COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	ΟΠ1300	**SEMESTER**	4th
COURSE TITLE	Mathematical Programming		

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, Practical Exercises	5	6
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, specialized general knowledge, skills development*	Core
PREREQUISITE COURSES:	There are no prerequisite courses. It is recommended that students who are interested in attending the course have completed successfully the following course: Linear Programming.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://www.mie.uth.gr/?page_id=17836

(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*

This course requires an understanding of basic concepts of linear programming and its objective is to introduce the students to the key methodologies of non-linear and dynamic programming. The focus is on understanding various optimization techniques and on learning the theory upon which these techniques rely. After the end of the class, the students will be familiar with the development of the necessary skills for formulating related problems, using advanced tools to solve them, and comparing alternative solutions. In particular, after successful completion of the course, the students should be in position to:

- formulate a nonlinear optimization problem
- apply an algorithmic solution methodology
- validate the identified solution using some optimization software
- perform sensitivity analysis for the comparative evaluation of alternative scenarios
- check if a given solution satisfies necessary/sufficient optimality conditions
- identify and characterize deterministic and stochastic dynamic programming problems
- check if necessary conditions for the application of the dynamic programming methodology are satisfied
- define stages/states/decisions/objective function in dynamic programing problems
- apply the dynamic programming solution methodology

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
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment

Decision-making *Working independently* *Team work* *Working in an international environment* *thinking Working in an interdisciplinary environment* *Production of new research ideas*	*Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive* *……* *Others…* *…….*

- Retrieve, analyze and synthesize data and information, with the use of necessary technologies
- Autonomous Work
- Decision Making
- Design and project management
- Exercise judgement and self-evaluation
- Development of free, innovative and inductive thinking
- Development of new research ideas
- Team Work

(3) SYLLABUS

Review of linear programming. Introduction to nonlinear programming - Convexity of functions and sets. Problems without constraints. Problems with constraints. Lagrange multipliers - Karush Kuhn Tucker optimality conditions. Dynamic Programming - The Principle of Bellman. Optimality conditions. Problems with a finite horizon - Problems with an infinite horizon.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	In class lectures.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Usage of ICT for education (support of the learning process through the course's website), for research activities (search of bibliographic resources on the web) and communication with students (e-mail)
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*	

Activity	*Semester workload*
Lectures	70
Self-evaluating exercises	30
Autonomous work	50
Course Total	***150***

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.*	I. Written final exam (60%) II. Midterm (30%) III. Homework (10%) The evaluation criteria are made known to the students at the beginning of the semester and are posted on the course's website.

(5) **ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:

Βασιλείου Π.Χ., Γεωργίου Α. (1996). Μη Γραμμικές Μέθοδοι Βελτιστοποίησης. Εκδόσεις Ζήτη, Θεσσαλονίκη.

Λυμπερόπουλος Γ, Ζηλιασκόπουλος Α. (2005). Θεωρία Βελτιστοποίησης. Πανεπιστημιακές Σημειώσεις, Πανεπιστημιακές Εκδόσεις Θεσσαλίας.

Ξηρόκωστας Δ. (1999). Επιχειρησιακή Έρευνα - Μη Γραμμικός και Δυναμικός Προγραμματισμός. Εκδόσεις Συμμετρία, Αθήνα.

Ροβιθάκης Γ.Α. (2007). Τεχνικές Βελτιστοποίησης, Εκδόσεις Α. Τζιόλα & Υιοί Α.Ε.

Hillier F.S. & Lieberman, G.J., (1984). Εισαγωγή στην επιχειρησιακή έρευνα, Τόμοι Α-Γ. Μετάφραση Γ. Οικονόμου. Εκδόσεις Παπαζήση.

Hillier F.S., Lieberman G.J., (2001). Introduction to Operations Research. McGraw-Hill.

Rardin R.L., (2016). Optimization in operations research, Pearson.

Taha H., (2011). Introduction to Operations Research. Μετάφραση στα ελληνικά, Εκδόσεις Α. Τζιόλα & Υιοί Ο.Ε.

Winston W.L., Venkataramanan M., (2002). Introduction to Mathematical Programming. Duxbury Press.

- Related scientific journals:

- Annals of Operations Research
- Computational Optimization and Applications
- Computers and Industrial Engineering
- Computers and Operations Research
- Discrete Optimization
- Engineering Optimization
- European Journal of Industrial Engineering
- European Journal of Operational Research
- INFORMS Journal on Computing
- International Transactions in Operational Research
- Journal of Global Optimization
- Journal of Industrial and Management Optimization
- Journal of Optimization Theory and Applications
- Journal of the Operational Research Society
- Management Science
- Mathematical and Computer Modelling
- Mathematical Methods of Operations Research
- Mathematical Programming
- Mathematics of Operations Research
- Naval Research Logistics
- Operational Research
- Operations Research
- Operations Research Letters
- Optimization
- Optimization and Engineering
- Optimization Letters
- Optimization Methods and Software
- OR Spectrum
- RAIRO - Operations Research
- SIAM Journal on Optimization