UNIVERSITY OF SKÖVDE

TRANSLATION FROM SWEDISH

# COURSE SYLLABUS

## Industriell optimering och beslutsanalys, Forskarnivå
## Industrial Optimization and Decision Analysis, Post-graduate level
## 7.5 credits

**Course Code:** IT0917F
**The Course Syllabus applies from:** Jan 1, 2019
**Date of Approval:** Dec 10, 2018
**Version Number:** 1

**Third-cycle Subject Area:** Informatics

**Academic Level:** Post-graduate level

### 1 Name, Scope and Level of the Course

The course is given by the University of Skövde and is named Industrial Optimization and Decision Analysis, Post-graduate level. It comprises 7.5 credits and is on Post-graduate level.

### 2 Objectives

After completed course the research student should be able to:

- apply mathematical theory of optimization on smooth (continuous and differentiable) problems;
- demonstrate a good understanding of different types of optimization techniques, including classical and metaheuristic methods;
- describe key concepts of multi-objective optimization and the common techniques for multi-criteria decision analysis;
- formulate optimization problems based on industrial scenarios and relate them to standard optimization models;
- extend existing optimization methodologies, if required, and use numerical software to solve single and multi-objective optimization problems;
- use visualization techniques to aid the decision making process; and
- critically examine and reflect upon recent developments in the synergy of optimization techniques and decision analysis methods and the related research within informatics, particularly within the context of multi-criteria decision making and interactive multi-objective optimization.

### 3 Course Content

The course is composed of five major parts: lectures, written assignments, laboratory assignments, seminar, and project work. The course will cover the following topics:

- optimality theory for single and multi-objective optimization,
- classical optimization methodologies for solving single-objective optimization problems,
- key concepts of multi-objective optimization,
- standard optimization models,
- metaheuristic algorithms for solving multi-objective optimization problems,
- visualization techniques and multi-criteria decision making methods,
- industrial applications of multi-objective optimization and decision analysis,
- advanced topics like interactive multi-objective optimization for incorporating user preferences.

The written assignments will examine the students on their understanding of the theoretical aspects of optimization and related algorithms, while the laboratory assignments will test their implementation abilities.

The seminar assignment involves the study of a relevant piece of literature and serves to promote critical analysis of competing methodologies. Students will be required to carry out a course project in an area connected to their field of study/research. The students then submit individual project reports and give project presentations on the case studies and their proposed solutions. The project grade will depend on the significance of the chosen problem, the implementation and analysis and discussion of the results.

## 4 Forms of Teaching

The teaching comprises lectures, supervision, laboratory sessions, project work, presentations and seminars/group discussions.

The teaching is conducted in English.

## 5 Examination

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

The final grade of the course is issued when all course units have been passed. Individual course units will not receive a grade.

Registration of examination results:

| Name of examination | Credits | Grading |
|---|---|---|
| Written assignment | 2 hp/credits | U/G |
| Laboratory assignment | 2 hp/credits | U/G |
| Seminar assignment | 1 hp/credits | U/G |
| Project presentation | 2.5 hp/credits | U/G |

To obtain a final passing grade of the course, each part of the examination must have been approved.

## 6 Admission Requirements

The admission requirements of the 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 Specified Entry Requirements The Applicant must have completed academic courses of at least 60 credits, including independent thesis writing of at least 15 credits at advanced level, within the field Informatics, applicable areas of a similar kind or other fields Which are Directly judged as relevant for the Licentiate or PhD thesis.

Further More, a passing grade in the high school course English B or the equivalent is required. Similar knowledge ice Usually Proved through an acknowledged Internationally The language test Such as IELTS, TOEFL or other equivalent tests.

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## 7 Third-cycle Subject Area

The course forms a part of the third-cycle subject area of Informatics at the University of Skövde.

## 8 Approval of Course and Course Syllabus

This course was approved by the Committee for the Doctoral Programme in Informatics Dec 10, 2018. This course syllabus was ratified by the Committee for the Doctoral Programme in Informatics Dec 10, 2018. It is valid from Jan 1, 2019.

## 9 Overlapping with Another Course

This course cannot constitute a part of a degree also containing a course, the content of which is totally or partly equivalent to the content of this course.

## 10 Additional Information

Further information will be available on the university's website before the course is provided.

National and local regulations for higher education are available on the university's website.

During and after the course there will be a follow-up evaluation concerning the learning outcomes. The main objective of the follow-up is to contribute to improving the course. The research students' experience and points of view constitute one part of the scrutiny and are obtained through written group course evaluation/discussions. The research students are to be informed about the outcome of these as well as possible decisions concerning steps to be taken.

## 11 Course Literature and Other Educational Materials

Branke, J. et al. (2008). *Multiobjective Optimization: Interactive and Evolutionary Approaches.* Springer. ISBN 9783540889076.

Deb, K. (2009). *Multi-Objective Optimization Using Evolutionary Algorithms.* Wiley. ISBN 9780470743614.

Deb, K. (2012). *Optimization for engineering design: Algorithms and Examples.* Prentice-Hall of India Pvt.Ltd. ISBN 812030943X.

El-Ghazali, T. (2009). *Metaheuristics: From Design*

*to Implementation.* Wiley. ISBN 9780470278581.

Keeney, R. & Raiffa, H. (1993). *Decisions With Multiple Objectives.* Cambridge University Press. ISBN 9780521438834.

Wang, L., Ng, A. & Deb, K. (2011). *Multi-objective Evolutionary Optimisation for Product Design and Manufacturing.* Springer. ISBN 9780857296177.

Scientific articles according to the teacher's instructions.

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