OPERATIONS RESEARCH – PRODUCTION SYSTEMS OPTIMISATION

COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL			
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT			
LEVEL OF STUDIES	UNDER GRADUATE			
COURSE CODE	270 711	**SEMESTER**	7	
COURSE TITLE	OPERATIONS RESEARCH – PRODUCTION SYSTEMS OPTIMISATION			
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*			**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures		2	
	Tutorial		3	
				5 (total)
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).				
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized Knowledge, skills development			
PREREQUISITE COURSES:	No			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (official)- English (optional)			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES			
COURSE WEBSITE (URL)	http://ikaros.teipir.gr/OPS/operres_en.html			

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon completion of the module the students will be able to

- Recognize the theoretical and practical problems that may be approached with optimization
- Develop an optimization model for a practical problem
- Be able to identify the software tools that could be useful for the solution of the optimization problem
- Be familiar with decision making tools and techniques such as Linear Programming-LP, Mixed Integer Non-Linear Programming- MILNP, Non-Linear Programming- NLP
- Use the most widely known appropriate software applications (i.e. office SOLVER)
- Be able to implement optimization methods and tools in energy systems
- Apply mathematical programming application for the analysis and optimisation of energy systems.
- Apply the Pinch Analysis method for energy saving
- Familiarize themselves with energy audits in the industry and, in general, acquire knowledge and incentives for the development and operation of ESCOs that may be a very prosperous professional path for them.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology concerning the optimisation of production systems
Adapting to new situations since the students acquire knowledge for technologies and projects they have never heard before.
Decision-making for the selection of the most method and tool for a specific problem
Working independently as well as in teams for the completion of the Laboratory's Assignments
Production of new research ideas for innovation in the dynamic field of the energy systems and special focus in energy saving and energy optimisation problems.
Production of free, creative and inductive thinking in the accomplishment of the relevant assigned projects.

(3) SYLLABUS

- Theoretical and practical issues in decision-making
- The science and the art of modeling
- From the real problem to the mathematical mode
- Types of models
- LINEAR PROGRAMMING
- Introduction in Linear Programming (LP)
- Identification of LP problems
- The basic steps in developing LP models
- Various examples and Exercises of LP problems
- The solution of LP problems. The Simplex method, the graphical method and the use of LP software
- LP examples from the field of Mechanical Engineering
- Sensitivity analysis in LP
- Case studies
- INTEGER and MIXED INTEGER LINEAR PROGRAMMING
- The necessity of using integer variables
- The difficulty in solving Integer Programming problems
- The role of binary variables in solving decision - making problems
- Mixed Integer Linear Programming, modeling and solution methods
- Case studies
- Computational applications (EXCEL, LINDO)
- General revision in Mathematical Programming
- NETWORKS
- The significance and the practical implications of Network Analysis
- The Shortest Path Problem
- The Spanning Tree Problem
- The Maximal Flow Problem
- SPECIAL APPLICATIONS
- Other important aspects and problems of Operations Research
- Case studies
- Energy use in the Industry
- Energy intensive industrial sectors
- The concept and applications of energy efficiency
- The basic objectives and ideas of the Optimisation
- Most widely applied optimization techniques
- Energy Management
- Energy Audits and Energy Management Systems
- Pinch Technology

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures, laboratories</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>In the processing of their two module assignments they will need to use possibly production management software</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Tutorial</td><td>39</td></tr>
<tr><td>Case studies – laboratory practice</td><td>24</td></tr>
<tr><td>Study</td><td>36</td></tr>
<tr><td>Course total</td><td>125</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Written examination, case studies and team work assignment

Written examination: 60%
Laboratory exercise: 40%</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

1. Ahern, J. (1980). The exergy method of energy systems analysis. New York: Wiley. ISBN-13: 978-0471054948
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8. Klemes, J. (2011). Sustainability in the process industry. New York: McGraw-Hill. ISBN-13: 978-0071605540
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