

205115 - Combinatorial Optimization in Logistics

Coordinating unit:	205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering		
Teaching unit:	732 - OE - Department of Management 715 - EIO - Department of Statistics and Operations Research		
Academic year:	2017		
Degree:	MASTER'S DEGREE IN TECHNOLOGY AND ENGINEERING MANAGEMENT (Syllabus 2016). (Teaching unit Optional)		
ECTS credits:	7,5	Teaching languages:	English

Teaching staff

Coordinator:	María Albareda Sambola
Others:	José María Sallán Leyes

Degree competences to which the subject contributes

Basic:

- CB6. Knowledge and understanding that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context.
- CB7. METMF_The ability to apply the knowledge and problem-solving skills acquired in new or unfamiliar environments within wider (or multidisciplinary) contexts related to the area of study.
- CB8. METMF_The ability to integrate knowledge and deal with the complexity of making judgements on the basis of information that, albeit incomplete or limited, includes thoughts on the role played by social and ethical responsibility in the application of knowledge and judgement.
- CB9. METMF_The ability to communicate conclusions, and the knowledge and reasons that ultimately sustain these conclusions, to specialised and lay audiences in a clear and unambiguous way.
- CB10-METP. Learning abilities that will enable students to keep studying in a largely self-directed or independent manner.

Specific:

- CE03-MEM. The ability to optimise problems and systems using mathematical models and make decisions in conditions of uncertainty.
- CE05-MEM. The ability to analyse the need for physical and financial resources in process and project management in technological settings.
- CE06-MEM. The ability to optimally assign physical and financial resources in process and project management in technological settings.

Transversal:

- CT1a. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.
- CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
- CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

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Teaching methodology

Lecture: Lecturers present concepts, principles and techniques, with the active participation of students.

Problem Based Learning: Lecturers and students resolve exercises and standard problems through specific techniques related to the theoretical contents and principles of the course.

Project Based learning: Students resolve complex problems through specific techniques related to the theoretical contents and principles of the course.

Self-study: Students diagnose their learning needs, in collaboration with the lecturers, and plan their own learning process.

Learning objectives of the subject

This course can be seen as an extension of the mandatory course ?Tools for Decision Making?. The goal of the course is to get some insight on the main techniques used for solving combinatorial optimization problems that arise in logistics.

Study load

Total learning time: 187h 30m	Hours large group:	30h	16.00%
	Hours medium group:	30h	16.00%
	Self study:	127h 30m	68.00%

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Content

<p>Module 1: Problems and formulations</p>	<p>Learning time: 80h 30m</p> <p>Theory classes: 15h Practical classes: 15h Self study : 50h 30m</p>
<p>Description:</p> <p>This module has two main goals. The first one is to identify classical combinatorial optimization problems within realistic situations. The second one is to develop good skills in developing mathematical programming formulations, and get some insight in what characteristics distinguish a good formulation from a correct one. Special emphasis will be put in network flow problems and their special properties.</p> <p>Related activities:</p> <ul style="list-style-type: none"> Deliverable individual tasks Group project (First part) Final exam 	
<p>Module 2: Upper bounds: heuristics</p>	<p>Learning time: 54h</p> <p>Theory classes: 7h Practical classes: 8h Self study : 39h</p>
<p>Description:</p> <p>The goal of this module is to overview different techniques that allow identifying good solutions in reasonable times, in situations where exact methods based on mathematical programming are not affordable, because of the instance size or the problem complexity. In particular, the course covers some heuristics designed ad-hoc for specific combinatorial optimization problems, as well as general metaheuristics that need to be adapted for each particular problem.</p> <p>Related activities:</p> <ul style="list-style-type: none"> Deliverable individual tasks Group project (Second part) Final exam 	

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<p>Module 3: Lower bounding techniques</p>	<p>Learning time: 53h Theory classes: 8h Practical classes: 7h Self study : 38h</p>
<p>Description: The use of lower bounds is crucial both, to speed up exact solution methods and to assess the quality of heuristic solutions. This module covers different methods for obtaining such bounds, ranging from combinatorial lower bounds, which are specifically designed for some classical combinatorial optimization problems, to general methods such as linear or Lagrangean relaxations.</p> <p>Related activities: Deliverable individual tasks Group project (Third part) Final exam</p>	

Qualification system

The final grade depends on the following three elements:

- * 30%, Deliverable individual tasks
- * 40%, Group project (report and dissertation)
- * 30%, Final exam

Bibliography

Basic:

Nemhauser, G.L.; Wolsey, L.A. Integer and combinatorial optimization. New York: John Wiley and Sons, cop. 1999. ISBN 047182819x.

Wolsey, Laurence A. Integer programming. New York [etc.]: John Wiley & Sons, cop. 1998. ISBN 0471283665.

Ahuja, R.K.; Magnanti, T.L.; Orlin, J.B. Network flows: theory, algorithms, and applications. Harlow: Pearson, 2014. ISBN 9781292042701.