UNIVERSITY
OF SKÖVDE

COURSE SYLLABUS

Industrial Optimization: Models and Methods, third-cycle level

5 credits

Course code: IT0939F
Version number: 2.2
Valid from: 1 July 2024
Ratified by: Curriculum Committee for Third-cycle Studies
Date of ratification: 11 March 2024

1. General information about the course

The course is provided by the University of Skövde and is named Industrial Optimization: Models and Methods, third-cycle level (Industriell optimering: modeller och metoder, forskarnivå). It comprises 5 credits .

The course is a part of the third-cycle subject area of Informatics.

2. Entry requirements

The prerequisites for this course are general entry requirements for third-cycle courses and study programmes, i.e. a second-cycle qualification or satisfied requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second cycle (or the equivalent).

In order to fulfil the specific entry requirements, the applicant must have completed course requirements of at least 60 credits, including an independent project of at least 15 credits at the second cycle, within the subject Informatics, applicable areas of a similar kind or other fields assessed as directly relevant for thesis work in the subject Informatics.

An additional requirement is proof of skills in English equivalent of studies at upper secondary level in Sweden, known as the Swedish course English 6. This is normally demonstrated by means of an internationally recognized language test, e.g. IELTS or TOEFL or the equivalent.

3. Course content

This course studies scientific strategies to support decision making through mathematical modeling. It seeks to design, improve, and operate complex systems through mathematical modeling and has various applications in business, engineering, health care, and industry. The emphasis will be on industrial optimization problems, but problems from other domains will also be discussed in the course.

In industrial optimization, heuristic methods are sometimes used in cases when analytic methods that always find an optimal solution could easily be applied. This course provides the student with a good background in analytic optimization methods to cope with a variety of industrial problems. The course provides knowledge about different forms of mathematical optimization models as well as exact solution approaches. The course contains both a theoretical and a practical part. The theoretical part focuses on learning and developing different types of mathematical optimization models as well as learning and applying certain exact solution methods for solving industrial optimization problems. In the practical part, through a hands-on approach supported by computer software, the student will learn how to solve the mathematical optimization models using an appropriate method for each model type.

4. Objectives

After completed course the doctoral student should be able to:

- Develop mathematical models and exact algorithms for industrial and combinatorial optimization problems
- Understand the function and use of the commonly used computer software for solving mathematical optimization models
- Describe and apply certain exact solution methods for solving industrial optimization problems
- Understand and discuss the importance of exact solution approaches and mathematical optimization
- Compare and contrast exact and approximation solution approaches for their advantages and disadvantages in dealing with different optimization problems
- Read, understand and effectively communicate the related scientific papers.

5. Examination

The course is graded G (Pass) or U (Fail).

To receive the grade Pass on the course, all examination parts have to be graded Pass.

The examinations of the course consist of the following modes of assessment:

- **Written assignment**
  2 credits, grades: G/U
- **Laboratory assignment**
  2 credits, grades: G/U
- **Project presentation**
  1 credit, grades: G/U

Doctoral students with a permanent disability who have been approved for directed educational support may be offered adapted or alternative modes of assessment.

6. Types of instruction and language of instruction

The teaching comprises lectures, laboratory sessions, project work, supervision and presentations.

The teaching is conducted in English.

7. Course literature and other educational materials

Reading material, handouts, and research papers as provided by the instructor.

References

Gärtner, B. & Matoušek, J. *Understanding and Using Linear Programming.* Springer. ISBN 9783540307174.

Hamdy, A. T. (2013). *Operations Research: An Introduction* (9th ed.). Pearson. ISBN 933251822X.

Hillier, F. S. & Lieberman, G. J. (2014). *Introduction to Operations Research* (10th ed.). New York: McGraw-Hill. ISBN 1259162982.

Korte, B. and Vygen, J. *Combinatorial Optimization* (6th Ed.). Berlin: Springer. ISBN 9783662560389.

Snyman, J. A. & Wilke, D. N. *Practical Mathematical Optimization: Basic Optimization Theory and Gradient-Based Algorithms* (2nd Ed.). Springer International Publishing AG. ISBN 9783319775852.

Williams, H.P. *Model Building in Mathematical Programming* (5th Ed.). Wiley. ISBN 9781118443330.

8. Doctoral student influence

Doctoral student influence in the course is ensured by means of course evaluation. The students are informed about the results of the evaluation and potential measures that have been taken or are planned, based on the course evaluation.

9. Additional information

Further information about the course, as well as national and local governing documents for higher education, is available on the website of the University of Skövde.