

## FUC - Ficha de Unidade Curricular

### Curricular Unit's File

<b>Code</b>	L0105
<b>Name (PT)</b>	Investigação Operacional
<b>Name (EN)</b>	Operation Research
<b>Regime</b>	Semestral
<b>Level</b>	1.º Ciclo
<b>Teaching language</b>	Português , Inglês
<b>School</b>	Escola de Gestão (EG)
<b>Department</b>	DMQGE
<b>Scientific area</b>	Investigação Operacional (IO)
<b>Responsible academic staff</b>	Maria João Sacadura Fonseca Calado de Carvalho e Cortinhal
<b>Pre-requisites</b>	Not applied.
<b>Objectives</b>	This is an introductory course on Operations Research. The goal of this course is to introduce students to concepts, models and techniques to most efficiently manage resources, maximize profits and/or minimize costs. Learning to interpret mathematical results for the specific problem, rather than just to obtain a solution is a skill to be developed over the course.
<b>Learning outcomes</b>	On the completion of this course the student will be able to 1) Develop linear programming, integer programming and mixed integer programming formulations, use general software (Solver from Excel) to determine optimal solutions to a variety of decision making problems and present managerial recommendations based on optimal solutions and sensitivity analysis; 2) Identify situations in which some network problems can be used, and apply adequate methodologies to solve them 3) Draw the network representation of a project and to perform time and economic analysis as well as resource management over the project
<b>Syllabus</b>	1. INTRODUCTION TO OPERATIONS RESEARCH 2. LINEAR PROGRAMMING AND LINEAR INTEGER PROGRAMMING 2.1. Linear Programming and Integer or Mixed Integer Programming formulations; 2.2. Optimization software (Solver Excel) 2.3. Sensitivity analysis 2.4. Practical examples 3. NETWORK MODELS 3.1. The minimum Spanning Tree Problem 3.2. The Shortest Path Problem 3.3. The Maximum Flow Problem 3.4. The Minimum-Cost Network Flow Problem 3.5. Practical examples. 4. PROJECT MANAGEMENT 4.1. Draw of a project network: AOA and AON networks; 4.2. Time analysis: Critical Path Method(CPM)and Program Evaluation Review Technique (PERT) method; 4.3. Sensitivity analysis of the duration of an activity to the duration of the project 4.4. Schedules evaluation: Numerical tools and graphical tools 4.5. Economic analysis: Project crashing and time-cost trade-off; 4.6. Resource Management :the Schedule Generation Scheme parallel heuristic;
<b>Assessment</b>	Two options: 1. Continuous Evaluation: one group assignment, one mid term test and one final test, comprising 25%, 25% and 50% of the final grade. Can be asked to do an oral presentation of their work. Attend to at least 80% of the classes. Final mark: average grade of at least 9.5. Final Examination: $\geq 7.5$ but $< 9.5$ : oral examination In both cases, if grade $\geq 17$ can be asked to do an oral examination. If they do not attend to it, their final grade will be 16

<b>Teaching methodology</b>	<p>Acquire analytical, information gathering, written and oral communication skills, according with the established learning outcomes for this unit. It will be used the following learning methodologies(LM):</p> <ol style="list-style-type: none"> <li>1. Expository, to the presentation of the theoretical reference frames</li> <li>2. Participative, with analysis and resolution of exercises</li> <li>3. Active, with the realization of group works</li> <li>4. Self-study, related with autonomous work by the student, as is contemplated in the Class Planning.</li> </ol>										
<b>Demonstration of the syllabus coherence with the curricular unit's objectives</b>	<p>This "demonstration of consistency" stems from the interconnection of the syllabus with learning goals (LG) and is explained as follows:</p> <p>LG1. Present in all but mainly in 2. LINEAR PROGRAMMING AND LINEAR INTEGER PROGRAMMING          LG2. 1. INTRODUCTION TO OPERATIONS RESEARCH and 3. NETWORK MODELS          LG3. 1. INTRODUCTION TO OPERATIONS RESEARCH and 4. PROJECT MANAGEMENT</p>										
<b>Demonstration of the coherence between the teaching methodologies and the learning outcomes</b>	<p>The learning-teaching methodologies are aimed at the development of the students' main learning competences that allow to fulfill each of the learning goals, therefore, in the grid below, it is presented the main interlinks between the learning-teaching methodologies and the respective goals</p> <table border="1"> <thead> <tr> <th>Learning-Teaching Methodologies (LTM)</th> <th>Learning Goal (LG)</th> </tr> </thead> <tbody> <tr> <td>1. Expository, to the presentation of the theoretical reference frames</td> <td>LG1, LG2 and LG3</td> </tr> <tr> <td>2. Participative, with analysis and resolution of application exercises</td> <td>LG1, LG2 and LG3</td> </tr> <tr> <td>3. Active, with the realization of group works</td> <td>LG1 and LG2</td> </tr> <tr> <td>4. Self-study, related with autonomous work by the student, as is contemplated in the Class Planning.</td> <td>LG1, LG2 and LG3</td> </tr> </tbody> </table>	Learning-Teaching Methodologies (LTM)	Learning Goal (LG)	1. Expository, to the presentation of the theoretical reference frames	LG1, LG2 and LG3	2. Participative, with analysis and resolution of application exercises	LG1, LG2 and LG3	3. Active, with the realization of group works	LG1 and LG2	4. Self-study, related with autonomous work by the student, as is contemplated in the Class Planning.	LG1, LG2 and LG3
Learning-Teaching Methodologies (LTM)	Learning Goal (LG)										
1. Expository, to the presentation of the theoretical reference frames	LG1, LG2 and LG3										
2. Participative, with analysis and resolution of application exercises	LG1, LG2 and LG3										
3. Active, with the realization of group works	LG1 and LG2										
4. Self-study, related with autonomous work by the student, as is contemplated in the Class Planning.	LG1, LG2 and LG3										
<b>Main Bibliography</b>	<p>O exame final, que decorre na época regular e na época de recurso, consistirá de um conjunto de questões, algumas de natureza teórica outras de natureza prática.</p> <p>Ao exame de época de recurso podem aceder os alunos nas seguintes condições:</p> <ol style="list-style-type: none"> <li>1. Não terem ainda obtido aprovação na UC;</li> <li>2. Pretendam efectuar melhoria de nota.</li> </ol> <p>Os alunos abrangidos pelo Regulamento Interno para Estudantes com Estatutos Especiais deverão contactar o docente da UC, ou o Coordenador da mesma, na primeira semana de aulas de cada semestre, com vista ao enquadramento dos processos de aprendizagem e avaliação na UC.</p>										
<b>Complementary Bibliography</b>	<p>The final exam, which takes place in regular and re-sitting seasons, contains questions about all the subjects taught, some of them theoretical.</p> <p>Students can enroll the re-sitting season exam in the following conditions:</p> <ol style="list-style-type: none"> <li>1. If they have not achieved a passing score yet;</li> <li>2. In order to improve their final grade.</li> </ol> <p>The students that fall under the Internal Regulation to the Students with Special Status (Regulamento Interno para Estudantes com Estatutos Especiais) must contact the teacher or the coordinator of the Learning unit, in the first week of classes of each semester, towards the insertion in the learning processes and evaluation in the Learning unit.</p>										