COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING
ACADEMIC UNIT	Financial and Management Engineering
LEVEL OF STUDIES	Undergraduate
COURSE CODE	ΓΕ0181 SEMESTER 9
COURSE TITLE	SPECIAL ISSUES ON OPERATION RESEARCH

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
	3	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	3	5

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background/ Specialised general knowledge/ Skills development
PREREQUISITE COURSES:	Prerequisite knowledge from Courses: Operations Research I, Operations Research II, Linear Algebra
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (English for Erasmus students)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(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 aims for students to further study methods and problems that are related to Operational Research. The syllabus could be divided in three phases:

1. **Further study on Mathematical Programming**, where students are taught some more recently developed algorithms, such as Ellipsoid Algorithm, Internal Point Algorithm, External Point Algorithm etc., and study the advantages of these methods compared to Simplex algorithm
2. **Study of meta-heuristics**, where classical meta-heuristic algorithms are presented and their applications on Operation Research problems (such as routing and scheduling problems) are given as case studies
3. **Artificial Intelligence in Operation Research**, where the contribution of the field of AI in OR is briefly introduced

Throughout the semester, various real world problems, which a Financial and Management Engineer will cope with, will be studied.

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Decision-making
Problem Solving
Research skills
Working independently
Team work
Production of free, creative and inductive thinking

(3) SYLLABUS

1. Ellipsoid Algorithm
2. Internal Point Algorithm
3. External Point Algorithm
4. Scaling Techniques
5. Meta-heuristics
   (Tabu Search (TS), Threshold Accepted (TA), Variable Neighborhood Search (VNS), Large Neighborhood Search (LNS) etc.)
6. Genetic Programming: Theory and industrial applications
7. Intelligent Computational Methods applied on Forecasting problems in OR
8. Mathematical Programming and Artificial Intelligence
9. Fuzzy Multi-criteria Decision Making
10. Intelligent Optimization methods in Financial Engineering
11. Evolutionary Optimization in Management Engineering
    (routing problems, energy dispatch problems, scheduling, resource leveling, production management, handling uncertainty)

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	**Use of ICT in Teaching**	YES	Electronic Lecture Notes, Exercises
	Use of ICT in Laboratory Education	YES	Usage of MATLAB
	Use of ICT in Communication With Students	YES	Announcements, Email
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.*	*Activity*		*Semester workload*
	Lectures		39
	Study and analysis of bibliography		26
	Study for the semester's project		30
	Development of a method to		10

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	solve the studied problem	
	Report writing	20
	Presentation of the project	3
	Course total	*128*

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.*	The evaluation of students' performance is achieved by the completion of a project, which can be: ✓ either related to the development of a method from the ones that are part of the course, in order to solve a simple problem (with respect to the Programme Track that each student attends ✓ or a study of a specific problem and propose a solution using a predefined method that is included in libraries of any programming language, where mathematical programming or artificial intelligent methods are included Furthermore, deliverable of this project is a report which follows the structure of a research study (Introduction, Literature Review, Methods, etc.)

(5) ATTACHED BIBLIOGRAPHY

- *Recommended reading:*
  A. *Course's handbooks:*

  Bronson, R. and Naadimuthu, G., 2010. Επιχειρησιακή έρευνα. 2η εκδ. ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ.

  Hillier, F.S. and Lieberman, G.J., 2017. ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΕΠΙΧΕΙΡΗΣΙΑΚΗ ΕΡΕΥΝΑ. 10η εκδ. Εκδόσεις ΤΖΙΟΛΑ.

  Taha, H.A., 2017. ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΕΠΙΧΕΙΡΗΣΙΑΚΗ ΕΡΕΥΝΑ. 10η εκδ. Εκδόσεις ΤΖΙΟΛΑ.

  B. *Supplementary Bibliography:*

  Bazaraa, M., Jarvis, J., Sherali, H. (2005). "Linear Programming and Network Flows", 3rd edition, Wiley-Interscience

  Griva, I., Nash, S., Sofer, A. (2009). "Linear and Nonlinear Optimization", 2nd edition, SIAM

  Liberzon, Calculus of Variations and Optimal Control Theory, 2011, Princeton University Press.

  Μπότσαρης Χαρ., (2001). Αλγόριθμοι Γραμμικού Προγραμματισμού και Θεωρία Παιγνίων, Ελληνικό Ανοικτό Πανεπιστήμιο

  Ploskas, N. and Samaras, N., 2017. Linear Programming Using MATLAB® (Vol. 127). Switzerland: Springer.

- *Related scientific Journals:*

  European Journal of Operational Research, Elsevier
  Operational Research, Springer
  EURO Journal on Computational Optimization, Springer
  Annals of Operations Research, Springer
  Computers & Operations Research, Elsevier