

## Thermal Installations (E028700)

Course size (nominal values; actual values may depend on programme)  
 Credits 6.0 Study time 180 h Contact hrs 75.0 h

### Course offerings and teaching methods in academic year 2018-2019

Offering	Language	Teaching Method	Hours
A (semester 1)	English	seminar: practical PC room classes	3.75 h
		seminar: coached exercises	32.5 h
		self-reliant study activities	30.0 h
		excursion	8.75 h
		lecture	30.0 h
		B (semester 1)	Dutch
excursion	8.75 h		
self-reliant study activities	30.0 h		
seminar: practical PC room classes	3.75 h		
seminar: coached exercises	32.5 h		

### Lecturers in academic year 2018-2019

De Paepe, Michel TW03 lecturer-in-charge

### Offered in the following programmes in 2018-2019

Programme	crdts	offering
Bridging Programme Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	A
Bridging Programme Master of Science in Chemical Engineering	6	A
Bridging Programme Master of Science in Chemical Engineering	6	B
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	B
Master of Science in Chemical Engineering	6	A
Master of Science in Chemical Engineering	6	B

### Teaching languages

Dutch, English

### Keywords

THERMAL INSTALLATIONS  
 heat exchangers, two phase gas liquid flow, flow regimes, Heat transfer and pressure drop during evaporation and condensation, Steam technology, combined-heat-and-power, cryogenics

### Position of the course

Insight in the thermal energy flows in industrial installations  
Design of heat exchangers (single and two phase flow) and installations and steam boilers  
Operational aspects of thermal systems in industry : CHP, steam networks and cryogenics

#### Contents

- Classification of heat exchangers
- Design of recuperators: Logarithmic temperature difference, NTU method, Non constant heat transfer coefficient
- Tubular heat exchangers: constructive aspects
- Shell and tube heat exchangers: constructive aspects
- Plate heat exchangers: constructive aspects
- Compact heat exchangers
- Fouling: Fouling types, Results of fouling
- Heat pipes
- Two phase flows: Flow regimes and pressure drop
- Condensation: Condensation modes, Condensers
- Boiling: Critical heat flux, pool boiling, flow boiling
- Steam boilers: Boiler classification, Circulation and construction
- Steam distribution: constructive aspects, steam traps
- Cryogenics
- Decentralised energy production: Combined heat and power

#### Initial competences

Engineering Thermodynamics, Heat and combustion technique, Transport phenomena

#### Final competences

- 1 Pointing out heat exchanger types and their properties
- 2 Designing heat exchangers
- 3 Using software for energy calculations
- 4 Understanding the physics of two phase gas liquid flow
- 5 Analysing complex thermal processes and cycles
- 6 Approaching energy use in an industrial context in a critical way both in a company and in society

#### Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

#### Conditions for exam contract

This course unit cannot be taken via an exam contract

#### Teaching methods

Guided self-study, excursion, lecture, self-reliant study activities, seminar: coached exercises, seminar: practical PC room classes

#### Extra information on the teaching methods

Lecturing theory, guided exercises on heat exchangers design  
project on two-phase flow, project on design with software

#### Learning materials and price

Book :  
Heat Exchangers: Selection, Rating, and Thermal Design, Third Edition Hardcover-  
March 1, 2012 by Sadik Kakaç Hongtan Liu, Anchasa Pramuanjaroenkij, CRC press  
Notes on Minerva  
Software : EES

#### References

- Fundamentals of heat exchanger design, Shah, Sekulic, Wiley.
- Heat exchanger design handbook, Kuppan, Marcel Dekker.
- Int Journal of Applied Thermal Engineering
- Heat transfer Engineering
- ASME Heat Transfer
- Int Journal of Heat and Mass Transfer

#### Course content-related study coaching

#### Evaluation methods

end-of-term evaluation and continuous assessment

#### Examination methods in case of periodic evaluation during the first examination period

Open book examination, oral examination

Examination methods in case of periodic evaluation during the second examination period

Open book examination

Examination methods in case of permanent evaluation

Assignment, skills test, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

During examination period: written theory closed-book exam, ;exercices exam open book

reports on projects: 1 on heat exchanger design, 1 on two phase flow design, 1 on energy analysis in plant

Calculation of the examination mark

PE1 reports 4/20 oral theory exam 4/20 exercises exam 12/20

PE2 exercises exam 20/20