

Operations Research Models and Methods (E004255)

Course size (nominal values; actual values may depend on programme)
 Credits 6.0 Study time 180 h Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2018-2019

Offering	Language	Teaching Methods	Hours
A (semester 1)	English	self-reliant study activities	5.0 h
		lecture	30.0 h
		seminar: coached exercises	30.0 h
B (semester 1)	Dutch	self-reliant study activities	5.0 h
		seminar: coached exercises	30.0 h
		guided self-study	30.0 h

Lecturers in academic year 2018-2019

Aghezzaf, El-Houssaine	TW18	lecturer-in-charge
De Vuyst, Stijn	TW18	co-lecturer

Offered in the following programmes in 2018-2019

Programme	crdts	offering
Master of Science in Electrical Engineering (main subject Communication and Information Technology)	6	A
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	6	A
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	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 Industrial Engineering and Operations Research	6	B
Master of Science in Chemical Engineering	6	A
Master of Science in Civil Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Industrial Engineering and Operations Research	6	A
Master of Science in Sustainable Materials Engineering	6	A
Master of Science in Chemical Engineering	6	A
Postgraduate programme in Innovation and Entrepreneurship in Engineering	6	A

Teaching languages

Dutch, English

Keywords

Deterministic and Stochastic Modelling, Optimization, Decision-making Analysis

Position of the course

Operations Research is the engineering discipline that deals with application of advanced analytical methods to help make informed decisions. It employs mathematical modeling techniques, statistical analysis, and mathematical optimization methods to determine optimal or near-optimal solutions to the complex decision-making problems.

This course "Operations Research Models and Methods" provides students with the necessary knowledge and skills, in these methods and techniques, to enable them tackle the wide range of optimization problems stemming from management and control of the various engineering, production and logistical systems. The focus is first put on the fundamentals on which these methods and techniques are built, then how they work, and finally on their potential practical applications to real-world engineering problems.

Contents

Part I: Deterministic models

- Model Building in Mathematical Programming
- Linear Programming and the Simplex Algorithm
- Duality and Sensitivity Analysis
- Integer Programming and Applications
- Dynamic Programming and Applications
- Network Models and Applications
- Nonlinear Programming Methods

Part II: Stochastic models

- Decision Making Under Uncertainty
- Game Theory and Applications
- Stochastic processes and Applications
- Monte-Carlo Simulation and Applications
- Queuing Models and Applications

Initial competences

Required: Linear Algebra, Recommended: An introduction to Probability and statistics.

Final competences

- 1 Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact;
- 2 Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
- 3 Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the modelling simplifications and assumptions that were made;
- 4 Being able to critically interpret the results obtained and validate or invalidate the corresponding decisions, simplifications and assumptions that were made;

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, lecture, self-reliant study activities, seminar: coached exercises

Learning materials and price

The book "Introduction to Operations Research", by Hillier and Lieberman, and the book "Operations Research: Applications and Algorithms", by Wayne Winston, will be used as reference books for this course. Other lecture notes will be provided via Minerva.

References

- "Operations Research: Applications and Algorithms", by Wayne L. Winston. Duxbury Pr ISBN-13: 9780534209711 (2004).
- "Introduction to Operations Research", by Frederick S. Hillier and Gerald J. Lieberman. McGraw-Hill, 9 edition; ISBN-13 9780077298340, Copyright year: 2010.
- "Optimization in Operations Research", by Ronald L. Rardin. Prentice Hall, (1997); ISBN-10: 0023984155, ISBN-13: 978-0023984150.
- "Nonlinear Programming: Theory and Algorithms", by Mokhtar S. Bazaraa, Hanif D.

Sherali and C. M. Shetty. Wiley-Interscience, 3 edition (2006); ISBN-10: 0471486000, ISBN-13: 978-0471486008.

- "Introduction to Probability Models", by Sheldon M. Ross. Academic Press, 9 edition (2006); ISBN-10: 0125980620, ISBN-13: 978-0125980623.

Course content-related study coaching

The professor and the assistants are available before and after each course. Also, office hours will be indicated on the course plan provided to the students in the beginning of the semester.

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination with open questions

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

Written examination with open questions

Examination methods in case of permanent evaluation

Report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

- Periodic evaluation: written exam with closed book.
- Non-periodic evaluation: evaluation of group projects based on the written reports.

Calculation of the examination mark

Evaluation throughout semester as well as during examination period. Special conditions: Evaluation during examination period: 75%. Evaluation throughout the semester: 25%.