

**APPENDIX**

**to the**

**Degree Statute and Education and Examination Regulations  
for the Bachelor in Electrical and Electronic Engineering**

**2022-2023 academic year**

**Chapter 9 Description of the education (the units of study)**

Date of most recent adoption by dean	June 30, 2022
Date of most recent consent by school council	Juni 17, 2022
Date of most recent consent by degree committee	June 30, 2022

Date of adoption of amendment 1	not applicable
Date of adoption of amendment 2	not applicable

## 9 Description of the education (the units of study)

This chapter describes the education provided in your degree course in the form of a curriculum overview and description of the units of study, starting with the units of study in the propaedeutic phase and those in the minors. It also specifies whether the course offers modules and/or elective units.

Below is a schematic overview of the degree formats and tracks for the degree course.

<b>Name of degree course: Elektrotechniek / Electrical and Electronic Engineering</b>		
CROHO number: 34267		
Degree format	Full-time	Part-time
Language	Dutch and English	Dutch
Variants and tracks	Minors	Abridged from associate to bachelor degree Minors

Below is a schematic overview that gives you an overall impression of the degree course. It also indicates the units of study and modules contained in the degree course.

#### Overview of all units of study in the propaedeutic phase

semester	periode	code	naam	aantal studiepunten
1	1	e-ELT-1a-PRJa	Project 1a: Design and realization of an electronic product	5
1	1	e-ELT-1a-EEFa	Electrical Engineering Fundamentals Course A	5
1	1+2	e-ELT-1-EESa	Electrical Energy Systems Design Course A	5
1	1+2	e-ELT-1-ESDa	Electronic Systems Design Course A	5
1	2	e-ELT-1b-PRJb	Project 1b: Design and realization of an electronic product	5
1	2	e-ELT-1b-EEFb	Electrical Engineering Fundamentals Course B	5
2	3	e-ELT-2a-PRJ2a	Project 2a: Developing embedded and electric power systems	5
2	3	e-ELT-2a-EEFc	Electrical Engineering Fundamentals Course C	5
2	3+4	e-ELT-2-EESb	Electrical Energy Systems Design Course B	5
2	3+4	e-ELT-2-ESDb	Electronic Systems Design Course B	5
2	4	e-ELT-2b-PRJ2b	Project 2b: Developing embedded and electric power systems	5
2	4	e-ELT-2b-EEFd	Electrical Engineering Fundamentals Course D	5

#### Overview of all units of study in the post-propaedeutic phase

semester	periode	code	naam	aantal studiepunten
3	1+2	e-ELT-3PRJ	Project 3: Control Systems for Industrial and Power Systems	15
3	1+2	e-ELT-3CRS	Electronics Design, Signals and Systems course	15
4	3+4	e-ELT-4PRJ	Project 4: Industrial and Power Systems	15
4	3+4	e-ELT-4CRS	Course Power Systems	15
5		e-ELT-5STAGE	S5-Internship	30
6	3+4	e-ELT-6PLG	Industrial Control Systems (ICS) PLG	20
6	3+4	e-ELT-6CRS	Industrial Control Systems Course	10
7		Minor elective EEE offers the following minor:		
		e-M-POW/2	Power Minor - full time	30
8		e-ELT-8AFST	Graduation assignment	30

## 9.1 Units of study in the propaedeutic phase

Elektrotechniek - tabel 1 - e-ELT-1a-EEFa

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course A
Long English name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course A
Short Dutch name of unit of study (OSIRIS)	ELT S1a Fundamentals A
Short English name of unit of study (OSIRIS)	ELT S1a Fundamentals A
Alluris unit of study Dutch name	Electrical Engineering Fundamentals Course A
Alluris unit of study English name	Electrical Engineering Fundamentals Course A
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-1a-EEFa
Term	P1 S1
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	140
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	<ul style="list-style-type: none"> <li>• Basic mathematical skills</li> <li>• Basic knowledge of network analysis</li> <li>• Basic measurement skills for analysis of circuits.</li> </ul>
Exit qualifications	C1 Analysis (1) C3 Realisation (1) C5 Management (1) C7 Research (1)
Cohesion	
Mandatory participation	Nee (No)
Activities and/or instructional formats	
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• Electrical Engineering, Hambley, A.</li> </ul>
Required software / required materials	SOWISO - Licence for digital mathematics learning environment DMM RS Pro multimeter, via HAN.ADALM2k measurement module, via HAN.EE-sim simulation tool software.

Dutch name (modular) exam (OSIRIS)	Math 1: Wiskundige functies en differentiaalrekening
English name (modular) exam (OSIRIS)	Math 1: Mathematical functions and differential calculus
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Math 1: Wiskundige functies en differentiaalrekening
English name (modular) exam (Alluris)	Math 1: Mathematical functions and differential calculus
Alluris Code (modular) exam	MATH1-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student</p> <ol style="list-style-type: none"> <li>1. Can determine a graph of a power function (integer or fractional exponent).</li> <li>2. Can determine the inverse of a power function.</li> <li>3. Can determine graphs of exponential and logarithmic functions.</li> <li>4. Has mastered the calculation rules for logarithms.</li> <li>5. Has mastered the trigonometric ratios in a right-angled triangle, can express angles in degrees and radians.</li> <li>6. Can derive trigonometric ratios from the unit circle and has mastered the definition of trigonometric functions for a random angle.</li> <li>7 Can draw graphs of trigonometric functions.</li> <li>8. Can write periodic functions by means of a trigonometric function, draw the corresponding sine curve and determine its characteristic properties.</li> <li>9. Can find all solutions to a simple trigonometric comparison at a given interval.</li> <li>10. Can describe the behavioural change of a function by means of a differential quotient and calculate and interpret differential quotients, also from within a context problem.</li> <li>11. Can make use of the sum, difference, product, quotient lines for determining the derived function and its interpretation within a context.</li> </ol>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82MS calculator or Texas Instruments TI-30XB
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for	Registration for the modular exam through OSIRIS. The

exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken 1: DC Analyse</b>
English name (modular) exam (OSIRIS)	Networks Theory 1: DC Analysis
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken 1: DC Analyse
English name (modular) exam (Alluris)	Networks Theory 1: DC Analysis
Alluris Code (modular) exam	NET1-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Has knowledge of the definitions of the quantities of voltage, current, power and energy.</li> <li>• Handles references for quantities of voltage and current.</li> <li>• Applies Ohm's law and Kirchhoff's laws correctly.</li> <li>• Describes the network elements on the basis of voltage-current relationship.</li> <li>• Determines the correct currents and voltages in simple resistive networks.</li> <li>• Determines equivalent resistance to serial or parallel connection of resistance.</li> <li>• Applies the principle of current and voltage division.</li> <li>• Can apply systematic solving method, knows how to set up a correct system in node voltages.</li> <li>• Applies Norton's and Thévenin's theorem for determining a source equivalent circuit diagram.</li> <li>• Applies the superposition theorem in determining currents and voltages in linear networks.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.

Discussion and review	See Part 2 - 8.9.1 and 8.9.2.
<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken practicum 1: DC Analyse</b>
English name (modular) exam (OSIRIS)	Networks Lab 1: DC Analysis
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken practicum 1: DC Analyse
English name (modular) exam (Alluris)	Networks Lab 1: DC Analysis
Alluris Code (modular) exam	NETP1-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Can correctly implement diagrams that are linked to the theory of Networking 1.</li> <li>• Can make a correct assessment of the measured result.</li> <li>• Can connect the circuit in the correct manner.</li> <li>• Can measure correctly and record the measurements in a report.</li> <li>• Validates the measured results using the expected values and draws the right conclusions within this context.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 2 - e-ELT-1a-PRJ1a

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Project 1a: Ontwerpen en realiseren van een elektronisch product
Long English name of unit of study (OSIRIS)	Project 1a: Design and realization of an electronic product
Short Dutch name of unit of study (OSIRIS)	ELT S1a Project 1a
Short English name of unit of study (OSIRIS)	ELT S1a Project 1a
Alluris unit of study Dutch name	Project 1a: Ontwerpen en realiseren van een elektronisch product
Alluris unit of study English name	Project 1a: Design and realization of an electronic product
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-1a-PRJ1a
Term	P1 S1
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	140
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	
Mandatory participation	Nee (No)
Activities and/or instructional formats	Workshops, project meetings, project work and learning team sessions.
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• Project Management – A Practical Approach, Grit, R., Edition: 5</li> <li>• Elling, R., Andeweg, B., Swankhuizen, C. Report writing for readers with little time.</li> </ul>
Required software / required materials	Analog Devices ADALM2000 Advanced Active Learning ModuleCard set 'Engineering Methods Pack' EE-Sim circuit simulator (freeware)

	EasyEDA Online PCB Design Tool
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<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Project 1a</b>
English name (modular) exam (OSIRIS)	Project 1a
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Project 1a
English name (modular) exam (Alluris)	Project 1a
Alluris Code (modular) exam	PRJ1a-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	None
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Oral
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	2
Permitted resources	All materials needed for giving a demonstration.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. Professional products must be submitted digitally. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Professional Skills 1a: rapporteren</b>
English name (modular) exam (OSIRIS)	Professional Skills 1a: report
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Professional Skills 1a: rapporteren
English name (modular) exam (Alluris)	Professional Skills 1a: report
Alluris Code (modular) exam	SKILLS1a-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student reports in a professional manner to clients, lecturers and fellow students about the approach, preliminary and final results of projects. The professional report contains: <ul style="list-style-type: none"> <li>• The appropriate components.</li> </ul>

	<ul style="list-style-type: none"> <li>• Is well-structured.</li> <li>• Is logical and is written correctly.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P1 P2
Number of examiners	2
Permitted resources	All materials needed for demonstrating the professional product.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. Professional products must be submitted digitally. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 3 - e-ELT-1b-EEFb

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course B
Long English name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course B
Short Dutch name of unit of study (OSIRIS)	ELT S1b Fundamentals B
Short English name of unit of study (OSIRIS)	ELT S1b Fundamentals B
Alluris unit of study Dutch name	Electrical Engineering Fundamentals Course B
Alluris unit of study English name	Electrical Engineering Fundamentals Course B
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-1b-EEFb
Term	P2 S1
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	140
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	<ul style="list-style-type: none"> <li>• Simple calculations of electrical and magnetic fields within electrical engineering components.</li> <li>• Basic mathematical skills</li> <li>• Basic knowledge of network analysis</li> <li>• Basic measurement skills for analysis of circuits. •</li> </ul> Students work on their development together in learning teams.
Exit qualifications	C1 Analysis (1) C3 Realisation (1) C5 Management (1) C7 Research (1)
Cohesion	-
Mandatory participation	Nee (No)
Activities and/or instructional formats	None
Required literature / description of 'learning material'	Electrical Engineering, Hambley, A.
Required software / required materials	SOWISO - Licence for digital mathematics learning environment DMM RS Pro multimeter, via HAN.ADALM2k module EE-Sim simulation

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Math 2: Differentiaalrekening, vectoranalyse en complexe getallen en integreren</b>
English name (modular) exam (OSIRIS)	Math 2: Differential calculus, vector calculus and complex numbers and integral calculus
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Math 2: Differentiaalrekening, vectoranalyse en complexe getallen en integreren
English name (modular) exam (Alluris)	Math 2: Differential calculus, vector calculus and complex numbers and integral calculus
Alluris Code (modular) exam	MATH2-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ol style="list-style-type: none"> <li>1. Has mastered the chain rule for differentiating composite functions.</li> <li>2. Knows the relationship between primitive functions and differentiation and can use it to determine whether a function <math>F</math> is a primitive of a function <math>f</math>;</li> <li>3. Masters calculations related to addition, scalar multiplication and breaking down in unit vectors in relation to vectors from <math>R^2</math> and <math>R^3</math>.</li> <li>4. Can determine the length of vectors, the internal product for two vectors and the angle between two vectors.</li> <li>5. Can determine the external vector product for two vectors and can apply this in order to, for example, determine the force vector acting on a moving charged particle in a magnetic field.</li> <li>6. Can carry out mathematical calculations with complex numbers.</li> <li>7. Can use different notations (rectangular notation and modulus-argument notation).</li> <li>8. Can perform calculations (sums, differences, products, divisions and powers) in relation to complex numbers.</li> </ol>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Casio fx-82MS calculator or Texas Instruments TI-30XB. No graphical calculator.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam

from 1 February 2023 (via OSIRIS)	period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken 2: AC Analyse</b>
English name (modular) exam (OSIRIS)	Networks Theory 2: AC Analysis
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken 2: AC Analyse
English name (modular) exam (Alluris)	Networks Theory 2: AC Analysis
Alluris Code (modular) exam	NET2-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• The student describes the behaviour of network elements with their complex impedances (stationary, harmonic situation).</li> <li>• The student applies a systematic solution method for solving a network for the stationary, harmonic condition.</li> <li>• The student uses the complex calculation method correctly, knows how to determine impedances in the correct manner and can determine alternating current behaviour of a resistance capacitor and coil.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken practicum 2: AC Analyse</b>
English name (modular) exam (OSIRIS)	Networks Lab 2: AC Analysis
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken practicum 2: AC Analyse

English name (modular) exam (Alluris)	Networks Lab 2: AC Analysis
Alluris Code (modular) exam	NETP2-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Can correctly implement diagrams that are linked to the theory of Networking 2.</li> <li>• Can make a correct assessment of the measured result.</li> <li>• Can connect the circuit in the correct manner.</li> <li>• Can measure correctly and record the measurements in a report.</li> <li>• Validates the measured results using the expected values and draws the right conclusions within this context.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 4 - e-ELT-1b-PRJ1b

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Project 1b: Ontwerpen en realiseren van een elektronisch product
Long English name of unit of study (OSIRIS)	Project 1b: Design and realization of an electronic product
Short Dutch name of unit of study (OSIRIS)	ELT S1b Project 1b
Short English name of unit of study (OSIRIS)	ELT S1b Project 1b
Alluris unit of study Dutch name	Project 1b: Ontwerpen en realiseren van een elektronisch product
Alluris unit of study English name	Project 1b: Design and realization of an electronic product
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-1b-PRJ1b
Term	P2 S1
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	140
Unit of study entry requirements	Projects 1a and 1b together form 1 project, but it has been split into two 5 ECTS credit parts for administrative reasons. The knowledge from Project 1a is applied in Project 1b (professional product). Students are assumed to have the knowledge and skills covered in Project 1a.
<b>Content and organisation</b>	
General description	
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	
Mandatory participation	Nee (No)
Activities and/or instructional formats	Workshops, project meetings, project work and learning team sessions.
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• Project Management – A Practical Approach, Grit, R., Edition: 5</li> <li>• Elling, R., Andeweg, B., Swankhuizen, C. Report writing for readers with little time.</li> </ul>

Required software / required materials	Analog Devices ADALM2000 Advanced Active Learning ModuleCard set 'Engineering Methods Pack' EE-Sim circuit simulator (freeware) EasyEDA Online PCB Design Tool
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<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Leerteam 1</b>
English name (modular) exam (OSIRIS)	Learning Team 1
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Leerteam 1
English name (modular) exam (Alluris)	Learning Team 1
Alluris Code (modular) exam	LT1-V
Assessment dimensions or learning outcomes	Student shows how he has developed personally, content related and professionally and he controls how to give effect to his own learning process
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Can evaluate S1 and reflect on himself.</li> <li>• Can name several points for development for S2 on the basis of feedback received in S1 and (self) reflection on this.</li> <li>• Can convert points for development into learning objectives.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	All materials needed to compile a portfolio.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Project 1b</b>
English name (modular) exam (OSIRIS)	Project 1b
OSIRIS Code (modular) exam	-
Dutch name (modular) exam	Project 1b

(Alluris)	
English name (modular) exam (Alluris)	Project 1b
Alluris Code (modular) exam	PRJ1b-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	None
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written Oral
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	2
Permitted resources	All materials needed for giving a presentation and demonstration.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Professional Skills 1b: presenteren</b>
English name (modular) exam (OSIRIS)	Professional Skills 1b: present
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Professional Skills 1b: presenteren
English name (modular) exam (Alluris)	Professional Skills 1b: present
Alluris Code (modular) exam	SKILLS1b-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• The student prepares the individual project presentation using a planned approach, this is based on audience questions.</li> <li>• And structured in: opening body close and links the subject of the presentation to its audience and adapts its content accordingly.</li> <li>• The student gives an individual presentation: <ul style="list-style-type: none"> <li>• The student clearly expresses the point/message of the presentation.</li> <li>• Explains why this topic is of interest to the audience of engineers.</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• Starts the presentation with an original opening that grabs the audience's attention.</li> <li>• Ends with a strong close.</li> <li>• Manages to give a compelling presentation of the content of the topic.</li> <li>• Uses appropriate nonverbal communication (tone of voice, eye contact, posture, pace) to support the presentation.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written Oral
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 5 - e-ELT-1-EESa

<b>General information</b>	
Changes compared to previous academic year	No changes
Long Dutch name of unit of study (OSIRIS)	Electrical Energy Systems Design Course A
Long English name of unit of study (OSIRIS)	Electrical Energy Systems Design Course A
Short Dutch name of unit of study (OSIRIS)	ELT 1 Electrical Energy Systems Design A
Short English name of unit of study (OSIRIS)	ELT 1 Electrical Energy Systems Design A
Alluris unit of study Dutch name	Electrical Energy Systems Design Course A
Alluris unit of study English name	Electrical Energy Systems Design Course A
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-1-EESa
Term	P1 P2 S1
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	30 uur
Unit of study entry requirements	Not applicable
<b>Content and organisation</b>	
General description	None
Exit qualifications	C1 Analysis (1) C2 Design (1)
Cohesion	None
Mandatory participation	Nee (No)
Activities and/or instructional formats	None
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• Electrical Engineering, Hambley, A.</li> <li>• Electrical Power System Essentials, second edition, edited by Wiley</li> </ul>
Required software / required materials	-

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Elektromagnetisme</b>
English name (modular) exam (OSIRIS)	Electromagnetism
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektromagnetisme
English name (modular) exam (Alluris)	Electromagnetism

Alluris Code (modular) exam	MAGN-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• correctly calculates the magnetic field, flux density and magnetic flux of a current or coil.</li> <li>• calculates forces on currents and induced voltages correctly.</li> <li>• calculates a given magnetic circuit correctly.</li> <li>• calculates the self-inductance and mutual inductance of coils correctly.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Duurzaam Elektriciteitsnet</b>
English name (modular) exam (OSIRIS)	Sustainable Electricity Grid
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Duurzaam Elektriciteitsnet
English name (modular) exam (Alluris)	Sustainable Electricity Grid
Alluris Code (modular) exam	SusGrid-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	None
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Oral
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2

Number of examiners	1
Permitted resources	-
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	

Elektrotechniek - tabel 6 - e-ELT-1-ESDa

<b>General information</b>	
Changes compared to previous academic year	None
Long Dutch name of unit of study (OSIRIS)	Electronic Systems Design Course A
Long English name of unit of study (OSIRIS)	Electronic Systems Design Course A
Short Dutch name of unit of study (OSIRIS)	ELT S1 Electronic Systems Design A
Short English name of unit of study (OSIRIS)	ELT S1 Electronic Systems Design A
Alluris unit of study Dutch name	Electronic Systems Design Course A
Alluris unit of study English name	Electronic Systems Design Course A
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-1-ESDa
Term	P1 P2 S1
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	30 uur
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	None
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C7 Research (1)
Cohesion	None
Mandatory participation	Nee (No)
Activities and/or instructional formats	None
Required literature / description of 'learning material'	Electrical Engineering, Hambley, A.
Required software / required materials	EE-Sim circuit simulator Analog Devices ADALM2000 Advanced Active Learning Module
<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Digitale circuits - Talstelsels en digitale logica</b>
English name (modular) exam (OSIRIS)	Digital circuits - Number systems and digital logic
OSIRIS Code (modular) exam	-

Dutch name (modular) exam (Alluris)	Digitale circuits - Talstelsels en digitale logica
English name (modular) exam (Alluris)	Digital circuits - Number systems and digital logic
Alluris Code (modular) exam	DIGCIR-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	None
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	None.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Elektronica Basics Practicum</b>
English name (modular) exam (OSIRIS)	Electronics Basics Lab
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektronica Basics Practicum
English name (modular) exam (Alluris)	Electronics Basics Lab
Alluris Code (modular) exam	ELBasL-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Applies knowledge of ELBas-V to the realisation or simulation of practical circuits.</li> <li>• Can correctly implement diagrams that are linked to the theory of ELBas.</li> <li>• Can make a correct assessment of the measured result. • Can connect the circuit in the correct manner.</li> <li>• Can measure correctly and record the measurements in a report.</li> <li>• Validates the measured results using the expected values and draws the right conclusions within this context.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product)

	Individual assessment Oral
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Elektronica Basics</b>
English name (modular) exam (OSIRIS)	Electronics Basics
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektronica Basics
English name (modular) exam (Alluris)	Electronics Basics
Alluris Code (modular) exam	ELBas-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Knows the basic properties of the diode, Zener diode, transistor and the operational amplifier (OPAMP).</li> <li>• Using these components, designs circuits such as rectifiers, voltage regulators, controlled switches, inverting and non-inverting amplifiers.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.

Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Programmable Logic Controllers</b>
English name (modular) exam (OSIRIS)	Programmable Logic Controllers
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Programmable Logic Controllers
English name (modular) exam (Alluris)	Programmable Logic Controllers
Alluris Code (modular) exam	PLC-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• The student has an understanding of the concepts and possibilities of a PLC and uses these to work out a well-defined control problem.</li> <li>• The student has knowledge of the IEC- 61131 implementations of ladder logic, function block diagrams and structured text and uses this to write a PLC program in one or more of these methods.</li> <li>• The student understands the use of basic operators and function blocks in PLC programs including Boolean operators, mathematical operators and timer-, trigger- and counter-function blocks and applies this in the compilation and execution of PLC programs.</li> <li>• The student tests PLC programs both through simulations and 'on target'.</li> <li>• The student applies the knowledge of PLC programming in writing and controlling the physical models and modules in a real-time practical.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 7 - e-ELT-2a-EEFc

<b>General information</b>	
Changes compared to previous academic year	None
Long Dutch name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course C
Long English name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course C
Short Dutch name of unit of study (OSIRIS)	ELT S2a Fundamentals C
Short English name of unit of study (OSIRIS)	ELT S2a Fundamentals C
Alluris unit of study Dutch name	Electrical Engineering Fundamentals Course C
Alluris unit of study English name	Electrical Engineering Fundamentals Course C
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-2a-EEFc
Term	P3 S2
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	Theory course in basic knowledge and skills. This unit of study comprises courses and/or labs in mathematics, networking and coaching, thus providing knowledge and skills that are needed to some extent to carry out the project.
Exit qualifications	C1 Analysis (1) C3 Realisation (1) C5 Management (1) C7 Research (1)
Cohesion	None
Mandatory participation	Practicals are mandatory
Activities and/or instructional formats	None
Required literature / description of 'learning material'	Electrical Engineering, Hambley, A.
Required software / required materials	SOWISO - Licence for digital mathematics learning environment DMM RS Pro multimeter, via HAN.
<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Math 3: Integraalrekening</b>
English name (modular) exam (OSIRIS)	Math 3: Integral Calculus

OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Math 3: Integraalrekening
English name (modular) exam (Alluris)	Math 3: Integral Calculus
Alluris Code (modular) exam	MATH3-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: 1. Can determine the primitive of simple functions. 2. Can determine the primitive of functions by using calculation rules: the sum, difference and multitude rules, also when the integrand is of the $f(a \cdot x + b)$ type. 3. Can determine a primitive using a table of standard primitives. 4. Can determine a primitive using the substitution method. 5. Can determine a primitive using partial integration. 6. Can determine a primitive using fraction decomposition. 7. Can determine the surface area between a graph and the x-axis with the aid of a definite integral. 8. Can determine the area between two graphs.
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken 3: Passieve en Actieve Filters</b>
English name (modular) exam (OSIRIS)	Networks Theory 3: Passive and Active Filters
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken 3: Passieve en Actieve Filters
English name (modular) exam (Alluris)	Networks Theory 3: Passive and Active Filters

Alluris Code (modular) exam	NET3-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: 1. Has knowledge of the higher harmonics in a periodic signal. 2. Can explain the meaning of the term 'transfer function'. 3. Sets the transfer as determined (indicated) in a first-order network. 4. Determines the Bode diagram in relation to a first-order transfer and calculates the logarithmic frequency scale. 5. Can determine a second order network, transmission, resonant frequency, bandwidth, quality factor and filter type for the series resonance circuit. 6. Determines the Bode diagram for each type of second-order transfer, clearly giving the cut-off points of asymptotes and characteristic values such as the maximum and knows how to use a logarithmic frequency scale correctly. 7. Designs 1st order active filters, differentiators and integrators using OPAMPS and knows the advantages in comparison to passive filters.
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken practicum 3: Passieve en Actieve Filters</b>
English name (modular) exam (OSIRIS)	Networks Lab 3: Passieve en Actieve Filters
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken practicum 3: Passieve en Actieve Filters
English name (modular) exam (Alluris)	Networks Lab 3: Passieve en Actieve Filters
Alluris Code (modular) exam	NETP3-V

Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Can correctly implement diagrams that are linked to the theory of Networking 3.</li> <li>• Can make a correct assessment of the measured result.</li> <li>• Can connect the circuit in the correct manner.</li> <li>• Can measure correctly and record the measurements in a report.</li> <li>• Validates the measured results using the expected values and draws the right conclusions within this context.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	None.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 8 - e-ELT-2a-PRJ2a

<b>General information</b>	
Changes compared to previous academic year	Geen
Long Dutch name of unit of study (OSIRIS)	Project 2a: Ontwikkeling van embedded en elektrische energiesystemen
Long English name of unit of study (OSIRIS)	Project 2a Developing embedded and electric power systems
Short Dutch name of unit of study (OSIRIS)	ELT S2a Project 2a
Short English name of unit of study (OSIRIS)	ELT S2a Project 2a
Alluris unit of study Dutch name	Project 2a: Ontwikkeling van embedded en elektrische energiesystemen
Alluris unit of study English name	Project 2a Developing embedded and electric power systems
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-2a-PRJ2a
Term	P3 S2
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	3-4
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	
Mandatory participation	Nee (No)
Activities and/or instructional formats	Workshops, project meetings, project work and learning team sessions.
Required literature / description of 'learning material'	• Project Management – A Practical Approach, Grit, R., Edition: 5.
Required software / required materials	Microcontroller development kit (via HAN)Analog Devices ADALM2000 Advanced Active Learning ModuleCard set 'EngineeringMethods Pack'EE-Sim circuit simulator (freeware)EasyEDA Online PCB Design Tool

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Project 2a</b>
English name (modular) exam (OSIRIS)	Project 2a
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Project 2a
English name (modular) exam (Alluris)	Project 2a
Alluris Code (modular) exam	PRJ2a-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student works in a project group to design a product that is controlled by a microcontroller and that is related to power/energy.</p> <p>The group works in a project-based manner (holds regular consultations, establishes agreements, divides tasks, etc.)</p> <p>The group provides a formal and functional description of the product to be designed and defines the specifications unambiguously.</p> <p>The group makes a block diagram of the architecture of the product and names the functionality and mutual coherence for each subsystem.</p> <p>The group makes a test plan of the product and of the subsystems that make up the product.</p> <p>The group creates a user manual of the product.</p>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Group assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	2
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Professional Skills 2a: vergaderen</b>
English name (modular) exam (OSIRIS)	Professional Skills 2a: meetings

OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Professional Skills 2a: vergaderen
English name (modular) exam (Alluris)	Professional Skills 2a: meetings
Alluris Code (modular) exam	SKILLS2a-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• The student writes an individual informative text with: the tasks, roles and responsibilities of the chair, minute-taker and participants account of the importance of structured meetings with the BOB and ODAT methods a reflection on his/her own role in project group meetings (written in first person 'I') possible improvements for the meeting.</li> <li>• The student drafts agenda items in the agenda format provided. Agenda items contain: subject, purpose and time required.</li> <li>• The student substantiates project decisions once using the minutes format provided. These minutes contain: decisions and their argumentation clearly formulate action points (SMART).</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 9 - e-ELT-2b-EEFd

<b>General information</b>	
Changes compared to previous academic year	None
Long Dutch name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course D
Long English name of unit of study (OSIRIS)	Electrical Engineering Fundamentals Course D
Short Dutch name of unit of study (OSIRIS)	ELT S2b Fundamentals D
Short English name of unit of study (OSIRIS)	ELT S2b Fundamentals D
Alluris unit of study Dutch name	Electrical Engineering Fundamentals Course D
Alluris unit of study English name	Electrical Engineering Fundamentals Course D
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-2b-EEFd
Term	P4 S2
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	Theory course in basic knowledge and skills. This unit of study comprises courses and/or labs in mathematics, networking and coaching, thus providing knowledge and skills that are needed to some extent to carry out the project. In a final week, students get an overview of their own discipline and beyond.
Exit qualifications	C1 Analysis (1) C3 Realisation (1) C5 Management (1) C7 Research (1)
Cohesion	None
Mandatory participation	Practicals are mandatory
Activities and/or instructional formats	None
Required literature / description of 'learning material'	Electrical Engineering, Hambley, A.
Required software / required materials	SOWISO - Licence for digital mathematics learning environment DMM RS Pro multimeter, via HAN.
<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Math 4: Differentiaalvergelijkingen en Laplacetransformatie</b>
English name (modular) exam	Math 4: Differential Equations and Laplace Transform

(OSIRIS)	
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Math 4: Differentiaalvergelijkingen en Laplacetransformatie
English name (modular) exam (Alluris)	Math 4: Differential Equations and Laplace Transform
Alluris Code (modular) exam	MATH4-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: 1. Can specify the order and degree of a differential equation. 2. Can solve a differential equation by applying the method of separation of variables. 3. Can calculate the integration constant for an initial value problem. 4. Can apply resolving a differential equation to an electrical engineering problem. 5. Can transform functions in the time domain to the s-domain using Laplace transform. 6. Can determine Laplace transforms using a table of Laplace transforms. 7. Can apply properties of Laplace transforms. 8. Can solve a differential equation using a Laplace transform.
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken 4: Schakelverschijnselen</b>
English name (modular) exam (OSIRIS)	Networks Theory 4: Transient Responses
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken 4: Schakelverschijnselen
English name (modular) exam	Networks Theory 4: Transient Responses

(Alluris)	
Alluris Code (modular) exam	NET4-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• The student sets up the differential equation for a current or voltage in a 1st-order RC or RL network.</li> <li>• The student can determine the static condition of a network.</li> <li>• The student determines values of currents or voltages in a network.</li> <li>• The student determines the general solution of the differential equation prepared under 1 for the situation where a source with a constant or harmonic source function is connected to <math>t=0</math> s.</li> <li>• The student determines the initial conditions necessary for solving the differential equation prepared under 1 and processes it in the solution.</li> <li>• The student draws a clear graph for a requested current or voltage for the situation in which a source with constant source function is connected and clearly indicates the characteristic values on the axes.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Netwerken practicum 4: Schakelverschijnselen</b>
English name (modular) exam (OSIRIS)	Networks Lab 4: Transient Responses
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Netwerken practicum 4: Schakelverschijnselen
English name (modular) exam (Alluris)	Networks Lab 4: Transient Responses
Alluris Code (modular) exam	NETP4-V
Assessment dimensions or learning outcomes	Not applicable.

Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Can correctly implement diagrams that are linked to the theory of Networking 4.</li> <li>• Can make a correct assessment of the measured result.</li> <li>• Can connect the circuit in the correct manner.</li> <li>• Can measure correctly and record the measurements in a report.</li> <li>• Validates the measured results using the expected values and draws the right conclusions within this context.</li> </ul>
Exam and modular exam format(s)	<p>PD ((Professional)Product) Individual assessment Written</p>
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	None.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 10 - e-ELT-2b-PRJ2b

<b>General information</b>	
Changes compared to previous academic year	None
Long Dutch name of unit of study (OSIRIS)	Project 2b: Ontwikkeling van embedded en elektrische energiesystemen
Long English name of unit of study (OSIRIS)	Project 2b: Developing embedded and electric power systems
Short Dutch name of unit of study (OSIRIS)	ELT S2b Project 2b
Short English name of unit of study (OSIRIS)	ELT S2b Project 2b
Alluris unit of study Dutch name	Project 2b: Ontwikkeling van embedded en elektrische energiesystemen
Alluris unit of study English name	Project 2b: Developing embedded and electric power systems
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-2b-PRJ2b
Term	P4 / S2
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	3-4
Unit of study entry requirements	Projects 2a and 2b together form 1 project, but it has been split into two 5 ECTS credit parts for administrative reasons. The knowledge from Project 2a is applied in Project 2b (professional product). Students are assumed to have the knowledge and skills covered in Project 2a.
<b>Content and organisation</b>	
General description	
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	
Mandatory participation	Nee (No)
Activities and/or instructional formats	Workshops, project meetings, project work and learning team sessions.
Required literature / description of 'learning material'	• Project Management – A Practical Approach, Grit, R., Edition: 5.
Required software / required materials	Microcontroller development kit (via HAN) Analog Devices ADALM2000 Advanced Active Learning ModuleCard set 'EngineeringMethods Pack' EE-Sim circuit simulator (freeware) EasyEDA Online PCB Design Tool

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Leerteam 2</b>
English name (modular) exam (OSIRIS)	Learning Team 2
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Leerteam 2
English name (modular) exam (Alluris)	Learning Team 2
Alluris Code (modular) exam	LT2-V
Assessment dimensions or learning outcomes	Student shows how he has developed personally, content related and professionally and he controls how to give effect to his own learning process.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Can evaluate on S2 and reflect on himself.</li> <li>• Can name several development points for S3 on the basis of feedback received in S2 and (self) reflection on this.</li> <li>• Can convert development points into SMART-formulated learning goals.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Project 2b</b>
English name (modular) exam (OSIRIS)	Project 2b
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Project 2b
English name (modular) exam (Alluris)	Project 2b
Alluris Code (modular) exam	PRJ2b-V
Assessment dimensions or learning outcomes	Not applicable.

Assessment criteria	The student makes a technical design for a product specified in block 3. The design meets the technical quality requirements discussed in the courses. The technical design is made and is well tested according to a predefined test plan. The delivered product meets the specifications. The student works together in the group in a project-based manner, as discussed under professional skills.
Exam and modular exam format(s)	PD ((Professional)Product) PA (Participation) Individual assessment Group assessment Written Oral
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	2
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Professional Skills 2b: Schrijfvaardigheid</b>
English name (modular) exam (OSIRIS)	Professional Skills 2b: Writing Skills
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Professional Skills 2b: Schrijfvaardigheid
English name (modular) exam (Alluris)	Professional Skills 2b: Writing Skills
Alluris Code (modular) exam	SKILLS2b-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student produces via and efficient professional approach to writing a clear well-structured professional reports (cv and motivation letter) which in terms of content and language is attuned to the reader and meets to requirements of reporting. 1. CV is up to date and contains the elements personal details, personal profile, education, work experience and hobbies. 2. Motivation letter is written correctly, has an appealing

	opening and close, refers to the CV and is in line with the vacancy.
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 11 - e-ELT-2-EESb

<b>General information</b>	
Changes compared to previous academic year	None
Long Dutch name of unit of study (OSIRIS)	Electrical Energy Systems Design Course B
Long English name of unit of study (OSIRIS)	Electrical Energy Systems Design Course B
Short Dutch name of unit of study (OSIRIS)	ELT S2 Electr. Energy Systems Design B
Short English name of unit of study (OSIRIS)	ELT S2 Electr. Energy Systems Design B
Alluris unit of study Dutch name	Electrical Energy Systems Design Course B
Alluris unit of study English name	Electrical Energy Systems Design Course B
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-2-EESb
Term	P3 P4 S2
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	-
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	None
Exit qualifications	C1 Analysis (1)  C2 Design (1)
Cohesion	None
Mandatory participation	Nee (No)
Activities and/or instructional formats	None
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• Electrical Engineering, Hambley, A.</li> <li>• Notes Physics (Mechanics); van de Eijnden/de Jongh/Ypma; March 14, 2017 (digital)</li> </ul>
Required software / required materials	-

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Elektrische Machines</b>
English name (modular) exam (OSIRIS)	Electrical Machines
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektrische Machines

English name (modular) exam (Alluris)	Electrical Machines
Alluris Code (modular) exam	MACH-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• correctly describes the specificities of DC machines, synchronous and asynchronous machines.</li> <li>• calculates correctly with ideal and non-ideal single-phase transformers in simple applications.</li> <li>• calculates static operating points of a DC machine correctly.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Mechanica</b>
English name (modular) exam (OSIRIS)	Mechanics
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Mechanica
English name (modular) exam (Alluris)	Mechanics
Alluris Code (modular) exam	MEC-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student <ul style="list-style-type: none"> <li>• correctly decomposes forces on objects in simple applications.</li> <li>• calculates translation and rotational movements correctly.</li> <li>• calculates correctly with moments of inertia and reductions in simple applications</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment

	Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Casio fx-82calculator (all models), fx-991 all models or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 12 - e-ELT-2-ESDb

<b>General information</b>	
Changes compared to previous academic year	Two exams instead of one (at the end of both blocks, students have to work out an assignment).
Long Dutch name of unit of study (OSIRIS)	Electronic Systems Design Course B
Long English name of unit of study (OSIRIS)	Electronic Systems Design Course B
Short Dutch name of unit of study (OSIRIS)	ELT S2 Electronic Systems Design B
Short English name of unit of study (OSIRIS)	ELT S2 Electronic Systems Design B
Alluris unit of study Dutch name	Electronic Systems Design Course B
Alluris unit of study English name	Electronic Systems Design Course B
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-2-ESDb
Term	P3 P4 S2
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	5
Study load in hours	140
Contact hours	-
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	None
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C7 Research (1)
Cohesion	None
Mandatory participation	Nee (No)
Activities and/or instructional formats	None
Required literature / description of 'learning material'	-
Required software / required materials	Microcontroller development kit (via HAN)

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Microcontroller Programmeren 1</b>
English name (modular) exam (OSIRIS)	Microcontroller Programming 1
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Microcontroller Programmeren 1

English name (modular) exam (Alluris)	Microcontroller Programming 1
Alluris Code (modular) exam	MIC1-V
Assessment dimensions or learning outcomes	None
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Defines an application for an Arduino microcontroller in which a sensor, actuator and the serial monitor are applied</li> <li>• The student makes a flow chart of the application specified by him</li> <li>• Creates a microcontroller program from its specified application applying prescribed style and programming guidelines.</li> <li>• The student tests the application specified by him according to a predefined test procedure.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3
Number of examiners	1
Permitted resources	None
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	None

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Microcontroller Programmeren 2</b>
English name (modular) exam (OSIRIS)	Microcontroller Programming 2
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Microcontroller Programmeren 2
English name (modular) exam (Alluris)	Microcontroller Programming 2
Alluris Code (modular) exam	MIC2-V
Assessment dimensions or learning outcomes	n.v.t.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Defines an application for an Arduino microcontroller that implements functions, pointers, arrays and uses external libraries.</li> <li>• Applies prescribed style and programming guidelines to achieve a high readability and clear structure of a program that guarantees good portability.</li> </ul>

	<ul style="list-style-type: none"> <li>• Designs and documents the required (state) behavior on the basis of a functional description of a simple control implementation and debugs a program based on the above design, using the (smart) sensors, actuators and libraries available within the makers community.</li> <li>• The student tests the application specified by him according to a predefined test procedure.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment None
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	None
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	None

## 9.2 Units of study in the post-propaedeutic phase

Elektrotechniek - tabel 13 - e-ELT-3CRS

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Electronics Design, Signals and Systems course
Long English name of unit of study (OSIRIS)	Electronics Design, Signals and Systems course
Short Dutch name of unit of study (OSIRIS)	ELT S3 Electronics Design
Short English name of unit of study (OSIRIS)	ELT S3 Electronics Design
Alluris unit of study Dutch name	Electronics Design, Signals and Systems course
Alluris unit of study English name	Electronics Design, Signals and Systems course
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-3CRS
Term	P1 P2 S3
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	15
Study load in hours	420
Contact hours	Geprogrammeerde contacttijd 142 uur.
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	Theory course in basic knowledge and skills. This unit of study comprises courses and/or labs on electronics and control engineering, thus providing knowledge and skills that are needed to some extent to carry out the control engineering project.
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C7 Research (1)
Cohesion	The other unit of study in semester 3 is more or less related to this unit of study. (See also curriculum diagram).
Mandatory participation	Nee (No)
Activities and/or instructional formats	Theory lessons and labs.
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• 9781292014388, Data and Computer Communications, International Edition, Stallings, W.</li> <li>• 9781292222998, Electronic Devices, Conventional Current Version, Tenth Ed., Global Ed., Floyd, Thomas L.,</li> </ul>

	<p>Pearson Education Limited</p> <ul style="list-style-type: none"> <li>• 9781292223124, Electrical Engineering, Principles &amp; Applications, Seventh Ed., Global Ed., Hambley, Allan R., Pearson Education Limited</li> <li>• 9781292274522 Feedback Control of Dynamic Systems, Global Edition, Franklin, Gene F., Edition: 8.</li> </ul>
Required software / required materials	EE sim, Matlab/Simulink

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Regeltechniek</b>
English name (modular) exam (OSIRIS)	Control Systems
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Regeltechniek
English name (modular) exam (Alluris)	Control Systems
Alluris Code (modular) exam	CS-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• describes the distinction between drive and control and can draw up a block diagram for a control and, if required, simplify it.</li> <li>• describes the effect of feedback control and provide the structure of a control circuit.</li> <li>• sets the feedback control in such a way that the set system specifications such as phase and gain margin and/or static error, overshoot and settling time are met.</li> <li>• is capable in using design and simulation tools for designing and tuning controllers and making plausible that this controller functions according to the specifications.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Datacommunicatie 1</b>
English name (modular) exam (OSIRIS)	Data Communication 1
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Datacommunicatie 1
English name (modular) exam (Alluris)	Data Communication 1
Alluris Code (modular) exam	DCM1-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Describes media, modulation methods and protocols of the physical tier.</li> <li>• Describes the consequences of noise and bandwidth restriction.</li> <li>• Relates the bit error rate to message size and efficient use of the connection.</li> <li>• Knows various methods of data transport (synchronous and asynchronous) and the different ways of coding.</li> <li>• Knows the methods of error detection, error correction and data compression.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Datacommunicatie 2</b>
English name (modular) exam (OSIRIS)	Data Communication 2
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Datacommunicatie 2
English name (modular) exam	Data Communication 2

(Alluris)	
Alluris Code (modular) exam	DCM2-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Describes the most important standardised WAN or LAN protocols of the data link tier.</li> <li>• Describes the network tier with the related problems with regard to routing, segmenting/ reassembling and congestion control.</li> <li>• Describes the transmission tier protocols TCP and UDP and knows when connection oriented and connectionless connections are used.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Datacommunicatie Lab</b>
English name (modular) exam (OSIRIS)	Data Communication Lab
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Datacommunicatie Lab
English name (modular) exam (Alluris)	Data Communication Lab
Alluris Code (modular) exam	DCML-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Analyses error situation with regard to data transmission.</li> <li>• Gives an indication of the cause of data communication problems.</li> <li>• Analyses a data communication protocol when use is made of error detection and correction and data compression.</li> </ul>

	<ul style="list-style-type: none"> <li>• Gives a calculation of the transmission time of a quantity of data and measures the real time.</li> <li>• Investigates which addresses are used for a specific TCP/IP connection.</li> <li>• Investigates which tiers play a part in relation to a TCP/IP connection.</li> <li>• Determines how the routing works in relation to a TCP/IP connection.</li> <li>• Analyses setting up a connection-oriented connection in relation to TCP/IP.</li> <li>• Reports on the application of a TCP/IP stack on an embedded system.</li> <li>• Indicates in which way a performance improvement is possible for a specific system.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Elektronica 1</b>
English name (modular) exam (OSIRIS)	Electronics 1
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektronica 1
English name (modular) exam (Alluris)	Electronics 1
Alluris Code (modular) exam	ELC1-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• knows the properties of the different semiconductor switches and can apply and dimension the components in different basic circuits;</li> <li>• can extract the basic switch data from the data sheets;</li> <li>• Knows the basic properties of the opamp and can use it</li> </ul>

	to design an amplifier.
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Elektronica 2</b>
English name (modular) exam (OSIRIS)	Electronics 2
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektronica 2
English name (modular) exam (Alluris)	Electronics 2
Alluris Code (modular) exam	ELC2-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• is familiar with various amplifier circuits that can be made with an opamp;</li> <li>• can dimension the components around the opamp so that the circuit meets the given specifications;</li> <li>• can design first and higher order filters using opamp circuits;</li> <li>• knows the differences between Butterworth, Chebyshev and Bessel filters and knows when to use which filter;</li> <li>• can design linear and switching power supplies using data sheets;</li> <li>• can describe the functioning of a harmonic oscillator and calculate the oscillation frequency and minimum gain.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5

Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Practicum Elektronica</b>
English name (modular) exam (OSIRIS)	Electronics Lab
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Practicum Elektronica
English name (modular) exam (Alluris)	Electronics Lab
Alluris Code (modular) exam	ELCL-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• applies knowledge of ELC1 and ELC2 to the realisation of practical circuits;</li> <li>• can correctly implement diagrams that are linked to the theory of ELC;</li> <li>• can make a correct assessment of the measured result;</li> <li>• can connect the circuit in the correct manner;</li> <li>• can measure correctly and record the measurements in a report;</li> <li>• validates the measured results using the expected values and draws the right conclusions within this context.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Group assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.

Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Systeembeschrijvingen</b>
English name (modular) exam (OSIRIS)	System Descriptions
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Systeembeschrijvingen
English name (modular) exam (Alluris)	System Descriptions
Alluris Code (modular) exam	SD-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• analyses a physical system in the electrical, mechanical and/or process-technological domains. You have made a system structure diagram for the analysis of which a white-box model has been set up via the structured definition of differential equations.</li> <li>• is able to transform this differential equation to the frequency domain into a transfer function.</li> <li>• has realised a simulation diagram of this model with which you have performed relevant experiments to investigate system behaviour. You have made the correctness of the model plausible by considering the simulation results.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 14 - e-ELT-3PRJ

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Project 3: Industrial and Power Systems Regeltechniek
Long English name of unit of study (OSIRIS)	Project 3: Control Systems for Industrial and Power Systems
Short Dutch name of unit of study (OSIRIS)	ELT S3 Project 3
Short English name of unit of study (OSIRIS)	ELT S3 Project 3
Alluris unit of study Dutch name	Project 3: Industrial and Power Systems Regeltechniek
Alluris unit of study English name	Project 3: Control Systems for Industrial and Power Systems
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-3PRJ
Term	P1 P2 S3
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	15
Study load in hours	420
Contact hours	Geprogrammeerde contacttijd 224 uur.
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	Project. The students work on designing and/or building a product or prototype and thereby develop professional and practical skills. The project can be carried out in a mono-disciplinary, bi-disciplinary or multidisciplinary way, either at HAN or on location. The project involves designing a system in which control engineering and electronics are essential elements.
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	The other unit of study in semester 3 is more or less related to this unit of study. (See also curriculum diagram).
Mandatory participation	Nee (No)
Activities and/or instructional formats	Project work.
Required literature / description of	Project Management – A Practical Approach, Grit, R.,

'learning material'	Edition: 5.
Required software / required materials	Card set 'Engineering Methods Pack'.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Project 3</b>
English name (modular) exam (OSIRIS)	Project 3
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Project 3
English name (modular) exam (Alluris)	Project 3
Alluris Code (modular) exam	PRJ3-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• Students are able to carry out a project with students from another degree course.</li> <li>• Students possess the basic skills in (written) communication, consultation, reflection and cooperation.</li> <li>• Student designs, improves, measures and/or realises a product in which measurement and control technology, communication systems and/or interface electronics are used.</li> <li>• Describes the (technical) results belonging to the phases within the V model (Action plan, User/Functional/Technical Requirements, High- Level/Detail design, Realisation, Tests).</li> <li>• The student actively applies themselves to the task of achieving the project objectives.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Group assessment Written Oral
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P3
Number of examiners	2
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam</b>	<b>Professional Skills 3</b>
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<b>(OSIRIS)</b>	
English name (modular) exam (OSIRIS)	Professional Skills 3
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Professional Skills 3
English name (modular) exam (Alluris)	Professional Skills 3
Alluris Code (modular) exam	SKILLS3-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Uses an efficient writing plan to write a clearly structured text (e.g. an action plan, memo and/or summary) that is attuned to the reader in terms of both content and language.</li> <li>• Gives a structured individual presentation about a critical choice in the project and underpins that choice with convincing arguments.</li> <li>• Thinks critically about the project and about own performance (type 2 thinking).</li> <li>• Answers critical questions clearly. produces level 2 project activities in meeting, presentation, collaboration and reflection.</li> <li>• Reflects on own learning goals.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written Oral
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P2 P3
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 15 - e-ELT-4CRS

<b>General information</b>	
Changes compared to previous academic year	Workshop EMC is added
Long Dutch name of unit of study (OSIRIS)	Course Power Systems
Long English name of unit of study (OSIRIS)	Course Power Systems
Short Dutch name of unit of study (OSIRIS)	ELT S4 Power Systems
Short English name of unit of study (OSIRIS)	ELT S4 Power Systems
Alluris unit of study Dutch name	Course Power Systems
Alluris unit of study English name	Course Power Systems
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-4CRS
Term	P3 P4 S4
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	15
Study load in hours	420
Contact hours	Geprogrammeerde contacttijd 110 uur.
Unit of study entry requirements	Not applicable.
<b>Content and organisation</b>	
General description	This unit of study covers the basic principles of 3-phase electric machines, power converters and network calculations. The most important topics are: <ul style="list-style-type: none"> <li>• Rotating magnetic field machines, synchronous, asynchronous, etc.</li> <li>• Power converter, choppers and inverters</li> <li>• Symmetrical short-circuit current.</li> <li>• Conductor cross-section in accordance with NEN1010.</li> </ul>
Exit qualifications	C2 Design (1) C3 Realisation (1) C7 Research (1)
Cohesion	The other unit of study in semester 4 is more or less related to this unit of study. (See also curriculum diagram).
Mandatory participation	Nee (No)
Activities and/or instructional formats	Theory lessons and labs.
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• Electrical Machines, Drives and Power Systems, 6th edition, Theodore Wildi.</li> <li>• Electrical Power System Essentials, second edition, edited by Wiley.</li> <li>• Power Electronics a first course author Ned Mohan, edit by Wiley.</li> </ul>

Required software / required materials	EE sim, Matlab/Simulink
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<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Practicum Asynchrone Machines</b>
English name (modular) exam (OSIRIS)	Asynchronous Machines Lab
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Practicum Asynchrone Machines
English name (modular) exam (Alluris)	Asynchronous Machines Lab
Alluris Code (modular) exam	ASYNL-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• performs measurements on asynchronous machines under supervision.</li> <li>• processes the measured values correctly into machine characteristics.</li> <li>• correctly calculates parameters of a equivalent circuit based on the measured values.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Asynchrone Machines</b>
English name (modular) exam (OSIRIS)	Asynchronous Machines
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Asynchrone Machines
English name (modular) exam (Alluris)	Asynchronous Machines

Alluris Code (modular) exam	ASYN-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• correctly explains the operation of asynchronous machines.</li> <li>• calculates operation points of asynchronous machines correctly using the equivalent circuits and formulas, both with a fixed and a variable supply frequency.</li> <li>• draws torque-speed graphs and applies them correctly.</li> <li>• calculates losses in the machine correctly.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Elektrische aandrijvingen</b>
English name (modular) exam (OSIRIS)	Electrical Drive Systems
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektrische aandrijvingen
English name (modular) exam (Alluris)	Electrical Drive Systems
Alluris Code (modular) exam	EDRVS-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• correctly converts a machine characteristic into a torque-speed characteristic, relevant operating times, torques and currents.</li> <li>• based on this information, dimensions a suitable powertrain and selects the correct components.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written

Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>EMC-V</b>
English name (modular) exam (OSIRIS)	EMC-V
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	EMC-V
English name (modular) exam (Alluris)	EMC-V
Alluris Code (modular) exam	EMC-V
Assessment dimensions or learning outcomes	None
Assessment criteria	None
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Group assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Dutch name (modular) exam (OSIRIS)	Elektriciteitsproductie
English name (modular) exam (OSIRIS)	Electricity Production
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Elektriciteitsproductie
English name (modular) exam (Alluris)	Electricity Production
Alluris Code (modular) exam	EP-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Must be able to specify different energy forms, carriers and converters and describe the physical basic principles.</li> <li>• Can describe how various forms of electricity power plants work (coal-fired power plant, nuclear power plant, gas plant, CCGT plant, hydroelectric plant, wind turbine and solar power plant).</li> <li>• Can explain the PV diagram of a wind turbine.</li> <li>• Can determine the yield of a wind turbine and wind park.</li> <li>• Can determine the yield of a solar panel (PV).</li> <li>• Can draw and name a grid-connected PV system.</li> <li>• Can draw and name a wind system.</li> <li>• Can describe a circuit process as the basis for the conversion of heat into work (Carnot).</li> <li>• Can calculate a simple combustion reaction (know what CO<sub>2</sub> is).</li> <li>• Is familiar with the physical background of: AC, three-phase systems, voltages, currents and power, energy/electricity transport, synchronous grid, balance, moment of inertia of the grid, frequency- capacity control.</li> <li>• Can explain the structure and creation of electricity grids (describe and show) on a national (DSOs and TSO) and a European level (ENTSOe).</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam

from 1 February 2023 (via OSIRIS)	period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Leerteam 4</b>
English name (modular) exam (OSIRIS)	Learning Team 4
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Leerteam 4
English name (modular) exam (Alluris)	Learning Team 4
Alluris Code (modular) exam	LT4-V
Assessment dimensions or learning outcomes	Student shows how he has developed on a personal, content related and professional level, reasons the choices he made and future choices and indicates the direction of development
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Can evaluate S3 and S4 and reflect on himselfcan name several development areas for S5, based on feedback received in S3 and S4 and (self) reflection</li> <li>• Can convert points for development into SMART-formulated learning objectives and elaborate these in a PDP.</li> <li>• Knows how to substantiate choices for projects, internship and minorillustrates the direction of further development for the next semesters.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Laagspanningsinstallatie ontwerpen</b>
English name (modular) exam (OSIRIS)	Low voltage installation design
OSIRIS Code (modular) exam	-
Dutch name (modular) exam	Laagspanningsinstallatie ontwerpen

(Alluris)	
English name (modular) exam (Alluris)	Low voltage installation design
Alluris Code (modular) exam	NEN
Assessment dimensions or learning outcomes	None
Assessment criteria	The student designs a low voltage installation for a domestic dwelling. The student chooses the correct earthing-system (TT, TN, etc.). The student selects cables for a single phase AC distribution system, in accordance to the HD 60364. The student selects the required protections and explains the protection-principles. The student demonstrates by simulation and/or calculation that the design complies with the regulations.
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P3
Number of examiners	1
Permitted resources	None
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Vermogenselektronica 1</b>
English name (modular) exam (OSIRIS)	Power Electronics 1
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Vermogenselektronica 1
English name (modular) exam (Alluris)	Power Electronics 1
Alluris Code (modular) exam	POWEL1-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Can describe basic converter topologies including basic calculations.</li> <li>• Has knowledge of driven rectifier, levelling and filtering.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment

	Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Vermogenselektronica 2</b>
English name (modular) exam (OSIRIS)	Power Electronics 2
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Vermogenselektronica 2
English name (modular) exam (Alluris)	Power Electronics 2
Alluris Code (modular) exam	POWEL2-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• can design and realise power electronics based on converter topologies for specified applications in the area of electrical drives, alternative electric energy sources and power supply systems for electronic devices.</li> <li>• you take the current standards, manufacturability, testability, safety and sustainability within an industrial environment into account in the design.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.

Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Practicum Vermogenselektronica</b>
English name (modular) exam (OSIRIS)	Power Electronics Lab
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Practicum Vermogenselektronica
English name (modular) exam (Alluris)	Power Electronics Lab
Alluris Code (modular) exam	POWELL-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• can carry out practical measurements and calculations on converters as part of structured assignments.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Group assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Practicum Synchrone Machines</b>
English name (modular) exam (OSIRIS)	Synchronous Machines Lab
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Practicum Synchrone Machines
English name (modular) exam (Alluris)	Synchronous Machines Lab
Alluris Code (modular) exam	SYNL-V
Assessment dimensions or learning	Not applicable.

outcomes	
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• performs measurements on synchronous machines under supervision.</li> <li>• processes the measured values correctly into machine characteristics and phasor diagrams.</li> <li>• correctly calculates parameters of the equivalent circuit on the basis of the measured values.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Synchrone Machines</b>
English name (modular) exam (OSIRIS)	Synchronous Machines
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Synchrone Machines
English name (modular) exam (Alluris)	Synchronous Machines
Alluris Code (modular) exam	SYN-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• correctly describes the different windings in synchronous machines and their functions.</li> <li>• explains the operation of synchronous machines correctly.</li> <li>• calculates working points of synchronous machines correctly using the equivalent circuit and formulas. †</li> <li>• correctly explains the reactive power regulation of a synchronous machine to the mains.</li> <li>• draws phasor diagrams correctly for all possible operating states of the synchronous machine.</li> <li>• draws torque-speed and torque-load angle graphs correctly and applies them correctly.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam)

	Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Practicum Transmissie- en distributiesystemen</b>
English name (modular) exam (OSIRIS)	Practicum Transmissie- en distributiesystemen
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	TRDSP-V
English name (modular) exam (Alluris)	TRDSP-V
Alluris Code (modular) exam	TRDSP-V
Assessment dimensions or learning outcomes	<p>You can use a simulator to carry out calculations in transmission and distribution networks for both load flow as well as short circuits.</p> <p>You know the difference between constant power and constant impedance loads in a simulator.</p> <p>You can examine the common network components, such as transformers, lines or cables, etc. with the help of a simulator.</p> <p>You can use a simulator to answer simple questions about distribution and transmission networks. Think of, the choice of cables, determination of short-circuit currents, the influence of connecting solar parks or wind turbines to an existing network.</p>
Assessment criteria	Profesional Product
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P4
Number of examiners	1
Permitted resources	Computer simulations (Vision)

Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Not applicable
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	To be agreed with Lecturer

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Transmissie- en Distributiesystemen</b>
English name (modular) exam (OSIRIS)	Transmission and Distribution Systems
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Transmissie- en Distributiesystemen
English name (modular) exam (Alluris)	Transmission and Distribution Systems
Alluris Code (modular) exam	TRDS-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• understand how the transport and distribution network of electrical energy is organized.</li> <li>• Can perform calculations on a 3-phase symmetric network.</li> <li>• Masters the basic knowledge of the distribution network at different voltage levels.</li> <li>• Can convert power transformer specifications into a useful calculation scheme for short circuit, power, and voltage drop calculations.</li> </ul> <p>Calculating the internal impedance of a transformer.</p> <ul style="list-style-type: none"> <li>• Can calculate short-circuit currents in networks in accordance with IEC60909 or %MVA method + Load-flow calculation in accordance with %MVA.</li> <li>• has knowledge of Earthing and earth faults.</li> <li>• can correctly deploy and calculate current and the voltage between the primary and secondary sides of distribution transforms.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models), fx-991 (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.

2023 (via Alluris)	
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 16 - e-ELT-4PRJ

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Project 4: Industrial and Power Systems
Long English name of unit of study (OSIRIS)	Project 4: Industrial and Power Systems
Short Dutch name of unit of study (OSIRIS)	ELT S4 Project 4
Short English name of unit of study (OSIRIS)	ELT S4 Project 4
Alluris unit of study Dutch name	Project 4: Industrial and Power Systems
Alluris unit of study English name	Project 4: Industrial and Power Systems
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-4PRJ
Term	P3 P4 S4
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	15
Study load in hours	420
Contact hours	Geprogrammeerde contacttijd 84 uur.
Unit of study entry requirements	Project 4 builds on the knowledge, insight and skills from the OW Project 3 and the Electronics Design, Signals and Systems IPS course. So students must: - Have taken these units of study Or: - Be able to demonstrate they have acquired the knowledge, insight and skills from these unit of study in another way. If in doubt, consult the learning team coach.
<b>Content and organisation</b>	
General description	Project. The students work on designing and/or building a product or prototype and thereby develop professional and practical skills. The project can be carried out in a mono-disciplinary, bi-disciplinary or multidisciplinary way, either at HAN or on location. The project includes designing a system with a power converter as a key element.
Exit qualifications	
Cohesion	The other unit of study in semester 4 is more or less related to this unit of study. (See also curriculum diagram).
Mandatory participation	Nee (No)
Activities and/or instructional formats	Project work.

Required literature / description of 'learning material'	Project Management – A Practical Approach, Grit, R., Edition: 5.
Required software / required materials	Card set 'Engineering Methods Pack'.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Project 4</b>
English name (modular) exam (OSIRIS)	Project 4
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Project 4
English name (modular) exam (Alluris)	Project 4
Alluris Code (modular) exam	PRJ4-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• The students are able to carry out a project with students from another degree course.</li> <li>• The students possess the basic skills in (written) communication, consultation, reflection and cooperation.</li> <li>• The student designs and implements a power converter. (dc wcd, DC-DC converter, etc.).</li> <li>• Describes the (technical) results belonging to the phases within the V model (Action plan, User/Functional/Technical Requirements, High- Level/Detail design, Realisation, Tests).</li> <li>• The student actively applies themselves to the task of achieving the project objectives.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	2
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Professional Skills 4</b>
English name (modular) exam (OSIRIS)	Professional Skills 4

OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Professional Skills 4
English name (modular) exam (Alluris)	Professional Skills 4
Alluris Code (modular) exam	SKILLS4-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Knows the 4 forms of assertive behaviour.</li> <li>• Connects the theory to their own experiences/behaviour and distils learning points.</li> <li>• Is aware of the importance of good leadership and specific personal leadership.</li> <li>• Knows his own communication style and its influence on others.</li> <li>• Has an eye for the effectiveness of his own co-operation behaviour and adjusts his difficult behaviour if necessary.</li> <li>• Knows his/her own conflict management style.</li> <li>• Chooses an effective conflict style on the basis of a conflict analysis.</li> <li>• Produces level 2 project activities in meeting, presentation, collaboration and reflection.</li> <li>• Reflects on own learning goals.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P4
Number of examiners	1
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 17 - e-ELT-5STAGE

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	S5-Stage
Long English name of unit of study (OSIRIS)	S5-Internship
Short Dutch name of unit of study (OSIRIS)	ELT S5 Stage
Short English name of unit of study (OSIRIS)	ELT S5 Internship
Alluris unit of study Dutch name	S5-Stage
Alluris unit of study English name	S5-Internship
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-5STAGE
Term	P1 P2 P3 P4 S5
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	30
Study load in hours	840
Contact hours	Geprogrammeerde contacttijd 3 uur.
Unit of study entry requirements	This semester builds on the knowledge and skills from the propaedeutic phase of Electrical and Electronic Engineering and Semester 3. So students wishing to do Internship must have: - gained sufficient knowledge and skills in the propaedeutic phase; - passed the OWE S3 project (3PRJ); Or: - gained comparable knowledge and skills in another way. If in doubt, consult the learning team coach.
<b>Content and organisation</b>	
General description	Internships are an important part of professional training and are mainly aimed at allowing you to work on your competences in a professional environment. You acquire the competences by doing work experience that contributes to your development as an entry-level professional. At the internship, it is important that you show a methodical work attitude and that you carry out the duties according to the regular procedures. You are supervised by an experienced member of staff. Your written reports contain a clear structure and include

	the goals and conclusions.
Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	The S5 internship is a specialisation of earlier projects in S3 and S4. The S5 internship also serves as preparation for the graduation project in S8.
Mandatory participation	Nee (No)
Activities and/or instructional formats	Individual internship; work duties related to internship assignment
Required literature / description of 'learning material'	Project Management – A Practical Approach, Grit, R., Edition: 5 Field-specific literature if applicable to the topic.
Required software / required materials	Not applicable.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Stagerapportage</b>
English name (modular) exam (OSIRIS)	Internship Report
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Stagerapportage
English name (modular) exam (Alluris)	Internship Report
Alluris Code (modular) exam	RAP5-IPS-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student is assessed for all the degree course exit qualifications, at the level as mentioned above under 'exit qualifications'. These assessment criteria are adopted from the national 'Bachelor of Engineering' profile and can be found in the 'S5-Internship-Assessment form', as appendix in the Internship Guide for Engineering. The assessment form can also be found in the digital learning environment.
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P2 P4
Number of examiners	1
Permitted resources	Not applicable.

Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 18 - e-ELT-6CRS

<b>General information</b>	
Changes compared to previous academic year	None
Long Dutch name of unit of study (OSIRIS)	Industrial Control Systems Course
Long English name of unit of study (OSIRIS)	Industrial Control Systems Course
Short Dutch name of unit of study (OSIRIS)	ELT S6 Industrial Control Systems
Short English name of unit of study (OSIRIS)	ELT S6 Industrial Control Systems
Alluris unit of study Dutch name	Industrial Control Systems Course
Alluris unit of study English name	Industrial Control Systems Course
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-6CRS
Term	P3 P4 S6
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	10
Study load in hours	280
Contact hours	72
Unit of study entry requirements	Semester 6 builds further on knowledge and skills in the field of electrical and electronic engineering. So for admission to semester 6, students must: - sufficient expertise in electrical and electronic engineering to effectively handle a complex electrical and electronic engineering problem. - successfully completed 3PRJ and 4PRJ; - earned at least 75 credits from the propaedeutic phase; - successfully completed 3CRS and 4CRS or an equivalent. Or: - demonstrate in some other way that they have sufficient expertise. If there is any doubt, the learning team coach will be consulted.
<b>Content and organisation</b>	
General description	S6 goals S6 prepares students to work as young professionals with new technologies within a professional practice. This is done by focusing on projects where new technological developments and research come together. In this way students are prepared for their future as professionals and this allows students to explore the possibilities that new technologies offer. S6 Supportive training Supportive training, this includes the System Modelling

	workshop (MOD), Control Systems 2 workshop (CS2), Servo Systems workshop (SERVO), Discrete-Event Systems workshop (DES) and Sensor workshop (SENS).
Exit qualifications	C1 Analysis (2) C2 Design (2) C3 Realisation (2) C4 Control (2)
Cohesion	The content of the courses is supportive of the project in the professional learning community (e-ELT-6PLG)
Mandatory participation	Nee (No)
Activities and/or instructional formats	Theory lessons and labs.
Required literature / description of 'learning material'	G.F. Franklin, J.D. Powell and A. Emami-Naeini, "Feedback Control of Dynamic Systems"
Required software / required materials	<ul style="list-style-type: none"> <li>• Matlab, Simulink, Stateflow, and Control System</li> <li>• ToolboxEPOS Studio</li> </ul>

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Regeltechniek 2</b>
English name (modular) exam (OSIRIS)	Control Systems 2
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Regeltechniek 2
English name (modular) exam (Alluris)	Control Systems 2
Alluris Code (modular) exam	CS2-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• Design and analysis of controlled systems using design and simulation tools.</li> <li>• Tuning controllers s they comply to robustness specifications.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration of the professional product.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.

Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Discrete Event Systemen</b>
English name (modular) exam (OSIRIS)	Discrete Event Systems
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Discrete Event Systemen
English name (modular) exam (Alluris)	Discrete Event Systems
Alluris Code (modular) exam	DES-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• Modelling discrete-event systems.</li> <li>• Simulating discrete-event systems, e.g. with computer tools.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration of the professional product.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Modelvorming</b>
English name (modular) exam (OSIRIS)	Modelling
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Modelvorming
English name (modular) exam (Alluris)	Modelling

Alluris Code (modular) exam	MOD-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<ul style="list-style-type: none"> <li>• Systematic modelling of dynamic system behaviour, both for linear and non-linear systems.</li> <li>• In addition to description in time and frequency domain, you can also give the description in the state domain.</li> <li>• Simulating and analysing system behaviour using computer tools.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration of the professional product.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Servotechniek</b>
English name (modular) exam (OSIRIS)	Servo Technology
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Servotechniek
English name (modular) exam (Alluris)	Servo Technology
Alluris Code (modular) exam	SERVO-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Has basic knowledge of systems engineering.</li> <li>• Tuning the servo loop, e.g. with computer tools and a DC.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P3 P4

Number of examiners	1
Permitted resources	All materials needed for giving a demonstration of the professional product.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 19 - e-ELT-6PLG

<b>General information</b>	
Changes compared to previous academic year	New text for s6 project identical to the other Engineering bachelors.
Long Dutch name of unit of study (OSIRIS)	Industrial Control Systems (ICS) PLG
Long English name of unit of study (OSIRIS)	Industrial Control Systems (ICS) PLG
Short Dutch name of unit of study (OSIRIS)	ELT S6 Industrial Control Systems
Short English name of unit of study (OSIRIS)	ELT S6 Industrial Control Systems
Alluris unit of study Dutch name	Industrial Control Systems (ICS) PLG
Alluris unit of study English name	Industrial Control Systems (ICS) PLG
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-6PLG
Term	P3 P4 S6
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	20
Study load in hours	560
Contact hours	100 uur
Unit of study entry requirements	<p>Knowledge and skills from the electrical and electronic engineering field are necessary to effectively handle a complex electro-technical problem. So students wishing to enter semester 6 must have:</p> <ul style="list-style-type: none"> <li>- gained sufficient knowledge and skills in the propaedeutic and main phases of Electrical and Electronic Engineering;</li> <li>- successfully completed 3CRS and 4CRS</li> <li>- successfully completed 3PRJ and 4PRJ</li> </ul> <p>Or</p> <ul style="list-style-type: none"> <li>- acquired comparable knowledge and skills in another way.</li> </ul>
<b>Content and organisation</b>	
General description	<p>S6 prepares students to work as young professionals with new technologies within a professional practice. This is done by focusing on projects where new technological developments and research come together. In this way students are prepared for their future as professionals and this allows students to explore the possibilities that new technologies offer.</p> <p>State of the art projects:</p> <ul style="list-style-type: none"> <li>• Come from the professional field</li> <li>• Explore the possibilities of new technology</li> <li>• Are multidisciplinary in nature</li> </ul> <p>Teaching method</p> <p>The projects take place in a real working environment this</p>

	<p>means:</p> <ul style="list-style-type: none"> <li>• Students act independently as junior Engineers</li> <li>• The teacher supervising the team acts as the senior engineer, guiding rather than teaching</li> <li>• Students learn how to expand their knowledge and skills in their area of expertise, beyond what they have been taught regarding the Body of Knowledge and Skills (BoKS) during the 1st and 2nd year.</li> </ul> <p>Supportive training in e-ELT-6CRS Supportive training, this includes the System Modelling workshop (MOD), Control Systems 2 workshop (CS2), Servo Systems workshop (SERVO), Discrete-Event Systems workshop (DES) and Sensor workshop (SENS).</p>
Exit qualifications	<p>C1 Analysis (2) C2 Design (2) C3 Realisation (2) C4 Control (2) C5 Management (2) C6 Consultation (1) C7 Research (2)</p>
Cohesion	Builds on the propaedeutic phase and the first year of the main phase. S6 is an integral educational unit, in which all aspects of electrical engineering are reflected.
Mandatory participation	Nee (No)
Activities and/or instructional formats	Professional Learning Community (PLC) with alternating periods of multidisciplinary project work and deepening on knowledge. The following working methods can be used: Professional Learning Community, Workshops, Symposia, (Guest) lectures,
Required literature / description of 'learning material'	Within the PLC, the students decide which literature they need together with the senior engineer and expert. They also decide together which learning material is needed to carry out the project/research. The expert monitors the level of the literature and learning material.
Required software / required materials	-

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Project 6</b>
English name (modular) exam (OSIRIS)	Project 6
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Project 6
English name (modular) exam (Alluris)	Project 6
Alluris Code (modular) exam	PRJ6-V

Assessment dimensions or learning outcomes	<p>What Delivers engineering product as can be expected of a junior Engineer</p> <p>How (method) Acts as a junior Engineer, capable of choosing an appropriate research- or design methodology, building their own network of experts and choosing relevant information resources, resulting in a contribution to the end result of a complex project.</p> <ul style="list-style-type: none"> <li>- Problem identification on either: <ul style="list-style-type: none"> <li>1. research objective, main &amp; sub questions</li> <li>2. design objective, required outputs</li> </ul> </li> </ul> <p>How (professional skills) Shows investigative attitude towards project, client and result in a complex, uncertain working environment.</p> <ul style="list-style-type: none"> <li>- towards assignment, client and results.</li> <li>- Sympathize &amp; asking the right questions.</li> <li>- Acting pro-active and responsible.</li> <li>- Reflecting on progress and results.</li> <li>- Dealing with uncertainties.</li> </ul> <p>Shows effective collaboration with team members, senior Engineers, experts, clients and other stakeholders.</p> <ul style="list-style-type: none"> <li>- Working with team members, senior engineer, experts and client</li> <li>- Effective cooperation with the different disciplines in the project</li> <li>- Asking for and giving support to team members</li> <li>- Giving feedback</li> </ul> <p>Shows professional communication of own and team results to the outside world</p> <ul style="list-style-type: none"> <li>- Creating your own professional network</li> <li>- Professional conversation with team members, stakeholders and network</li> <li>- (Re)presenting project group and results to the outside world (presentations, symposia, blogs, vlogs, etc.)</li> <li>- Symposium participation</li> </ul> <p>Applies in a conscious manner a method of project management and planning which results in a traceable and flexible project planning leading to involvement of all relevant stakeholders.</p> <p>Self Development: Acquiring and developing knowledge within the professional learning community (PLC) Developing yourself personally and within the field of expertise Incorporating feedback</p>
Assessment criteria	Students are assessed on the above learning outcomes. In the assessment form, criteria are specified per level of demonstration
Exam and modular exam format(s)	PF (Portfolio)

	PR (Presentation) PD ((Professional)Product) Individual assessment Group assessment Written Oral
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P4
Number of examiners	2
Permitted resources	All materials needed for giving a presentation and demonstration.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Vrij Project</b>
English name (modular) exam (OSIRIS)	Flexible Project
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Vrij Project
English name (modular) exam (Alluris)	Flexible Project
Alluris Code (modular) exam	VP-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• Can identify new roles and knowledge for themselves and is able and prepared to master themis enterprising and inquisitive plans and executes a self-selected project of at least 80 hours independently (on their own or in a small group) and takes responsibility for it.</li> <li>• Reflects on their own learning process and has the learning skills to continuously learnpresents the project in an inspiring way, shows how it was carried out and that the (minimum) 80 hours were effectively spent and how the self-chosen criteria were met.</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P3

	P4
Number of examiners	1
Permitted resources	All materials needed for giving a demonstration of the professional product.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

Elektrotechniek - tabel 20 - e-ELT-8AFST

<b>General information</b>	
Changes compared to previous academic year	
Long Dutch name of unit of study (OSIRIS)	Toets Afstuderen
Long English name of unit of study (OSIRIS)	Graduation Assignment
Short Dutch name of unit of study (OSIRIS)	ELT S8 Toets Afstuderen
Short English name of unit of study (OSIRIS)	ELT S8 Graduation Assignment
Alluris unit of study Dutch name	Toets Afstuderen
Alluris unit of study English name	Graduation Assignment
OSIRIS unit of study code	None
Alluris unit of study code	e-ELT-8AFST
Term	P1 P2 P3 P4 S8
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	30
Study load in hours	840
Contact hours	Geprogrammeerde contacttijd 12 uur.
Unit of study entry requirements	In the graduation assignment, the student combines all the knowledge they acquired during the major. So for admission to the graduation assignment, students must have completed all study units. The Minor need not have been followed/completed. If there is any doubt, the learning team coach is consulted. Based on the study progress, it will be recommended to start or wait with the graduation process. The basic principle is that any uncompleted study unit of the major can still reasonably be completed during the graduation process. Approval for the assignment by the graduation phase coordinator.
<b>Content and organisation</b>	
General description	During the graduation assignment, students work individually on an assignment in which they investigate, analyse and solve a complex problem independently. It is a test of one's ability and as such an integrated test in which the student shows they are able to take on the work of a starting practitioner at university of applied sciences level.

Exit qualifications	C1 Analysis (1) C2 Design (1) C3 Realisation (1) C4 Control (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	See also curriculum diagram.
Mandatory participation	Nee (No)
Activities and/or instructional formats	The student works independently on a design, does applied research for this, makes as much progress as possible and reports on the whole.
Required literature / description of 'learning material'	Not applicable.
Required software / required materials	Not applicable.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Toets Afstuderen</b>
English name (modular) exam (OSIRIS)	Graduation Exam
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Toets Afstuderen
English name (modular) exam (Alluris)	Graduation Exam
Alluris Code (modular) exam	ELT-Afst
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	You are assessed for all degree course exit qualifications, as mentioned above under 'exit qualifications / competences'. These assessment criteria are adopted from the national 'Bachelor of Engineering' profile and can be found in the 'Assessment form for graduation assignment', as appendix in the Graduation Guide for Engineering. The assessment form can also be found in the digital learning environment.
Exam and modular exam format(s)	PF (Portfolio) GS (Conversation, Criterion based interview, Graduation Exam) Individual assessment Written Oral
Weight factor of modular exam	1
Minimum result	5,5
Exam sittings	P1 P2

	P3 P4
Number of examiners	2
Permitted resources	Not applicable.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Not applicable.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

### 9.3 Minors of the degree course

Elektrotechniek - tabel 21 - e-M-POW/2

<b>General information</b>	
Changes compared to previous academic year	Explanation of entry requirements Mandatory participation for excursions
Long Dutch name of unit of study (OSIRIS)	Power Minor - Voltijd (code: M-POWV01)
Long English name of unit of study (OSIRIS)	Power Minor - full time (code: M-POWV01)
Short Dutch name of unit of study (OSIRIS)	ELT S7 Power Minor
Short English name of unit of study (OSIRIS)	ELT S7 Power Minor
Alluris unit of study Dutch name	Power Minor - voltijd (code: M-POWV01)
Alluris unit of study English name	Power Minor - full time (code: M-POWV01)
OSIRIS unit of study code	None
Alluris unit of study code	e-M-POW/2
Term	P1 P2 S7
Registering for educational components	For all education offered after 31 January 2023, students need to register for the educational components they wish to follow. See Part 3 'OSIRIS Regulations for Education, Exams and Modular Exams' for more information.
Credits	30
Study load in hours	840
Contact hours	Geprogrammeerde contacttijd 129 uur.
Unit of study entry requirements	This minor assumes students have specific basic knowledge. So the following entry enquirements apply for admission to this minor: - basic knowledge of electrical engineering (network theory DC and AC, basic electronics), demonstrable with a propaedeutic certificate. - basic knowledge of electrical installations, preferably distribution systems and synchronous machines, demonstrable with a completed Power Systems Course (HAN), or relevant main phase modules (30 EC) from Electrical and Electronic Engineering or Embedded System Engineering. - Language requirements: Sufficient level of Dutch.
<b>Content and organisation</b>	
General description	This minor was developed in collaboration with TenneT and The Hague University of Applied Sciences. The minor contains the following components. Production: Due to climate change, the generation of energy, especially renewable energy, is becoming an increasingly important issue. Transport: Energy generated in power stations or solar farms must be transported to users over long distances. This happens through the high-voltage transmission grid. Distribution: When designing

	distribution networks, the challenge is to minimise energy loss and maximise supply security. This calls for employees who can think systematically and come up with innovative solutions. The Power minor is only taught in Dutch.
Exit qualifications	C3 Realisation (1) C5 Management (1) C6 Consultation (1) C7 Research (1) C8 Professionalisation (1)
Cohesion	Programme for Electrical and Electronic Engineering students from across the whole country. The unit is closely related to the HAN ELT-programme in terms of technical content.
Mandatory participation	80% van de excursies
Activities and/or instructional formats	Lectures, work groups and practical training.
Required literature / description of 'learning material'	<ul style="list-style-type: none"> <li>• Electrical power system essentials, by Pieter Schavemaker and Lou van der Sluis.</li> <li>• Power Quality, Sjef Cobben.</li> <li>• Duurzame energietechniek. Joop Ouwehand, Trynke Papa, Bram Entrop, Jan de Geus, Jan de Geus, Wim Gilijamse, Jan de Wit.</li> </ul>
Required software / required materials	Safety shoes (S3) and helmet. Software will be made available by the lecturer during class.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Basis Generatie en Transport</b>
English name (modular) exam (OSIRIS)	Basic Generation and Transmission
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Basis Generatie en Transport
English name (modular) exam (Alluris)	Basic Generation and Transmission
Alluris Code (modular) exam	BGT-VT
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Can calculate a given three-phase system. Voltages, currents and power.</li> <li>• Can calculate the stable operational points of synchronous machines based on the equivalent circuit diagrams.</li> <li>• Can draw and apply machine diagrams and V- curves.</li> <li>• Can make an informed choice between the different energy forms.</li> </ul>

	<ul style="list-style-type: none"> <li>• Can name grid components and voltage levels.</li> <li>• Can select power transformers (context grids, phase and transformer vector groups) and ability to substantiate the operation.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	3
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Excursies</b>
English name (modular) exam (OSIRIS)	Excursions
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Excursies
English name (modular) exam (Alluris)	Excursions
Alluris Code (modular) exam	Excur-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	Attendance.
Exam and modular exam format(s)	PA (Participation) Individual assessment Oral
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Mandatory: safety shoes and helmet.
Method of registering for exam or modular exam opportunities registration period Up to 31 January	Not applicable.

2023 (via Alluris)	
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Hoogspanningstechniek</b>
English name (modular) exam (OSIRIS)	High-voltage Technology
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Hoogspanningstechniek
English name (modular) exam (Alluris)	High-voltage Technology
Alluris Code (modular) exam	HS-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Can indicate the constructive forms in order to obtain the right dielectric strength for high-voltage installations.</li> <li>• Can draw the field strength progress for a given construction.</li> <li>• Principles of the generation of high (test) alternating, direct and impulse voltages.</li> <li>• Knowledge of terms (operation and mechanisms): overvoltage, voltage division, field control, electric flux, fringe effects, field amplification, triple point, AC and DC field, (full/partial) dielectric strength. value of the dielectric strength, corona, Paschen's curve, life cycle, creepage, insulation classes, TOV, SIL, BIL, static behaviour decisive voltage, surge protection device, spark gap, leakage path, stress resistance (conduction boundary layer), partial discharge.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	3
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.

Discussion and review	See Part 2 - 8.9.1 and 8.9.2.
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<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Loadflow en Kortsluitstromen</b>
English name (modular) exam (OSIRIS)	Load Flow and Short-circuit Currents
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Loadflow en Kortsluitstromen
English name (modular) exam (Alluris)	Load Flow and Short-circuit Currents
Alluris Code (modular) exam	LK-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Perform load flow basic calculations.</li> <li>• Describe short- circuit grid behaviour.</li> <li>• Can calculate the symmetrical and asymmetrical short-circuit current in a given network: impedance and MVA methods.</li> <li>• Can name the dynamic short-circuit behaviour (symmetrical component methods).</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	3
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Practica Power Minor</b>
English name (modular) exam (OSIRIS)	Practica Power Minor
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Practica Power Minor
English name (modular) exam (Alluris)	Practica Power Minor

Alluris Code (modular) exam	PracVT
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	The student: <ul style="list-style-type: none"> <li>• has, after taking part in the minor, knowledge and skills regarding the situation in the field of the electricity grids (participating in excursions and labs is essential)</li> <li>• Can carry out practical measurements and calculations on grid models and implement security measures as part of a structured assignment.</li> <li>• Can perform measurements correctly and provide a good report.</li> <li>• Can make correct calculations in relation to grid models, protections and/or power quality and provide a good report based on the case study..</li> <li>• Can carry out 2 assignments and 1 presentation correctly carried out and report sufficient. Possible subjects: Renewable Energy and Energy Transition, Influence of the built environment, electrical transmission,)</li> </ul>
Exam and modular exam format(s)	PD ((Professional)Product) Individual assessment Written
Weight factor of modular exam	0
Minimum result	Vink (tick)
Exam sittings	P1 P2
Number of examiners	2
Permitted resources	None.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Projectopdracht</b>
English name (modular) exam (OSIRIS)	Project Assignment
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Projectopdracht
English name (modular) exam (Alluris)	Project Assignment
Alluris Code (modular) exam	Project-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	• Ability to create an energy technical design that includes

	<p>short-circuit current calculations, load flow, cable calculations, protections, etc.</p> <ul style="list-style-type: none"> <li>• The end product is a report of the grid design with protections including the required calculations and substantiations.</li> <li>• Select the correct protection for a given application: switching-off characteristic of differential protection and distance protection, OMT settings to determine the transformer, bus coupler, distribution grid and cable.</li> <li>• Presentation assessment*: bonus/malus for the group assessment based on individual performance.</li> </ul>
Exam and modular exam format(s)	<p>PR (Presentation)  PD ((Professional)Product)  Group assessment  Written</p>
Weight factor of modular exam	8
Minimum result	5,5
Exam sittings	<p>P2  P3</p>
Number of examiners	2
Permitted resources	None.
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	You do not need to formally register for (professional) products. For resits, contact the examiner.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

<b>Dutch name (modular) exam (OSIRIS)</b>	<b>Transport- en distributienetten</b>
English name (modular) exam (OSIRIS)	Transmission and Distribution Grids
OSIRIS Code (modular) exam	-
Dutch name (modular) exam (Alluris)	Transport- en distributienetten
English name (modular) exam (Alluris)	Transmission and Distribution Grids
Alluris Code (modular) exam	TDN-V
Assessment dimensions or learning outcomes	Not applicable.
Assessment criteria	<p>The student:</p> <ul style="list-style-type: none"> <li>• Can draw the various network structures and accurately indicate the security of those networks.</li> <li>• Can select the correct grid components and measuring equipment for a given application (field construction, grid earthing, earthing types, power switches, voltage and current transformers and selectivity).</li> <li>• Can choose the right security for a given application. Can</li> </ul>

	<p>compare the AC-DC grid.</p> <ul style="list-style-type: none"> <li>• Can explain the consequences of dirty power (for example in a smart meter).</li> <li>• Can explain the technical functioning of the F-V control.</li> </ul>
Exam and modular exam format(s)	ST (Written Exam) Individual assessment Written
Weight factor of modular exam	3
Minimum result	5,5
Exam sittings	P1 P2
Number of examiners	1
Permitted resources	Casio fx-82 calculator (all models) or Texas Instruments TI-30 (all models).
Method of registering for exam or modular exam opportunities registration period Up to 31 January 2023 (via Alluris)	Registration for the modular exam through Alluris. The registration term is several weeks prior to the exam period or the resit period.
Registering and deregistering for exam / modular exam opportunities from 1 February 2023 (via OSIRIS)	Registration for the modular exam through OSIRIS. The registration period is several weeks prior to the exam period or the resit period.
Discussion and review	See Part 2 - 8.9.1 and 8.9.2.

## 9.4 Graduation specialisations

Not applicable.

## 9.5 Honours, talent and bridging programs

### 9.5.1 Honours programs

Not applicable.

### 9.5.2 Talent programmes

Not applicable.

### 9.5.3 Bridging programmes

See Part 2 Section 5.4

## 9.6 Part-time and/or work-study degree format

### 9.6.1 Part-time degree format

Not applicable.

### 9.6.2 Work-study degree format

Not applicable.

## 9.7 Tracks with special feature

### 9.7.1 Fast track

Not applicable.

### 9.7.2 Abridged track

Not applicable.

### 9.7.3 Abridged track from associate to bachelor degree

Not applicable.

### 9.7.4 Track for elite athletes

Not applicable.

### 9.7.5 D-stream

Not applicable.

### 9.7.6 Combined track

Not applicable.

### 9.7.7 Other track with special feature

Not applicable.