects	
Module code:	MNPROJ	
Semester:	S6	
Workload in ECTS:	10 ECTS	
Module coordinator:		
	Email: w.broekman@fontys.nl	08850 77371 / 0622947217
Lecturer(s):	Wim Broekman, and several tutors	

Course description

In Minor Engineering projects, we work in multidisciplinary teams on realistic business tasks (the development and realization of innovative products). We address the problem in a systematic, structured manner. The client (company) obviously looks for 'value for money'. We will work on a project based approach and according to the principles of Methodical Design. This approach is described in the reader 'Methodical Design - from problem to innovative concept.

In implementing the project, we are dealing with (four) generic competencies. These competencies are action-oriented. Conscious acting is always a matter of:

1. UNDERSTAND (reflection, orientation) in the problem situation / task.
2. DESIGN of the product, service or control.
3. PLAN the implementation.
4. EXECUTE the plan.

Examples of actions / operations are: diagnose, analyse, evaluate, reflect, plan, model, create, deploy. These actions lead in turn to a semi-product (intermediate) or a professional product (the production of both products and services, and also provide control for the corresponding production processes).
The IPD project is closed with a professional symposium where the IPD student teams present their results in the English language and demonstrate their prototype.

Learning objectives

Mandatory Prerequisites

Semester S1 / S2, S3 / S4

Lecture hours

1 day a week on Wednesday

Learning aids

none

Planning

20 weeks working within a Group of 6-8 students

Project week	Topics: Example!	Tasks: Example!
week 0	Registration Project information (on website): - Roles & tasks model - Project descriptions / assignments - How to work in projects - Methodological design - manual(for international groups)	- Read the project manual/information
week C1 Wednesday	On Wednesday first meeting of group with coach. Standard subjects: Intro , Enrolment, Explanation of roles & tasks if needed, Group's assignment, Tasks to fulfil this week (don't forget the company visit)	- Distribute all the roles amongst group members - Start with creation of your individual 'mini plan(s) of action' (mini-PoA) for every role (templates can be founds elsewhere on this website) - Make an appointment for the first meeting at the company
week C2	- Meeting with company and/or meeting with coach	- Finish writing your personal MiniPoAs. - Everyone should contribute to the creation of the overall 'project plan'
week C3	- Presentation/discussion of the overall 'project plan' - 1st meeting with consultant, for discussion and agreements on mini PoA regarding 'professional role(s)' (and email your mini_PoA regarding 'process role(s)' to your coach, to be discussed in week 4).	- Invite the principal on time for Audit 1
week C4	- Meeting with coach (topic: mini_PoAs regarding 'process roles') Mini Course: reporting, 8th and 9th hour by Mrs Plegt	- Write Audit 1 report [MR-1, in English] and send it to coach and principal when finished
week C5	- Meeting with consultant (this is 1st and last but one scheduled)	- Prepare for the presentation of Audit 1
week C6	- Audit 1. At the end of the audit there should be an agreement between the group and the principal about the specifications - And/or meeting with coach	
week C7		- Prepare for the peer assessments
week C8	- Meeting with coach - Peer assessments (carried out by the project leader) <possible conflicts with exams>	
week C0	<restricted activities in parallel with exams>	- peer assessments(??) [-p.m.: Prepare yourself IN ADVANCE for Audit 2]
week C1	- Meeting with consultant?? [This is just a reminder.]	- Send first concept of the project description to the coach

	- Final ordering	- Prepare for Audit 2: - >write report MR-2 incl. new (detailed) planning, and send it to coach and principal - >invite principal - >prepare presentation - Do final ordering
week C2	- Audit 2. At the end of this audit there should be an agreement between the principal and the group about the design proposal of the prototype - Coach gives feedback on the performance of the students and the group	- Finish Project Description - Do final ordering (if delayed)
week C3	- Audit 2 (if delayed)	
week C4	- Meeting with coach	
week C5	- Meeting with consultant?? [This is just a reminder.]	
week C6	- Meeting with coach	- SSD-ers: Finish your Subsystem Design Report including the subsystem's specifications, 'design' documents and the test plan and deliver it to the consultant (we prefer English versions)
week C7		- Finish your individual project (technical) role report(s) and deliver it (them) to the consultant (we prefer English versions) - Preparation of demonstration of working final product
week C8	- Meeting with coach - The group will have to give a demonstration of the (working) product to consultants. Based on this demo consultants should give a go / no go per individual role. - Finishing final report - Peer assessments?	- The final report (in English) has to be delivered at tutor and client.
week S1	- (Final) Peer assessments	- Finish video for presentation
week S2		- Prepare final presentation (in English)
week S3	- Audit 3/ Symposium - Final evaluation, grading and delivery of results to principal.	- Reparation of work if necessary - Group's evaluation and delivery of the product (to principal)

Testing / assessment and grading

Additional remarks:

- All reports have to be handed in on Monday of that week planned before 13.00 hrs.
- The audit-reports MR1 en MR2 are in English at max 6 pages with the following subjects: project status (only most important issues), detailed planning to next milestone/audit, expected problems and solutions or ways to prevent them.
  As enclosures the finished role reports.
- Reports hand in too late: related person (reporter) gets a warning or (yellow/red) card
- For all roles: 1 student is responsible but all members will contribute in order to reach a high level result.
- Consultant meetings: all students of that cluster are present and will present their work (oral) according planning agreed with consultant.
- Marks will be put on the assessment documents available for each role.
- When handing in a document always attach the assessment document (as available via this site)

Final judgement: individual marks (see Project site)

5. Module descriptions Theory

5.1. CM6 Module description 'Drive Technics'

Module identification

Module name:	Drive Technics	
Module code:	CM6	
Semester:	S6	
Workload in ECTS:	4 ECTS	
Module coordinator:	H. Geraerdts	Room ER 0.15
Email:	hgm.geraedts@fontys.nl	
Lecturer(s)s:		

Content description

In the drive technics, we look at the design of the driving structure between the source (motor or other actuator) and the load (driven system). This link can take place in different ways. A direct link or via special transmission systems such as 4-rod mechanisms or towing clutch systems. Of importance is natural what does the load need to function and which drive source should we use for this. We differentiate between kinematic considerations (velocities and speed differences) and kinetic considerations (large capacities versus small capacities as used in mechatronic systems). An important starting point is the theory of dynamics that is the starting point of reasoning for choosing the right transmission in important dimensions.

Learning objectives

Obtaining insight into and calculating and designing drive systems of all kinds. Special attention is paid to the mechanics and dynamics of a number of multi-component driven mechanisms.

Mandatory prerequisites

CM1 t/m CM4

Lecture hours

14 weeks for two hours

Learning aids

Planning

(provisional)

Practical sessions

At the end of semester 6 there is a written exam. At the end of semester 7 there is a resit. The student is given the opportunity to take a number of handwritten, non-copied A4 with him during the examination. The exam will be drawn up with open questions that contain a strong context of professional practice.

5.2. CM7 Module description 'Dynamic Behaviour'

Module identification

Module name:	Dynamic Behaviour	
Module code:	CM7	
Semester:	S6	
Study load (ECTS):	4 ECTS	
Module coordinator:	Geraedts	Room ER 0.15
Email	HGM.Geraedts@fontys.nl	
Lecturer(s):		

Course description

In this module, the dynamic behaviour is treated as a consequence of the coupling of an actuator (a drive form as treated in the "Drive Technology" module) to a mechanism with a certain mass and stiffness distribution. To be treated: general vibration learning, reduction methods mass spring systems, and achievable dynamic accuracies. Learning objectives

Mandatory Prerequisites

CM1 t/m CM4

Lecture hours

14 weeks for two hours

Learning aids

Planning overview

Subjects
Theory:

Practical

Testing / assessment and grading Regular test in June. Resit in January Permitted tools in consultation with Lecturer

Schedule of lessons, practical's and/or project activities

5.3. EMC Module description 'Electromagnetic Compatibility'

Module-identification

Module name:	Electromagnetic compatibility	
Module code:	EMC	
Semester:	S6	
Study load in ECTS:	4 ECTS	
Module coordinator:		ER Room 0.73C
Email:	p.slenders@fontys.nl	08850 77661
Teacher(s):	P. Slenders	

Course description

The EMC course covers the basics during the design process needed to bring a circuit or an electrical system to get that/it satisfactory. The phenomena covered by the term Electromagnetic Compatibility takes place both on a chip on a board like this and continues to systems and installations. The requirements set out by the users or customers of the products, play a very important role in the harmonization of these requirements written down in the guidelines of the EEC.

Mandatory prerequisites

- EMC in general, specific EMC techniques of existing products
- Knowledge of static electric and magnetic fields and screening principles
- Parasitic components for PCB's, components and cables.
- Ground bounce, Layout properties and design examples
- Transmission line theory, single ended and balanced signals
- Differential and Common mode chokes and line filters
- LT spice to simulate EMC examples
- Short introduction in standing waves related to antenna principles
- Transfer impedance of a cable and shielding effects

Learning aids

Hand-outs

Contact Hours

14 weeks for two hours. Total 6 hours for a practical assignment class D amplifier at EMC level. Two homework assignments.

Testing / assessment and grading

The final assessment for the subject of EMC is a combination of the results of the homework, practical and the final exam. The final test is a mix of multiple choice and essay questions to test your gained knowledge.

The final test lasts 100 minutes.

Re-sit: There will be a re-sit of the final exam. The grading of the re-sit will be 90 points plus 10 points for filling in your student number and name. The home-work will only be included in the grading of the original exam and not in the grading of the re-sit.

5.4. HE4T Module Description Business Economics

Module-identificatie

Module name:	Business Economics	
Module code:	HE4T	
Semester:	S6	
Study load in ECTS:	4 ECTS	
Module coordinator:		ER Room 0.15
	Email: m.haasnoot@fontys.nl	08850 79289
Teacher(s):	M. Haasnoot	

Content of the module

The student is able to:

- Identify the purpose of a business and discuss the ways in which a business may be organized and managed
- Discuss the issues to be considered when setting the financial aims and objectives of a business.
- Explain the role of management accounting
- Define and distinguish between relevant costa, outlay costs and opportunity costs
- Identify and quantify the costs that are relevant to a particular decision.
- Distinguish between fixed cost and variable cost and use this to explain the relationship between cost, volume and profit.
- Prepare a break-even chart and deduce the break-even point for some activity.
- Discuss the weaknesses of break-even analysis.
- Deduce the Full (absorption) cost of a cost unit in a single-product environment
- Deduce the Full (absorption) cost of a cost unit in a multi-product environment
- Discuss the problems of deducing full (absorption) cost in practice
- Discuss the principles and practicalities of activity-based costing.
- Explain how new developments such as total life-cycle costing and target costing can be used to manage product costs.
- Define a budget and show how budgets, strategic objectives and strategic plans are related
- Explain the budgeting process and the interlinking of the various budgets within the business
- Undertake variance analysis and discuss possible reasons for the variances calculated
- Discuss the role and limitations of budgets for performance evaluation and control.
- Explain the nature and importance of investment decision making
- Make a decision analysis and calculate the net present value.
- Deal with risk in a best and worst case decision calculation.
- Explain how management accounting information can help a business gain a better understanding of its competitors and customers.
- Explain how the balanced scorecard can help monitor and measure progress towards the achievement of strategic objectives.
- Discuss the potential advantages and disadvantages for a business of adopting a divisional structure.
- Identify the major methods of measuring the performance of operating divisions and divisional managers and assess their usefulness
- Describe the problems of determining transfer prices between divisions and outline the methods used in practice.
- Identify the main elements of working capital.
- Discuss the purpose of working capital and the nature of the working capital cycle

- Explain the importance of establishing policies for the control of working capital.

Organization

1 Semester, weekly 2 hours theory class. See schedule.

Prerequisite requirement.

None

Schedule

Week	Subject	Description
1	Ch 1 introduction	Introduction to management accounting
2	Ch 2 Relevant costs	Relevant costs for decision making
3	Ch 3 Cost volume	Cost volume profit analysis
4	Ch 4 Full costing	Single and Multi product business costing
5	Ch 4 Full costing	Cost centre costing
6	Ch 5 Costing and pricing	Costing and pricing in a competitive environment
7		
8	Ch 6 Budgetting	Budgets link with strategic plans and objectives
9	Ch 7 Accounting	Accounting for control
10	Ch 8 Capital invest	Making capital investment decisions
11	Ch 9 Strategic	Strategic management accounting
12	Ch 10 Performance	Measuring performance /balanced scorecard
13	Ch 11 Working capital	Managing working capital
14	Questions	Test examination
EXAM		

Study material

Books and readers to be purchased by the student:

Title	**Author(s)**	**ISBN**
Management Accounting for Decision Makers Access to (MyAccountingLab not required)	Peter Atrill and Eddie Mc Laney	ISBN 10: 1292072431 or ISBN 13: 9781292072432 Eight edition, Prentice Hall
Also allowed:		
Management Accounting for Decision Makers	Peter Atrill and Eddie Mc Laney	ISBN 10: 0-273-76226-5 or ISBN13: 9780273762263 Seventh edition, Prentice Hall

Sheets will be made available weekly after the class on N@tschool.

A**ssessment method**

The Business Economics theory will be assessed by a written exam of 100 minutes. The final mark must be ≥ 55 points.

It is an open book examination: book, sheets and notes on paper are allowed. No digital devices, except a regular calculator, are allowed during examination.

HE20 Module description 'Customer Oriented Innovation'

Module-identification

Module name:	Customer Oriented Innovation	
Module code:	HE20	
Semester:	S6, Spring 2018	
Study load:	4 ECTS	
Module coordinator	P. van Kollenburg e-mail: p.vankollenburg@fontys.nl	Room ER 0.75 08850 75483
Teacher(s)	P. van Kollenburg	

Course description

You do want to know more about innovation in industry. One way is to read about the many different ways of developing new products, creating ideas and exploring how customers are involved in this process. A different method is to do research by going into the field and find out what customer involvement means for innovation. In this module you are going to find the pro's and con's of the different ways of product innovation by doing research in the industry in a small group. One of the focus points will be the involvement of customers in this innovation process. By carrying out this research you will learn to have a critical view on product innovation; all this by studying theory, articles, papers and hands on research work in industry.

Learning objectives

- Get to know the many different ways of product innovation
- Find out the pro's and con's of customer involvement in the innovation process
- Meet and explore companies who are working in this field of product development
- Get familiar with product innovation and the relation within the development process and the steering of such a processes
- Get experience in translating theoretical information into a product
- Get experience in setting up and carrying out a research project
- Get experience in writing an article
- Get experience in making conclusions available for a wider public by producing a YouTube video based on the research results

Mandatory prerequisites

For this module no other modules are prerequisite.

Learning aids

- Module workbook (will be handed over as PDF-file)
- scientific papers (will be handed over as PDF-file)
- dropbox account (you will be invited for this during the first meeting)

Lecture Hours

14 x 2 hours

Testing /assessment and grading

Credits will be given when the student has been given a sufficient mark (≥ 5.5) for the course. The grade of the course is made up by:

- 30 % average of the mini examines (individual mark)
- 50% for the Paper and defending the paper (must be ≥ 5.5), group mark

- 20% for the Video, group mark
- Individual reflection is required
- Resit: redo that part which is insufficient (all individual)

5.5. PM10 Module description 'Lean Production'

Module identification

Module name:	Lean Production	
Module code:	PM10	
Semester:	S6	
Study load:	4 ECTS	
Module coordinator	R. Hutten e-mail: remco.hutten@fontys.nl	Room ER 0.15 08850 74456 06 13111082
Teacher(s)	Remco Hutten	

Course description

To widen the opportunities of the Fontys Engineering School engineers to practical work situations this course provides knowledge and insights of modern production operations. The focus will be not be limited to the organisation of production activities, designing production processes and lay outing a manufacturing facility. It will be extended to supply chain management – basically one of the success factors of the local High Tech Systems industry – up to sustainability and quality thinking and acting. Of course, a lot of attention will be put on 'continuous improvement', by introducing and experiencing 'lean' principles, practices and tools. This will lead to insights in reducing wastes, losses and inefficiencies, improvement of 'throughput' time and time-to-market, improvement of operations and costs effectiveness and in listening to the voice of the customer. Therefor we do not skip the more conventional 'MRP' and 'ERP' based production organisations, in order to have not only an overview of current approaches but also getting insight into the differences with 'lean'. Of course – as being engineers – the focus will be on technically oriented production, including assembly and product & process design. Further, as producing and marketing of products is not only a technical issue, also the 'service component' and industrial engineering principles will not be avoided.

Learning objectives

This course is oriented on providing basic insights and tools to investigate and design industrial production & development organisations and processes, thus offering a basic set of knowledge and experiences, supporting engineers aiming for a career in any industrial environment. Application of these insights and tools will be exercised by means of exercises, cases and video impressions.
[nog nader specificeren, SMART doelstellingen]

Mandatory Prerequisites

No specific knowledge other that provided in the basic Engineering programs (first two years) is necessary. Basic knowledge from mathematics and statistics will be applied for calculation and understanding, especially with respect to decision making tools and statistical process control (SPC and Six Sigma). Additionally basic use of spreadsheets is necessary, for these will be used in the exercises.
Examples and cases are based on a wide range of organisations, products and process, applying different disciplines, making the program applicable for all Engineering students.
Main base for joining this program is a high interest in the functioning of (technical, production oriented) businesses.

Lecture hours

This course will be offered in 14 x 2 classroom lessons.

Additionally it is necessary - and thus compulsory – to perform homework on a weekly base, so to study the literature, to do exercises and work out cases. Within the program also one or two company visits are foreseen (not yet sure), which will most likely be planned aside of the contact hours (out of regular lesson times).

Planning overview

(The program is under construction, thus contents and order of the subjects may alter before and during the program)

- Introduction to operations and productivity, the global environment and operations strategy
- Product design and sustainability
- Quality management, TQM, Statistical Process Control, Six Sigma
- Process design, capacity planning, forecasting, throughput times
- Layout decision and workplace design
- Supply chain management, supply chain modelling
- Materials Requirements Planning (MRP) and Enterprise Resource Planning (ERP)
- Lean principles and operations, the Toyota Production System, flow, voice of the customer
- Lean and Six Sigma tools for production operations

The course will not only provide theory. Students will individually and collectively work on exercises, cases and eventually workshops. In order to have interactive lessons it is necessary to study the set literature, cases and videos and perform the exercises in front. Literature and connected online tools (MyOMLab®) are chosen to support the continuous learning experience. If possible one or two company visits will be organised. For reasons of scheduling limitations they will probably be organised aside of the current lessons, e.g. in the evening. Alternatively the course participants will be challenged to arrange company visits in small groups.
Short presentations of participants to present the working out of a case or assessment of a company are part of the program. Of course also in that case the language will be English.

Learning aids

Basic literature will be the next book:

Heizer, Jay and Render, Barry
Operations Management, with MyOMLab® with Pearson eText, Global Edition
Pearson, 11 ed., 2013, ISBN10 0273788302 = ISBN13 9780273788300
Remark: please make sure that you include MyOMLab® in your order.

Additionally other texts, cases, information and eventually assignments will be offered through N@tschool.

Testing / assessment and grading

Assessment of the theory is done by a final written examination (100 minutes). The examination will be possible in English as well as in Dutch.
Remark: intermediate assessment by means of written or online exercises, case examination, workshops, presentations etc. will not be part of the final assessment score. They will be used to support the learning process. Presence in the lessons, preparation of the 'homework' and participation in the intermediate assessments is therefore compulsory.

5.6. SSD Module description 'Small Signal Audio Design'

Module-identification

Module name:	Small Signal Audio Design	
Module code:	SSD	
Semester:	S6	
Credits	4 ECTS	
coordinator:	Guido Tent	No fixed office
	G.tent@fontys.nl; Guido@Tentlabs.com	040 2130 186
Teachers	Theory: Guido Tent Practice: Guido Tent, Henk Mandemakers	

Course description

Active elements (valve, transistor, FET); audio-circuits; amplification of signals; filters; power supplies; EMC / signal integrity / layout; thermal design and production aspects / service-ability.

Learning objectives

To learn how to design, build and evaluate small signal audio circuits.

Mandatory prerequisites

To be decided for external (exchange) students

Lecture hours

14 x 2 hours of theory, supported by 14 x 2 hours of guided practice

Learning aids

Small Signal Audio Design price circa € 60,- mandatory: no

Author: Douglas Self
Language: English
ISBN10: 0240521773
ISBN13: 9780240521770

Planning overview

C	Subject(s)	Study material
1	Active elements (valves, transistor, FET) - Input / output impedances	
2	Active elements (valves, transistor, FET) - Amplification (all terminals) - Distortion / non-linearity	
3	Circuits - Input / output impedances - Gain - Noise	
4	Circuits - Power supply rejection - Bandwidth	
5	Gain - Single gain stages - Followers (Emitter, source cathode)	
6	Gain - Cascode circuits - discrete opamps	

	- feedback	
7	Filters - Tone controls - Lowpass and highpass filters	
8	Reserved	
S1	Assignment	
S2	Assignment	
1	Power supplies - Shunt - Series	
2	Power supplies - Noise - Input / output impedances, bandwidth	
3	EMC / signal integrity - Pollution of ground plane - Layout rules	
4	EMC / signal integrity - Layout rules - Wiring of systems	
5	Thermal design - dissipation of components	
6	Thermal design Safety	
7	Produce-ability, Service-ability	
8	Produce-ability, Service-ability	
S1	Produce-ability, Service-ability	
T	Exam in exam period	

Testing/ assessment and grading

The module is final when the project (40 % of finale grade, 20% personal and 20% group result) and theory exam (60% of final grade) have been delivered.

Both theory and practice can be resit independently.

The practical part consists of the design of a circuit, based upon specifications like bandwidth, gain, distortion and noise.

The practical part starts in the first week and is carried out in pairs. A breadboard is obligatory. Components will be made available. From each assignment, a report shall be delivered the week after the assignment. In week 5, the project starts. This takes place in groups of 5-6 people.
The specifications of the design will be set prior to the start and will be verified in practice; this verification determines the group result. A final rapport is obligatory, which clearly shows the personal contribution of each group member.

Example projects are:
- Phono pre amp
- Microphone / line level pre amp with tone control
- IV converter (analogue backend of a CD player)
- Low power amplifier (~ 10 watt)
- Discretely built operational amplifier (opamp)

5.7. VSN module description 'Vision'

Module-identification

Module name:	Vision

Short description:	Introduction to machine vision	
Module code:	VSN6	
Semester:	S6	
Workload in ECTS:	4 ECTS	
Module coordinator:	Randy Kerstjens	Room ER 0.63
	r.kerstjens@fontys.nl	08850 73123
Lecturer(s):		

Course description

Machine Vision is a subfield of engineering that incorporates computer science, optics, mechanical engineering, and industrial automation.
Machine vision is machine-based image processing and requires also digital input/output devices and computer networks to control other manufacturing equipment such as robotic arms.

Learning objectives

- To gain insight in the basics of machine Vision
- Build simple machine vision applications using LabView (practical part)

Mandatory Prerequisites

Semester 1 – Semester 4 of an Engineering Bachelor of Fontys Engineering Eindhoven.
Knowledge of Labview is an advantage and some programming experience is recommended.

Learning aids

Slides, assignments and reference materials (available through n@tschool)

Planning

Week	Theory	Practical training
1	Introduction and overview	Introduction to LabView, Vision Assistant and assignment 1: Thresholding (filter)
2	Lighting, lenses and sensors	Introduction to LabView, Vision Assistant and assignment 1: Thresholding (filter)
3	Lighting, lenses and sensors	Introduction to LabView, Vision Assistant and assignment 1: Thresholding (filter)
4	Image processing	Assignment 1: Thresholding (filter)
5	Image processing	Assignment 2: Convoluting images (filter)
6	Inspection (detection, matching)	Assignment 2: Convoluting images (filter)
7	Wrap-up + state-of-the-art	Assignment 3: Filtering and measuring
8		Assignment 3: Filtering and measuring
9		Assignment 4: Pattern matching
10		Assignment 4: Pattern matching
11		Assignment 5: Wayfinding
12		Assignment 5: Wayfinding
13		Assignment 6: Inspection
14		Assignment 6: Inspection

Learning aids

· Sheets week 1: Introduction and overview
· Sheets week 2: Lighting, lenses and sensors
· Sheets week 3: Lighting, lenses and sensors
· Sheets week 4: Image processing
· Sheets week 5: Image processing

· Sheets week 6: Inspection (detection, matching)
· Sheets week 7: Wrap-up + state-of-the-art
· Introduction to LabView
· NI Vision Assistant
· NI LabView
· NI LabView Vision acquisition software
· Practical Assignment Descriptions (with resources if necessary)

Practical

This module has a significant practical part based on Labview from National Instruments. Students work in groups of 2.

Testing / assessment and grading

The overall grade for the course will be determined by the following components:

Grading is based on the quality of the practical assignments. The 6th and last practical assignment will be used as input for the final mark (>=5.5), provided that the first 5 practical assignments have been handed in (must be passed, determined by your teacher) and that all the practical and theoretical lessons have been attended. Otherwise, the mark will be insufficient (<5.5).

The following applies if the criteria described above are not met:

- If the grade of the sixth assignment is insufficient (<5.5) and a maximum of one practical assignment has not been handed in there will be one additional assignment.
- Students are allowed to miss one theory lesson provided that they write a short essay about the subjects of that particular lesson. If the essay is marked sufficient by the lecturer the final grade will still be awarded.

If you cannot attend your lesson for any reason, please make sure you notify your teacher in advance!

Scheduling / educational activities

Activity	Week number	Hours per week	room type	Maximum class size
Lecture	Q1 1-7	2	Room with beamer	32
Laboratory	Q1 1-7; Q2 1-7	3	Computer Laboratory	32

! The exact content of the vision module is subject to change. These changes will be communicated during the lectures. !

5.8. SYi Module description 'System Identification'

Module-identification

Module name:	System Identification	
Short description:	System identification in the frequency domain	
Module code:	SYI	
Semester:	S6	
Workload in ECTS:	4 ECTS	
Module coordinator:	A. Aslan	Room ER 0.63
	Email: n.vanlierop@fontys.nl	08850 89830

Lecturer(s):	Albert Aslan a.aslan@fontys.nl,

Course description

Within this course participants will learn the basics of system identification theory in the frequency domain as well as gain practical experience with the methods. This course has a significant added value to the modelling and control courses within the engineering department of Fontys. With the gained knowledge of this course it is possible to directly measure the dynamical behaviour of a system. This gives a valuable validation method and an addition to the model based approach. Especially in high tech systems it can enable higher performance and/or better insights into the dynamical behaviour.
This course is the first mutually developed course under the cooperation treaty between ASML and Fontys Engineering. The theoretical part of the course is given by Fontys and the practical part is given by ASML. This module has a practical component based on a fourth order electro-mechanical Quanser set-up.
The final practical assignment involves a reticle masking unit (REMA) of an actual ASML machine. This unit is available during the last weeks of the course. The REMA unit acts as a shutter for the reticle that contains the patterns for the chip production during the scanning process of a wafer. This has to be done quickly and accurately in synchronization with the stages in the wafer scanner. The dynamical behaviour of the REMA unit must be identified accurately in closed loop by the students. This practicum is executed on an actual industrial problem.

Learning objectives

After completing this course the student is able to:

- Describe and apply the meaning of the following terms: sampling, Shannon, aliasing, leakage, Cross/auto Power Spectral Density, correlation and coherence
- Describe the properties of different colours of noise signals and Multisine signals
- Select between and apply the following identification methods: open-loop identification, closed-loop identification using either the 2-point of three-point method.
- Analyse the validity of the identified system data in the frequency domain and adapt the identification method/signals to improve the measurement results.

Mandatory Prerequisites

Semester 1 – Semester 4 of an Electro-technical or Mechatronics Engineering Bachelor of Fontys Engineering Eindhoven.

Learning aids

Material	Title	Author	Edition	Publisher	Price
PowerPoints Practical assignments	Several	LRP, Maarten Kremers, Sven Hol, Roel Merry			
Matlab Help		Matlab			

Planning

Lecture	Subject	Designed by	Docent	ReMa
1	Introduction Recap Laplace	Fontys	Fontys	
2a	Modelling at ASML (physics vs measured, whole machine vs modules)	ASML	ASML	
2b	recap Fourier + bode	Fontys	Fontys	
3	Discrete time: sampling, Shannon, aliasing, leakage, Matlab demo	Fontys	Fontys	
4	Practical: Fourier + Matlab (link to practical examples)	ASML	ASML	Data only
5	Power spectra	Fontys	Fontys	
6	Cross/auto Power Spectral Density (PSD), complex conjugate and correlation	Fontys	Fontys	
7	Open loop transfer function measurement • Relations between time domain, Laplace and Fourier • Superposition	Fontys	Fontys	
8a	Coherence	ASML	ASML	
8b	Description and analysis of noise signals and Multisine signals	Fontys	Fontys	
9	Averaging / Windowing / zero padding	Fontys	Fontys	
10	Practical: open loop measurements / Matlab assignment (working towards tfestimate)	ASML	ASML	Quanser, 4th order systems
11	Practical: coherence + Matlab calculations for practical set-up	ASML	ASML	Data only
12	Closed loop 2-point and 3-point measurements	Fontys	Fontys	
13	Practical: closed loop measurements	ASML	ASML	REMA unit
14	Experiment design + summary/questions	ASML	ASML	

Practical

To gain insight in the practical issues involved with frequency domain identification the students will have to complete a series of practical assignments with several Quanser set-ups in combination with NI Labview. The identification data will be processed in Matlab. Besides the fourth order Quansar setups an industrial REMA unit from ASML will be used for the final assignment.

Required facilities (hardware, software)

Quanser 4^{th} order set-up	The gain practical insight in the identification methods Quanser set-ups will be used in combination with NI Labview to control the set-ups. The identification data will be processed in Matlab.
ASML REMA unit	A reticle masking unit (REMA) of an actual ASML machine is available during the last weeks of the course which is used a final practical assignment in which the students need to show their skills.

Laptop	Own laptop for installing and running NI Labview and Matlab Simulink

Testing / assessment and grading

- Exam SYIT:
  - Type of exam: written
  - Duration: 100 min
  - Minimal passing grade: 5.5

- Resit SYIT:
  - Type of exam: written
  - Duration: 100 min
  - Minimal passing grade: 5.5

- Exam SYIp:
  - Type of exam: practical assignment
  - The practical assignment will be graded with insufficient, sufficient or good.

- Resit SYIp:
  - Type of exam: practical assignment
  - The resit will be in the form of a repair assignment at the end of the SYI course and it will be graded with insufficient, sufficient or good.

The final grade of the SYI course is equal to the grade of the theoretical exam. However, the final grade will only be awarded when the practical component is graded sufficient or good.

- Allowed learning aids during the theoretical exam: 1 A4 of handwritten notes (no worked out assignments) and a calculator.

6. Booklist

See portal

F2. **Minor Be Creative Minor regulations – 2020 - 2021**

1. Name minor
Be Creative

2. English name
Be Creative

3. Content of minor
The Minor Be Creative focusses on the creative and entrepreneurial engineer. Within this minor you, as a student, are encouraged to create your own learning path, discover your talents and share your knowledge focusing in the WHY instead of the WHAT. The ultimate goal to achieve is that you, as part of a group of students, create a new product or concept, in a vast array of subjects. Noticeable regarding learning and educating:

- You are given a huge amount of freedom that makes you responsible for the end result;
- You as students set the pace and course;
- Lecturers are there for encouragement, advice and guidance;
- All within the new concept of learning: Connecting through Technology; we educate you to become the creative engineer of the future.

Rather than learning what the teachers say you have to learn, the minor is focused on what *you* want to learn and on *your* talent. Within this minor we want to focus on a different way of learning, in order to grab all the possible opportunities and excel in a way you did not expect. We want to create an environment in which learning is key instead of focusing on a forced result implied by the school system. We want you to have a great learning experience and reach your full potential in the next 20 weeks!

Resume for diploma supplement
The minor Be Creative focusses on the creative and entrepreneurial engineer. Within this minor students are encouraged to create their own learning path, discover their talents and share their knowledge. Students of the Be Creative minor learn in real-life situations where they, as part of a group of students, create a new product or concept in collaboration with various stakeholders.

4. Education components (see article 16 general section of the TER)
We believe that education should be focused on the learning goals and ambitions of a student. Understanding what the qualities of each individual student are and what the student wants to improve are of great importance to let this way of educating succeed. We believe that students should show a level of growth within their learning path and goals and are willing to share their knowledge and talents among other students. Our starting point within this minor consist out of main guidelines, that shares our vision on education.

1. Focus on continuous learning, talent and feedback

We believe that a continuous learning process is valuable for the student. It is of importance that students do not only learn a lot towards the end of a project or course, but throughout the whole project. Not only will the student learn more throughout the process, the student will also be aware of their strengths and weaknesses and know where they can improve early in the process. The continuous learning process is stimulated by feedback sessions held every three weeks. Next to that, the continuous learning process is also supported by their own individual

learning goals. This intrinsic motivation of learning a specific skill stimulates the student even more. A motivated student sees education as a privilege not as an obligation.

We believe, every student should be able to choose their own learning path. By choosing your own learning path, you will be more motivated to reach your goals and grow in skills and personal development. Each student has to write a Personal Development Plan in which the student describes who he/she is and what he/she wants to learn throughout the minor. This means that the student should be able to self-reflect and be aware of the skillset and talents they have. Not only will they be able to discover their talent, but they might find a passion and will work from that.

Regular feedback and reflection moments are more valuable than just final grades, in this way we support talent development of every individual student. Through feedback the students will realize what their strengths and weaknesses are, and how they can develop and grow even further.

Receiving feedback throughout the minor gives students the opportunity to adjust their way of working or attitude and show their qualities. Providing feedback to the students, will give the students the opportunity to strive for more and excel in what they didn't expect. As there is no focus on (final) grades, students will grow along the way throughout the project, rather than growing their focus learning peak in a final exam.

2. Learning in context

We believe the students are able to learn more when they are put into a real-life situation. As the projects are in collaboration with different stakeholders (companies, foundations, universities), the students experience a real-life situation with the stakeholders as client. Students need to plan and manage their own project, making them entrepreneurial and creative engineers. When the outcome of their project is successful enough, they will even realize it in the real world.

3. Sharing knowledge

We believe that every student has a certain set of knowledge and skills. By sharing this knowledge and skill set to the other students within their project, they are able to learn from others and grow in certain learning activities they did not expect. Students are stimulated to share their skills and their learning goals, to see and find where they match and can learn from each other. Because why would you learn something from scratch if someone else can teach you?

5. Enrolment in the education components

Does not apply

6. Overview of tests and registration for tests (see articles 18 and 22 general section of the TER)
As indicated above we focus on 3 main guidelines in the Be Creative minor. The evaluation criteria can be found in Appendix A.

1. Focus on continuous learning, talent and feedback is based on the final PDP report, reflection and 5 intermediate feedback presentations. These are graded by teachers and peers, based on 8 evaluation criteria.

2. Learning in context according project process and content based on final projectreport. These are graded by teachers, based on 12 evaluation criteria.

3. Sharing knowledge according course material based on given lectures or documentation. These are graded by the teachers and/or peers, based on 8 evaluation criteria.

The following requirements must be met in order to qualify for the final assessment:

1. The student has written and delivered their Personal Development Plan with specific goals in the first weeks;
2. The student has an overall positive chart, meaning that he showed an overall growth throughout the minor. An overall positive chart means:
    - The student has received *neutral* or *positive* in at least 3 out of 5 feedback sessions;
    - The student did not receive *negative* in the first two feedback sessions.
3. The student has been present at all of the feedback moments;
4. The student has shared knowledge and documented this in his portfolio;
5. The student has kept a blog about the project and personal progress;
6. The student has written a final document containing the following:
    - Personal Development Plan (this plan can be slightly different to the first version);
    - Collection of processed peer- and teacher feedback (as found in the feedback document);
    - Critical self-reflection on the whole project;
    - Group report about the project.
    - Portfolio (based on blog)
7. The student has made a video about their project (1 video per group);
8. Teacher should approve the final documents as mentioned in 6.

At the final assessment, there are three possible outcomes:

- Failure: Student scores less than 15 out of the 28 criteria on sufficient or higher, meaning that the student has failed the minor – no repairing phase is possible.
- Repair: Student scores less than 20 but more than 15 criteria on sufficient or higher. In this case the student is able to enter the repairing phase in agreement with the assessors. Together will be decided what is included to repair the score.
- Success: Student scores 20 or more out of the 28 criteria on sufficient or higher.

7. Passing the minor (see article 19 (3) general section of the TER)

In order to pass to minor the student needs to score at least 20 out of 28 evaluation criteria (Appendix

A) sufficient or higher (based on a bullet scale). The bullet scale resembles the following grading:

O	O	O	O
Insufficient	Sufficient	Good	Excellent

The student will receive either a 30 EC or none (sufficient or insufficient).

8. Examination Board (see article 38 general section of the TER)
Exam committee Electrical Engineering
Jan v.d. Linde (chairman)
Henk Mandemaker
(secretary) Tekin Yilmaz
(member)

Peter van Kollenburg
(member) Willem-Jan
Verkerk (member)

Tilly van Berlo (secretarial assistant)

e-mail: examencommissie-engineering@fontys.nl

9. Validity
This information applies to the academic year 2020-2021.

10. Entry requirements minor
To enter the minor, students should have received a propaedeutic certificate or have permission of the examination committee of their own educational program. We also recommend students to gain experience in working project-based prior to the minor.

11. Not accessible for
Does not apply

No other requirements are to be met for participation in the minor or passing the minor than mentioned in these minor regulations.

Appendix A: Evaluation criteria

Learning objectives: 1. Focus on continuous learning, talent and feedback (Matrix 1) 2. Learning in context (Matrix 2) 3. Sharing knowledge (Matrix 3)	**Level on which the study objective is tested**			
	Reproduce	**Explain**	**Apply**	**Analyze, evaluate, create**
1. Focus on continuous learning, talent and feedback according PDP and focus on feedback. Based on final PDP report, reflection and 5 intermediate feedback presentations. (Graded by teachers and peers) *Minimal required products:* *1. written and approved PDP* *2. Overall positive chart* *3. Presence at all feedback sessions* *4. Blog* *5. Portfolio*				X
2. Learning in context *according project process and content based on final project report (graded by teachers) Minimal required products:* *1. Group project report* *2. Final presentation + interim presentations* *3. Video of the final prototype*			X	
3. Sharing knowledge *according course material based on shared knowledge and documentation (graded by teachers and/or peers) Minimal required products:* *1. Documentation of shared knowledge* *2. Evaluation by peers on shared knowledge* *3. Reflection on shared knowledge*				X

Assessment form 1: Focus on continuous learning, talent and feedback

Learning objectives:	**Level on which the study objective is tested**	
1. Improvement of (technical) level 2. Approach 3. Working Attitude 4. Social Communicative Attitude 5. Professional Attitude 6. Giving & Receiving Feedback 7. Reflection 8. Presentation skills	**Feedback**	**Rating** **e.g.:** **O - O - ◉ - O**
1. Improvement of (technical) level The student creates and evaluates an improvement of their technical level throughout the minor. The student creates and evaluates an improvement of their soft skills throughout the minor.		O - O - O - O
2. Approach The student has been working efficiently and result oriented using SMART-goals as described in his Personal Development Plan. The student is able to analyze his social responsibility. The student makes sufficient use of the available approaches. The student shows initiative in developing himself. The student is willing to grasp the ability to learn more than expected.		O - O - O - O
3. Working Attitude The student shows flexible behavior. The student shows a positive working attitude towards his/her learning process.		O - O - O - O
4. Social Communicative Attitude The student communicates clear with other students and stakeholders, and is respected team member. The student is able to collaborate with other students and professionals involved.		O - O - O - O
5. Professional Attitude The student is able to create a planning and works according this planning, if necessary evaluate and adapt planning. The student is able to work independently and is disciplined. The student is able to challenge within his learning goals.		O - O - O - O
6. Giving & Receiving Feedback The student is able to give constructive feedback to team members. The student is able to cope with received feedback and improves himself according to the feedback received.		O - O - O - O
7. Reflection The student is able to reflect upon his (learning) activities. The student is able to evaluate himself and the way he works in order to improve.		O - O - O - O
8. Presentation Skills The student is able to present his reflection and learning goals. The student is able to present with a logical setup, correct structure and valid arguments. The student make use of audio-visual aids in a supporting way. The student is able to communicate well, both oral and non-oral, while presenting.		O - O - O - O

Assessment form 2: Learning in context

Learning objectives:	**Level on which the study objective is tested**	
1. Technical Level 2. Quality 3. Integration Soft Skills & Hard Skills 4. The Problem Environment 5. The Problem Definition 6. Goal & Requirements 7. Approach Research Framework 8. Design/Research Methods 9. Results/Research Outcomes 10. Conclusions & Recommendation 11. Summarize 12. Readability of Report	**Feedback**	**Rating** **e.g.:** **O - O - ◉ - O**
1. Technical level The technical level of the student is sufficient enough to successfully execute the project, meaning creating a working prototype.		O - O - O - O
2. Quality The student shows quality within his performed work as a professional.		O - O - O - O
3. Integration Soft Skills & Hard Skills The student is able to apply his soft/hard skills within the project		O - O - O - O
4. The Problem Environment The student is able to clearly analyze the assignment. The student is able to apply the assignment in the proper context. The students is able to identify which stakeholders are professionally involved within the project.		O - O - O - O
5. The Problem Definition The student is able to extract a clear assignment from the problem description. The student is able to identify the opportunities, requirements and constraints from the problem description.		O - O - O - O
6. Goal The student is able to clearly define the goal of the project. The student is able to describe the goal of the project well including the boundary conditions (financial, time, etc.) and the goal has been concretely formulated SMART. The student creates a clear set of requirements he has to comply with.		O - O - O - O
7. Approach Research Framework The student is able to have a well-defined and clear design strategy. The student is able to define a logical and realistic design framework. The student is able to sufficiently motivate his design choices.		O - O - O - O
8. Design/Research Methods The student is able to apply a design method. The student is able to underpin for the choice of material and components. The student is able to take potential manufacturing and production methods into account		O - O - O - O
9. Results/Research Outcomes The student is able to adequately describe the final result. The student is able to match the final result with the requirements as stated in the assignment/goal.		O - O - O - O
10. Conclusions & Recommendation The student is able to reflect and evaluate on the realization of the project The student is able to make conclusions based on proper analytic consideration. The student is able to write relevant recommendations		O - O - O - O
11. Summarize The student is able to clearly describe his project in spoken and written communication by means of a summary.		O - O - O - O
12. Readability of Report The student is able to write a readable report for the target group (both client and teacher).		O - O - O - O

Assessment form 3: Sharing Knowledge

Learning objectives: **To share and broaden knowledge by giving class to other team members.** 1. Preparation 2. Knowledge level 3. Wide Interest Area 4. Quality 5. Learning Goals 6. Presentation & Communication 7. Questions 8. Documentation	**Level on which the study objective is tested**	
	Feedback	**Rating** **e.g.:** **0 - 0 - ◉ - 0**
1. Preparation The student is able to prepare appropriately for the sharing of knowledge and write a one page proposal		0 - 0 - 0 - 0
2. Knowledge Level The student has sufficient knowledge about the given subject at the moment of sharing his/her knowledge.		0 - 0 - 0 - 0
3. Wide Interest Area The student is able to explain and find relevance of general knowledge for the subject and generate a critical attitude towards this relevance.		0 - 0 - 0 - 0
4. Quality The student shows quality within his performed work as a professional.		0 - 0 - 0 - 0
5. Learning Goals The student is able to formulate the learning goals before the sharing of the knowledge.		0 - 0 - 0 - 0
6. Presentation & Communication The student is able to share knowledge with a logical setup and a correct structure. The student makes use of supporting materials (e.g. audio/visual.) The student is able to communicate well		0 - 0 - 0 - 0
7. Questions The student is able to understand the questions and/or feedback.		0 - 0 - 0 - 0
8. Documentation The student is able to document the shared knowledge so it is reproducible by others.		0 - 0 - 0 - 0

F3. Minor Adaptive Robotics: Minor regulations 2020-2021

1. Name minor: Adaptive Robotics (AR)

2. English name: Adaptive Robotics (AR)

3. Content of the minor

The minor Adaptive Robotics (AR) is an innovative minor both in terms of teaching form and the related examination method. The minor is talent-based and there is considerable focus on talent development among the individual students. The minor will be taught in English.

The minor consists of an intensive kick-off phase (lasting 2 weeks) followed by an orientation phase (of 3 weeks). During these phases, the students will be given assignments (individually and in groups) and will receive teaching in the following modules:

- *ROS for Engineers (Robot Operating System)*
- *Principles of Robotics*
- *Vision, Sensors & Perception*
- *Norms, Standards & Safety*
- *Hardware Abstraction & Embedded Hardware*

In each of these subject areas, examination will often be based on the work undertaken, including videos, posters, presentations, development of own teaching material, etc. On that basis, students will demonstrate that they have achieved their own in-depth learning targets.

The knowledge acquired will be applied and expanded within a multidisciplinary group project that will be undertaken during 14 weeks of the minor period. During these 14 weeks, students will spend 4 days a week on their project, and 1 day a week on acquiring in-depth knowledge in classes and workshops. Within specified frameworks, the students will have the opportunity to define their own project, in close consultation with relevant subject lecturers. These projects will be coached by lecturers (both in terms of process and technical content).

The minor offers a new educational model in which students will learn to recognise and use their own talents and in which teaching will be offered in the form of (multiday) workshops.

This minor is suitable for students with a technical background (specifically mechanical engineering, mechatronics, electronics, ICT and automotive) and students who demonstrate sufficient prior technical knowledge. This minor is ideal for students open to self-development, talent development, technology and who demonstrate a proactive attitude. Following this minor is not recommended for students who have not yet completed their company internship, or who wish to follow more ‘traditional’ education.

Within the minor AR, students will work on the following competences:

Analysis: Students themselves are capable of defining a project, formulating objectives and drawing up a schedule of requirements. The students will also learn to prepare safety requirements for the product in the module *Norms, standards & safety.*

Design: Students are capable of producing a design for their (robot) system within their project. Design will also be dealt with in the modules Hardware Abstraction & Embedded Hardware and ROS for Engineers (Robot Operating System).

Realisation: The end product of the project is a working demonstrator. As part of a group, students will be able to build the demonstrator during the course of the project.

Control: Within the project, students will be able to evaluate whether their product complies with the requirements drawn up, and whether it complies with (existing) safety standards.

Management: Students learn to manage a project using the SCRUM method. Every two to three weeks, the students define the tasks in their project, and every two to three weeks deliver a sub product. The results of each period (sprint) are presented in a project pitch for their fellow students and coaches.

Research: Supervised by coaches, students learn to study the material in depth from the modules that form part of the minor, together with other knowledge needed to implement their main project.

Professionalization: Supervised by coaches, students learn to define (and achieve) their own learning objectives, define their talents and reflect on those talents.

4. Overview of teaching activities in the minor (see article 12 general section of the Teaching and Examination Regulations)

The minor AR consists of three phases:

Adaptive Robotics Minor	**Code S6**	**Points to Achieve**	**3 years study Engineering**
Kick off Phase		**1**	**2 weeks**
Gripper Case	ARGC6	1	weeks 1 and 2
Orientation Phase		**9**	**4 weeks**
Holonomic AGV and FPGA Case	ARHC6	2	weeks 3 and 4
Navigation Case	ARNC6	2	weeks 5 and 6
ROS & Python for Engineers	ROSE6	1	weeks 2 to 6
Principles of Robotics	PR6	1	weeks 2 to 6
Vision, Sensors & Perception	VSP6	1	weeks 2 to 6
Hardware Abstraction & Embedded Hardware	HA6	1	weeks 2 to 6
Norms, Standards & Safety	SAFE6	1	weeks 2 to 6
Core and evaluation phase		**Up to 25**	**14 weeks**
AR Minor Project	ARMP6	0	weeks 7 to 20
ROS & Python for Engineers	ROSE6	up to 7	for getting 5 or 7 points in a subject, you must define and agree with the teacher your assignment before the end of week 17
Principles of Robotics	PR6	up to 7	
Vision, Sensors & Perception	VSP6	up to 7	
Hardware Abstraction & Embedded Hardware	HA6	up to 7	
Norms, Standards & Safety	SAFE6	up to 7	
Talent	**ART6**	0	**Must be applied during the minor.**

Note: To pass the Adaptive Robotics Minor you must get a minimum of 22 points and pass ARGC6, ARHC6, ARNC6, ARMP6 and ART6.

1. Kick-off (2 weeks): During the kick-off phase, students and lecturers are introduced to one another and to the content of the minor. Students are introduced to mechanics, motor control and motion control, 3D printing and the SCRUM method. The majority of this phase consists of a project (Gripper Case) carried out within a team of 2 to 3 people.

2. Orientation (4 weeks): In the orientation phase, students become conversant with all aspects (modules) of the minor AR. This is achieved on the basis of a series of workshops within the module. The most important (multiday) workshop is learning to work with ROS (Robot Operating System). This phase is concluded with a project in which students use ROS to control a real robot (Navigation case). During this phase, students also start investigating their talents and (in consultation) define the project they wish/intend to carry out in the project phase.
3. Core and Evaluation (14 weeks): In the project phase, students use their talents, knowledge and skills within a multidisciplinary team. During the project, they deepen their knowledge of the various modules/subject areas, with the assistance of their coach lectures and their self-defined learning objectives are tested. Students also develop their talents. During the last week of the project students examine their final outstanding learning objectives, conclude the project work and present the project in a symposium.

The minor consists of the following modules:

ROS for Engineers
ROS (Robot Operating System) is a flexible framework for the development of robot software. It is a collection of tools, libraries, programming constructions and programming agreements. The most important use for ROS is the building of simple, platform-independent, complex robot applications.

Within the module ROS for Engineers, the basic principles and most commonly used tools and software components of ROS are discussed, to assist in the construction of various robot applications. This is using basic Object Oriented programming code in Python. This grants an insight into the possibilities of ROS. The programming of new robot software components is dealt with in the higher levels of this module.

Principles of Robotics
Robots are evolving rapidly from factory workhorses, limited physically to their work cells, into increasingly complex machines capable of implementing challenging tasks in a day-to-day environment. The aim of this module is to understand the basic concepts and algorithms on which the development of mobile robots and robot arms are based. The focus is on mobile travel and arm kinematics, observation of the environment, localisation and the production of a model of the environment (map) and path planning.

Vision, Sensors & Perception
A traditional robot in manufacturing industry is programmed to carry out a specific task, for example blindly picking up or setting down an object. The robot observes nothing of what is going on in its environment, and to protect factory workers, the robot is placed in a cage. An adaptive robot observes its environment with sensors such as cameras, laser range finders and with ultrasonic systems, and is required to act in a changing environment. This may be the observation of a factory worker or perceiving whether there is a cup of coffee on the draining board in a house. In this module, a series of camera and observation techniques are discussed (1D, 2D and 3D), together with a number of filter techniques, aimed at extracting relevant information from sensor data.

Norms, Standards & Safety
Machines and robots are required to comply with a series of regulations and standards. For industrial robots (fixed in their cell), these standards are already available (i.e. ISO10218-1 and ISO10218-2). For the next generation of robots (e.g. mobile platforms

that move freely or robots that collaborate with other robots and people), these standards are currently being defined. In this module, students will be introduced to the world of standards, and will learn the basic principles of designing safe machines/robots both for industrial applications and for the next generation of robots.

Hardware Abstraction & Embedded Hardware
In this module, students will be taught how robot hardware, such as actuators and sensors can be combined using ROS and how abstraction from this hardware is possible, for ROS. Students learn which design choices they have to make in order to implement hardware abstraction for example for embedded systems or industrial buses. Students will learn about:

- different types of actuator
- motor controllers
- position sensors on wheels and joints
- image sensory systems and distance sensory systems
- the translation of sensor signals
- the translation of motor commands

The minor also includes a talent line. In this talent learning line, students are taught to understand and recognise their talents, by talent coaches. They also learn to recognise obstacles in their day-to-day life to making full use of their talents. A talent is different from a competence. A competence can for example be design. A talent could for example be 'bridge builder' or 'pointing out someone's errors'. Talents can support competences and can be deployed for acquiring competences, or implementing competences in a particular manner.

5. Registration for teaching activities in the minor

Registration for this minor is possible via ProgressWWW (Fontys internal) or kies-op-maat (external) up to 2 months prior to the start of the minor.

6. Minor examination and registration for examinations (articles 18 and 22 general section of the Teaching and Examination Regulations)

Within the minor AR, five technical modules have been defined: Principles of Robotics, Vision & Perception, Norms, Standards & Safety, Hardware Abstraction & Embedded Hardware and ROS for Engineers (robot programming). Within each module, a student can achieve 4 levels. Learning objectives have been defined for each level, by a subject-competent lecturer (also the module owner). These learning objectives have been defined according to the Taxonomy of Bloom and range from understanding (level 1) through to application (level 2-3) and analysis/evaluation/ creation (level 4). The students are required to achieve at least level 1 for each module. Students can then opt to specialise further within the 5 modules. This further learning is based on a personal learning plan.

Learning objectives include:

Beginner: The student is able to explain such terms as SLAM, Kinematics, holonomic, omni wheel (Principles of Robotics)
Novice: The student is able to apply the key safety principles in system development (Safety)
Intermediate: The student is able to program a robot using software modules not discussed in class (ROS)

Expert: The student is able to combine information from a number of sensors to create an accurate 3D image of the environment (Vision)

Learning objectives for levels 1 and 2 are fixed for each module. For levels 3 and 4, students can attempt to achieve the learning objectives defined in advance, or select their own learning objectives (with a comparable degree of difficulty). These learning objectives must then be approved by the relevant module owner. A student cannot skip any levels; if a student wishes to achieve the learning objectives of level 4, he must first achieve the learning objectives of level 3.

For each technical module, examinations have been laid down for achieving level 1 and 2, that are the same for everyone. These learning objectives are examined for example via projects, video presentations, standard presentations and poster presentations. To achieve the learning objectives for levels 3 and 4, agreements must be reached concerning the form and submission method, with the module owners in question. Certain learning objectives can be examined according to specific work pieces undertaken by the student within his group project. Within the group project, each student has their own tasks. These are defined by the students themselves. Each student who design, developed and test of a robotics ROS compatible system can in this way demonstrate his learning objectives for example for level 3 or level 4 of the module ROS for engineers. The student is required to reach agreements on the demonstration requirements with the module owner. The module owner will determine whether the intended level has been achieved according to the work, the documentation and possibly additional explanation (e.g. viva) of the student.

Students can also opt to demonstrate learning objectives in the form of work that goes beyond the project. This can for example be achieved by producing a teaching module on a particular subject that relates to the learning objective and is approved by the module owner. An item of evidence must be presented with every examination.

The progress of the group projects is examined on the basis of two to three-weekly project pitches, in which students talk about what they have achieved and describe their next steps.

Talent education is concluded with a poster and video presentation in which the student demonstrates those areas in which he has achieved personal growth within this minor (which talents he has learned to recognise and how he has made use of those talents within the project).

There are no fixed intervals/moments for students, at which they ‘complete’ their subjects. In other words, the level can be determined at any moment the student and lecturer consider suitable (this will facilitate greater flexibility in the learning process). It does however mean that any retakes (of opportunities to demonstrate a level achieved) must always take place during the course of the minor, in consultation with the relevant lecturer(s).

7. Concluding the minor (see article 19, lid 3 general section Teaching and Examination Regulations)
If a student passes a level (learning objectives) within a module, points will be awarded. If the student has reached beginner level for all modules, he will be awarded 5 points. At the end of the minor, the student must have scored at least 20 points. He or she is therefore required to achieve a number of new learning objectives, and specialise in a number of modules. For each level achieved, the student will be awarded 2 additional points. For example:

Field	Points
ROS (for Engineers)	3
Principles of Robotics	5
Vision sensors and perception	7
Norms, standards & safety	3
Hardware abstraction & embedded hardware	3
Gripper Challenge	1.5
Total	22.5

In the Kick-off phase, students participate in groups of 2 or 3 members in the Gripper case, if they meet the minimum requirements stablished for the competition, they are awarded 1.5 points.

In the orientation phase, students participate in the navigation case, if they meet the minimum requirements for the competition they are awarded 1.5 points.

In addition to individual learning objectives and to the gripper and navigation case, students must also successfully complete their group project. This is evaluated according to the following elements:

- is the technical level of the finished product sufficient
- is the work attitude within the group sufficient
- are the project results sufficiently described (technical reporting of the entire project)

These requirements are assessed by the group tutor. The specific criteria are announced to the students at the start of the minor.

Talent development is subject (among others) to the following specific learning objectives:

1. You are able to explain how talent influences your work in a project team
2. You are able to explain how you intend to use the knowledge and experience of the talent in applying for a suitable job.

You are able to explain clearly what you unique personal professional development you have undergone.

The minor will conclude with an overall assessment, and no ECs will be allocated for each individual module.

8. Board of Examiners (article 38 general section Teaching and Examination Regulations)

Fontys School of Engineering acts as secretary for this minor. As a result, the Board of Examiners of the Fontys School of Engineering will determine whether the student has passed the minor and ensures that the student receives a certificate. The Board of Examiners is composed as follows:

Chair: Jan van der
Linde Secretary: Wim
v.d. Laak
Members: Joep Adamzcyk, Max Bogers, Piet van Loon, Jan van Schijndel

The Board of Examiners can be contacted by e-mail (examencommissie-eng-aut@fontys.nl) for information about additional facilities and examination of the minor.

9. Validity
This information is valid for academic year 2020-2021.

Explanatory notes: interim changes to a minor are possible on condition they are clearly communicated to the students, and included in the minor regulations.

10. Admission requirements minor
To be able to participate in this minor, the student must have completed the foundation course phase and S3 and S4, or have received permission from the Board of Examiners of his study programme, to participate in the minor.

Furthermore, this minor is only open to students of a technical study programme in higher professional education (Engineering or ICT) and students who demonstrate a technical background at higher professional education level.
There are 32 places available in the minor. Therefore students are required to write a motivation letter of maximum 2 pages explaining why he/she wants to participate in this minor and his/her educational and professional technical background and affinity with robotics. Based on this motivation letter the participants of this minor will be selected. Students will receive notice the latest 1 month prior to the start of the minor.

11. Not open to:
Students with no demonstrable technical background at higher professional education level.

No other requirements for participation and completion of the minor are imposed on students, than those laid down in the minor regulations presented in this document.

Minor SPDAM Regulations - 2020-2021

1. Name minor:
Smart Product Development Additive Manufacturing (SPDAM)

2. English name:
Smart Product Development Additive Manufacturing (SPDAM)

3. Content of minor
The minor Smart Product Development with Additive Manufacturing (SPDAM), an in-depth technical minor on 3D-printing. You will achieve competences –a combination of practical and theoretical knowledge, practical and cognitive skills, and behavior and values– enabling you to work in an additive manufacturing (AM) environment. The program learning goals are stated below:

- You will learn about the possibilities and limitations of AM-machines, and how to help companies (e.g. high tech industry, medical) to implement this new production technology.
- You will attain skills in the engineering design process:
  - systematic approach from function to solution,
  - in the field of mechanical, thermal, and flow product structures.
- You will be able to use specialized software packages for drawing, modelling, analysis, and simulation.
- You will learn about selecting materials and production technologies, and gain skills to operate different types of AM-machines and associated equipment:
  - properties of a machine
  - material science tests
  - occupational health and safety issues

Unit	Contents
Theory module	**Design for Additive Manufacturing (DFAM)** Design guidelines, Topology optimization, Economic aspects, Killer application identification (practice).
Practicals module	**Practical Skills for Additive Manufacturing (PSAM)** Hands-on experience in the lab with AM-equipment, Reverse engineering, Production preparation, Post processing, Testing materials and printed parts, Using specialized software (e.g. Materialise Magics), Occupational health and safety issues.
Theory module	**Production technology and Materials (PM11)** Properties of materials for AM, Heat treatment, Testing of materials. Conventional (lathes, milling, welding) versus additive processing, Different types of AM-machines, Support structures, Production flow.
Computer Module	**Stress analysis and Optimization (CM11)** Theoretical background and practical skills in finite element method. Modelling, analyzing, and optimizing mechanical stress by topology optimization in a product using professional software.
Computer Module	**Heat and Flow analysis (EP11)** Principles of heat and flow transfer. Theoretical background and practical skills in finite element method. Modelling and analyzing heat and/or flow, e.g. in a heat exchanger or injection mold, using professional software.
Project	**Integrated Product Development (IPDAM)** Project assignment from different companies (High Tech Systems, Medical, or General), which involves analyzing, designing, building and testing a product in which AM can deliver a superior solution.

3.1 Summary for diploma supplement

The minor Smart Product Development with Additive Manufacturing (SPDAM) is an in-depth technical minor on 3D-printing where learned a combination of practical and theoretical knowledge, practical and cognitive skills, and behavior and values– enabling to work in an additive manufacturing (AM) environment. The possibilities and limitations of AM(-machines), and how to help companies (e.g. high tech industry, medical) to implement this new production technology.

4. Education components (see article 16 general section of the TER)

Code	Title / Examination	Study load and contact hours
DFAM DFAM1 DFAM2	**Design for Additive Manufacturing** Written exam (individual) 100 minutes Re-designed part, presentation, report	**DFAM: 112 hours total = 5.6 hr/week (4 EC)**
PSAM PSAM1 PSAM2	**Practical Skills for Additive Manufacturing** Practical assignments and participation Practical assignments and participation	**PSAM: 112 hours total = 5.6 hr/week (4 EC)**
PM11 PM11T1 PM11T2	**Production technology and Materials** Written exam (individual) 100 minutes Written exam (individual) 100 minutes	**PM11: 112 hours total = 5.6 hr/week (4 EC)**
CM11 CM11P1 CM11P2	**Stress analysis and Optimization** Practical assignments Project + written exam (individual) 100 minutes	**CM11: 112 hours total = 5.6 hr/week (4 EC)**
EP11 EP11P1 EP11P2 EP11P3	**Heat and Flow analysis** Practical assignment heat Practical assignment flow Project	**EP11: 112 hours total = 5.6 hr/week (4 EC)**
IPDAM	**Project Integrated Product Development with Additive Manufacturing**	**IPDAM: 280 hours total = 14 hr/week (10 EC)**

5. Enrolment in the education components

Does not apply n.v.t.

6. Overview of tests and registration for tests (see articles 18 and 22 general section of the TER)

Code	Title / Examination	Grading
DFAM DFAM1 DFAM2	**Design for Additive Manufacturing** Written exam (individual) 100 minutes Re-designed part, presentation, report	**(DFAM1 + DFAM2) / 2 ≥ 55%** Grade: 10-100% Grade: 10-100%
PSAM PSAM1 PSAM2	**Practical Skills for Additive Manufacturing** Practical assignments and participation Practical assignments and participation	**(PSAM1 + PSAM2) / 2 ≥ 55%** Grade: 10-100% Grade: 10-100%
PM11 PM11T1 PM11T2	**Production technology and Materials** Written exam (individual) 100 minutes Written exam (individual) 100 minutes	**(PM11T1 + PM11T2) / 2 ≥ 55%** Grade: 10-100% Grade: 10-100%
CM11 CM11P1 CM11P2	**Stress analysis and Optimization** Practical assignments Project + written exam (individual) 100 minutes	**(CM11P1 + CM11P2) /2 ≥ 55%** Grade: 10-100% Grade: 10-100%
EP11 EP11P1 EP11P2 EP11P3	**Heat and Flow analysis** Practical assignment heat Practical assignment flow Project	**EP11P1 + EP11P2='sufficient',then EP11=EP11P3** Grade: insufficient / sufficient Grade: insufficient / sufficient Grade: 10-100%
IPDAM	**Project Integrated Product Development with Additive Manufacturing**	**≥ 55%**

- Written exams are provided in the English language.
- Enrolment for the exams (regular & resit) are automatically done by the organization for all students

7. Passing the minor (see article 19 (3) general section of the TER)

See table, section 6. All parts (DFAM, PSAM, PM11, CM11, EP11 and IPDAM) of the minor must be completed successfully. Sign up through Kies op Maat (https://www.kiesopmaat.nl), each module within be terminated whit a 5.5 or higher and the endscore will be:
((DFAM score/840x112) + (PSAM score/840x112) + (PM11 score /840x112) + (CM11 score/840x112) + (EP11 score /840x112) + (IPDAM score /840x280) = Endscore minor SPDAM

8. Examination Board (see article 38 general section of the TER)

Exam committee Mechanical Engineering

E-mail:	examencommissie-engineering@fontys.nl
Wim Broekman	(chairman)
Karin van Krijl	(secretary)
Jan van Schijndel	(member)
Ton Gielen	(member)
Esther Vinken	(member)
Gisela Greijmans	(secretarial assistant)

Centrale examencommissie

Email: examencommissie-eng-aut@fontys.nl
Chairman: Jan van der Linde

9. Validity

Deze informatie geldt voor het studiejaar 2020-2021

10. Entry requirements minor

Entry requirements based on an engineering/technical bachelor study, such as Mechanical engineering, Mechatronics, Automotive, or Applied Physics.
The student must be registered with one of the aforementioned studies and have completed the propedeuse.

11. Not accessible for

Students from programs other than **Mechanical engineering, Mechatronics, Automotive, or Applied Physics*** are excluded from participation.

*See section 10.

G. HBO Top programme

Programme Feasibility, Study Load, and Testing for FHENG TU/e Pre-Master's HBO Top Programmes

In collaboration with the Technical University Eindhoven (TU/e), Fontys provides programmes for HBO students in which courses can be taken at the TU/e during the HBO programme that are part of the Pre- Master's programme. This type of programme is also referred to as HBO Top. The admissibility of students is subject to strict requirements determined in consultation with the TU/e. By completing a sufficient number of courses, students are given the opportunity to start directly in one of the Master's programmes at the TU/e after obtaining their HBO certificate.

Background and Definition of the Problem

The various Pre-Master's programmes between universities and HBO programmes vary in scope (see http://doorstroommatrix.nl/). It may also be the case that, for logistical reasons and/or programme feasibility reasons, the time span within which the minimum ECTS of additional study load must be completed within the Pre-Master's programme is extended. The TU/e has an HBO Master's track of 150 ECTS which equals a study load of 2.5 years. However, this track spans 3 years. It should be noted that at least in the Master's for Electrical Engineering, Mechanical Engineering, and Systems & Control, this is not done for logistical reasons but in order to guarantee the programme's feasibility. This was confirmed in the annual evaluation meeting that takes place between the TU/e and all Fontys HBO programmes involved in an excellence programme. It is too expensive to provide specific HBO/TU Pre-Master's courses. HBO students are therefore expected to make an extra effort on top of the standard curriculum in the Pre-Master's phase because the theoretical study load of 30 ECTS is not considered feasible to complete in one semester in practice by the TU/e. During the regular 3-year programme, this is covered by providing a 150 ECTS programme over a period of three years.

Since the HBO Top programmes consist of the same Pre-Master's courses that are taken during the minor phase, this creates a problem in regards to the study load to be accounted for in ECTS.

In the Engineering department, a meeting took place on 1 December 2016 between the then Chair of the Central Examination Board: Els Lenssen, member of the Central Examination Board: Max Bogers, and the three excellence programme coordinators for each Engineering programme Willem-Jan Verkerk (Electrical Engineering), Willem van de Groep (Mechanical Engineering), and Nelis van Lierop (Mechanical Engineering). During this meeting, the issue of the feasibility of the HBO Top programme was discussed and a possible solution was defined whereby this minor variant is built up from a part to be allocated by the TU/e and a part to be allocated and tested by Fontys.

Proposal

The HBO Top programme coordinators are mandated by the MT to formulate learning agreements for the various HBO TOP programmes. These learning agreements are used to create a composition minor. The learning agreements to be defined by the coordinators of the excellence programme must meet the following requirements:

1. The agreement must contain at least 20ECTS of TU/e courses that are part of the HBO Top programme applicable to the student. The programme coordinator must ensure that courses which are part of the learning agreement are not used to apply for exemptions from courses in the Fontys Bachelor's programme.
2. The agreement must include a Fontys module of 10 ECTS called "Academic Skills". The structure of the content and the description of the module is included below.
3. By successfully completing the above parts of the composition minor, the student completes their minor phase as part of the Fontys programme.
4. For each programme type there is a programme description in which the content, preliminary conditions, and criteria are established.

Academic Skills Module Description

The Fontys lecturers responsible for this module are the excellence programme coordinators of the engineering programmes as mandated by the MT.

Size of the module: 10 ECTS*

*It is not always possible to create a total of exactly 20 ECTS of relevant TU/e courses within a TU/e semester. It is possible that a student has to obtain more than 20 ECTS of TU/e courses. When more than 20 ECTS of TU/e courses are included in the minor learning agreement (see Appendix I), the courses and the Academic Skills module add up to more than 30 ECTS. However, the total number of credits for the total composition minor in that case amounts to 30 ECTS. It is the student's responsibility, in consultation with

their study career advisor and the programme coordinator, to compose a realistic and feasible programme that includes at least 20 ECTS of TU/e courses.
The “Academic skills” module includes the following learning goals/competence development:

- The student must gain experience with large-scale lectures and instructional lesson models.
- The student must be able to independently analyse scientific literature in order to gain lacking previous experience.
- The student must have sufficient knowledge of the English language to be able to study English-taught academic-level courses and materials independently.
- The student must be able to conceptualise abstractly on an academic level.
- The student must be able to observe and reflect at an academic level.
- The student must be able to solve analytical problems independently at an academic level.
- The student must be able to formulate and report mathematical proof at an academic level.

The testing for achieving the above learning goals is done by means of an oral examination in which the student has to present and be able to defend the necessary evidence using a portfolio. The student must therefore demonstrate that they have been able to take level 5 modules at academic levels 6 and 7 of the European Qualifications Framework. This examination is carried out by the HBO Top coordinator mandated by the Examination Board as the first examiner. This mandate is defined in this document. The examination and its results shall be documented using the form included in Appendix II. In order for the HBO Top coordinator, as the sole examiner, to be able to administer the oral examination, this form also requires the student's consent in accordance with Article 17, paragraph 4 of the TER.

Procedure

The procedure to complete and formalise the free composition minor described here is as follows:

1. In consultation with the student, the mandated HBO Top coordinator will formulate a learning agreement in accordance with Appendix 1.
2. After the successful completion of the modules agreed in the learning agreement at the TU/e, an oral assessment will take place which will be administered by the HBO Top coordinator as first examiner and a second examiner appointed by the HBO Top coordinator. In preparation, the student submits:
    - Authenticated original TU/e list of grades of all completed courses included in the learning agreement.
    - Proof of the obtained Academic Skills by means of a portfolio. The composition of this portfolio is the student's responsibility and may consist of but is not limited to: self-reflection, proof of developed professional skills, written papers/articles/reports, etc.
3. If the assessment has been successfully completed, the programme coordinator must complete and sign the assessment form in Appendix II.
4. The student submits the signed test form, original authenticated list of grades, additional evidence, and portfolio material to the Operations Office
5. The Operations Office performs the following actions:
    - All the proof is entered into TRIM
    - The credits obtained are registered in the Progress portal in accordance with the structure below:
        - 43MINATOP – 30 ECTS – ***Pre-Master's minor*** (name of the minor on the diploma)
            - 43MINAHBOTP – 20 ECTS
            - 43MINAAV – 10 ECTS

The above coding has been determined in consultation with the Operations Office in accordance with the following structure:

- **43MIN**ATOP: 43MIN = Minor identifier for the institute (43)
- 43MIN**A**TOP: revision A. In the case of major changes (e.g. major changes in content or changes in study load)
- 43MINA**HBOTP**: study load from the TU/e modules of >=20 ECTS
- 43MINA**AV**: Academic Skills module from Fontys of 10 ECTS.

Appendix I: Learning Agreement for the HBO Top Free Composition Minor

See next page (to allow for the entire document to be included as it was originally). The red text has to be adjusted individually.

LEARNING AGREEMENT FOR THE HBO TOP COMPOSITION MINOR
ACADEMIC YEAR 2017/2018

FIELD OF STUDY: "Name Fontys education"

Name of student:

Sending institution: Fontys University of Applied Sciences

DETAILS OF THE PROPOSED STUDY PROGRAMME:
"HBO excellence program Fontys Engineering name field of study and Eindhoven University of Technology (TU/e) name TU/e master"

Course unit code (if any)	Course unit title	Number of ECTS credit
	List of TU/e courses (min. 20ECTS)	
	Academic skills (Fontys course)	10
	Total	**30***

*If the individual courses amount to more than 30ECTS, the total number of credits that will be registered for the Fontys minor is still limited to 30 ECTS.

Student's signature

…….. Date: ……

SENDING INSTITUTION

We confirm that this proposed programme of study/learning agreement has been approved.

Excellence Programme Coordinator**: Signature:

Name: …… ……

Date: ……..

**Mandated by the Fontys Engineering Management Team

RECEIVING INSTITUTION

The attached TU/e enrolment form for the excellence program, including the additional documents indicated in the enrolment form, guarantees that the proposed programme of study/learning agreement can be followed and registered at the TU/e. The excellence program coordinator is responsible for the academic skills course.

Appendix II: Examination Form for the Academic Skills Module of the Free HBO Top Composition Minor

See next page (to allow for the entire document to be included as it was originally).

FONTYS UNIVERSITY OF APPLIED SCIENCES ASESSMENT
ACADEMIC SKILLS HBO TOP COMPOSITION MINOR
FIELD OF STUDY: "Name Fontys education"

GENERAL INFORMATION			
Name of student:		Student number:	
Date of assessment:		Name of first assessor:	

Composition of minor part: 43MINAHBOTP (>=20 ECTS)				
Course code (TU/e)	**Course name (TU/e)**	**# credits**	**Part of learning agreement?***	**Course concluded?****
			Yes / No	Yes / No
			Yes / No	Yes / No
			Yes / No	Yes / No
			Yes / No	Yes / No
			Yes / No	Yes / No
			Yes / No	Yes / No
			Yes / No	Yes / No
Total # credits completed:				
43MINAHBOTP part completed?			Yes / No	

Composition of minor part: 43MINAAV (10 ECTS)		
Learning goal	**Learning goal demonstrated?***	**Notes & Evidence**
The student has demonstrated experience with large- scale lectures and instructional lesson models.	Yes / No	
The student has demonstrated being able to independently analyse scientific literature.	Yes / No	
The student has demonstrated sufficient knowledge of the English language to be able to independently study English-taught Academic level courses and materials.	Yes / No	
The student has demonstrated to be able to conceptualise abstractly on an academic level.	Yes / No	
The student has demonstrated being able to observe reflectively on an academic level.	Yes / No	
The student has demonstrated being able to solve analytical problems independently at an academic level.	Yes / No	
The student has demonstrated being able to formulate and report mathematical proof at an academic level.	Yes / No	
Academic Skills part 43MINAAV completed?*	Yes / No	

**Cross out what is applicable*
*** Concluded only if an original authenticated grade list is available*

Final appraisal of HBO Top Composition minor

The HBO TOP Composition minor has been successfully completed by thestudent. Excellence

Programme Coordinator: Signature:

Name: …… ……

Date: ……..

Student agrees to verbal exam by one assessor (according to OER article 17-4)

Name student: …… Signature: ……..

Appendix III: Background Information

HBO Top student excellence programme between Fontys Engineering Eindhoven and the Technical University Eindhoven (TU/e)

(Below is a quote from: https://www.tue.nl/studeren/tue-graduate-school/schakelprogramma/hbo-top-minor/)

"HBO-TOP (minor)

Are you an excellent HBO student? In that case, you may be eligible for the HBO Top programme during your HBO studies. After concluding the HBO Top programme you can easily move on to a Master's programme!

Please note: The HBO Top programme is not a regular minor. It is possible that the HBO Top programme will extend beyond one semester.

Can I participate?

You can join our HBO Top programme if:

- you are selected by Fontys or Avans
- you are selected by TU/e if you are not a student at Fontys or Avans
- you have completed your HBO propaedeutic year
- you have sufficient study progress (at least one propaedeutic year)
- you are interested in a Master's programme at TU/e

What is included in this excellence programme?

- During one or more years of your HBO programme, you will participate in the excellence programme.
- In most cases, you will have direct access to the TU/e Master's programme after successful completion of the HBO Top programme.
- If you have direct access to the TU/e Master's programme after successfully concluding the HBO Top programme, you can register for the Master's programme in studielink. (In that case, the automatic rejection does not apply to you)
- Part of the programme can be "on top of" your HBO programme.
- Within the programme you will receive credits for your HBO programme."

Requirements for connecting the HBO with the TU/e

(Quoted from: Master's in Electrical Engineering for HBO graduates https://static.studiegids.tue.nl/fileadmin/content/Faculteit_EE/Reglementen/EE_HBO-masterprogram_2016.pdf) **"HBO-minor and HBO-excellence programme**

At some HBO schools, e.g. Fontys, it is possible to take Pre-Master's courses during the HBO programme. At Fontys, these are the "HBO minor" and the "HBO excellence programme".

The HBO minor has been discontinued, although part of the programme can still be taken. If you are interested, please contact us (see page 1). Currently, TU/e focuses on offering Pre-Master's courses over a period of two to three years, some of which are part of the HBO programme, and others are in addition to the HBO programme. Check the current situation before making any plans.

When you register at TU/e after having completed your HBO programme, you will continue the programme from where you left off. Unless you completed 30 ECTS at TU/e during your HBO programme, you will register as a Pre-Master's student. After having completed the remaining Pre-Master's credits, you must register as a Master's student."

H. PROUD: **PR**ogramme **OU**tstanding **D**evelopment

PROUD is the honours programme of Fontys Engineering. It is extra-curricular so only meant for those motivated students looking for more challenge in their education. It is meant specifically for getting more experiences and skills in the field of engineering.
The following selection criteria are checked applied in order to enter the PROUD programme as a member:
The student:
1. Has completed the first year with the propaedeutic certificate.
2. Has an approval by his/her study counsellor to join the programme.
3. Has proven to be well motivated for the program by means of a written motivation.
4. Passed the intake interview at the university.
5. Has been accepted for an internship/research project at one of the PROUD partners in the
industry or at Fontys University / research.
6. Has defined a personal development plan that is approved of by the committee.

Main planning for PROUD
Semester 3: intakes and acceptance
Semester 4: start PROUD work
Semester 5: internship (when working for PROUD at a company preferable at that company)
Semester 6: PROUD work at company or Fontys
Semester 7: PROUD work at company or Fontys and finalizing PROUD programme with portfolio

During the programme, no big delays in the regular programme are allowed and the PROUD student should show active behaviour and ownership in building his/her portfolio as mentioned below. PROUD Committees can decide to remove a PROUD student from the PROUD programme in case of study delay or not showing eagerness to the PROUD programme and/or community.
In order to finalize the PROUD programme with a certificate, we expect the PROUD student to deliver his/her final PROUD portfolio. In this document, the PROUD students shows the final results of the required PROUD activities. The final PROUD portfolio shows the committees that the student has performed all the required activities, including a reflection on these items. Based on this evidence, the student will receive a PROUD honours certificate together with the Bachelor’s degree

I. Enrolment process exams

Registration for testing in the academic year 2020-2021, Fontys University of Applied Sciences Engineering
Registration for regular and resit examinations

- Full-time and part-time students must register for the regular and resit examinations for years 1 and 2.
- Registration for the examinations is done via the Progress portal (see the manual on the portal for registering for examinations).
- The registration period (course weeks 2 and 3) for the different examination periods is included in the annual calendar of Fontys University of Applied Sciences Engineering.
- Students who have not enrolled during the registration period, but wish to participate in the examination, can still be enrolled up to the day before the examination for a fee of €10 per exam (with a maximum of €50 per examination period).
- In order to participate, students must report to the administration office.
- Registration on the day of the examination is only possible by reporting to the administration office before the start of the exam and for a fee of €20 before the exam in question starts.
- Payment must be made by card at the administration office.
- Participating in an examination without being registered (via the Progress portal or after the registration period subject to payment) is not possible.
- A student who has not acted in accordance with the registration procedure described above cannot take part in the examination.

J. Composition Examination Board per 01-01-2019

Central Examination Board

Chair (one of the chairs of the Exam Committee)	Jan van der Linde
Member and Vice Chair (one of the chairs of the Exam Committee)	Fieke Geurts
Member and secretary (one of the chairs of the Exam Committee)	Wim Broekman
Member (one of the chairs of the Exam Committee)	Edgar van de Laak
External member (outside the four programmes)	Vacant
Secretarial support (administration office employee), employee is not a member of the Examination Board	Esther van den Berg-Wolfs

Automotive Exam Committee, taught in Helmond and Eindhoven

Chair of the Automotive Exam Committee	Edgar van de Laak
Secretary of the Automotive Exam Committee	Resi Fuchs
Member, full-time programme specialist and Vice Secretary of the Automotive Exam Committee	Rob Gulikers
Member and Vice Chair, programme specialist of full-time programmes	Ted Wonders
Secretarial support (administration office employee for the Automotive programme, combined with membership of the Examination Board, Secretary).	Resi Fuchs

Electrical Engineering Exam Committee

Chair of the Electrical Engineering Exam Committee	Jan van der Linde
Secretary and Vice Chair of the Electrical Engineering Exam Committee	Henk Mandemaker
Member, programme expert and Vice Secretary of the Electrical Engineering Exam Committee	Peter van Kollenburg
Member, specialist of part-time Dutch programmes	Tekin Yilmaz
Member, specialist of full-time English programmes	Willem-Jan Verkerk
Secretarial support (administration office employee for the Electrical Engineering programme), not a member of the Examination Board).	Tilly van Berlo

Mechatronics Exam Committee

Chair of the Mechatronics Exam Committee	Fieke Geurts
Secretary and Vice Chair of the Mechatronics Exam Committee	Chris Remmers
Member, specialist of full-time programmes and Vice Secretary of the Mechatronics Exam Committee	Paul Goede
Member, specialist of full-time English programmes	Eric de Haas
Secretarial support (administration office employee for the Mechatronics programme), not a member of the Examination Board).	Esther van den Berg-Wolfs

Mechanical Engineering Exam Committee

Chair of the Mechanical Engineering Exam Committee	Wim Broekman
Secretary and Vice Chair of the Mechanical Engineering Exam Committee	Karin van Krijl
Member, specialist of fulltime English programmes and Vice Secretary of the Mechanical Engineering Exam Committee	Esther Vinken
Member, programme specialist	Ton Gielen
Member, specialist of part-time programmes	Jan van Schijndel
Secretarial support (administration office employee for the Mechanical Engineering programme), not a member of the Examination Board.	Gisela Greijmans