MASTER 'S PROGRAMME
APPLIED MATHEMATICS - IN ENGLISH
1ST YEAR OF STUDY, 2ND SEMESTER

COURSE TITLE	COMBINATORIAL OPTIZATION
COURSE CODE	**MA2OCo**
COURSE TYPE	full attendance/ tutorial
COURSE LEVEL	2nd cycle (master's degree)
YEAR OF STUDY, SEMESTER	1st year of study, 2nd semester
NUMBER OF ECTS CREDITS	**6**
NUMBER OF HOURS PER WEEK	4 (2 lecture hours + 2 seminar/laboratory hours)
NAME OF LECTURE HOLDER	Dr. Mohorianu Corina
NAME OF SEMINAR HOLDER	Dr. Tănase Gabriela
PREREQUISITES	Curriculum: Graph Theory Competencies: basic graph algorithms Language: advanced level of English

A GENERAL AND COURSE-SPECIFIC COMPETENCES

General competences:

- ✓ Having a responsible attitude towards scientific research and teaching, being able to fully develop the personal potential in the professional career, respecting the principles of a rigorous and efficient work in order to fulfill complex tasks, respecting the ethical norms and principles in the professional activity
- ✓ Being able to work efficiently in a team and to coordinate and efficiently lead a team or an inter-disciplinary group
- ✓ Being able to make a selection of information resources and to use them efficiently in order to develop the professional activity and adapt it to the demands of a dynamical society

Course-specific competences:

- ✓ Manipulating notions, methods and mathematical models, specific techniques and technologies in scientific calculus and applications in economy and informatics
- ✓ Data processing, analysis and interpretation using mathematical, statistical and informatics tools
- ✓ Being able to develop, test and validate algorithms; implementation in high level programming languages
- ✓ Being able to construct and apply mathematical models for analysing and simulating some phenomena and processes
- ✓ Being able to develop, analyse and test computer systems and specific programming languages; being able to use them for solving problems in applied mathematics
- ✓ Being able to analyse and interpret some economic processes and phenomena

B LEARNING OUTCOMES

- ✓ Learning optimization techniques and commonly used algorithms
- ✓ Creating mathematical models using combinatorial techniques
- ✓ After successfully completing this course, the students will be able to:
  - ✧ Explain notions of combinatorial optimization
  - ✧ Describe combinatorial optimization algorithms
  - ✧ Use optimization techniques
  - ✧ Analyse real life problems and model them using combinatorial approaches

C LECTURE CONTENT

1. Network flows. Introductory notions. Examples
2. Max-Flow-Min-Cut theorem
3. Edmonds-Karp algorithm
4. Convergence study of the previously described algorithms
5. Flow properties and characterization
6. Minimum cost Flow algorithms – part 1

	7. Minimum cost Flow algorithms – part 2 8. Successive Path Algorithms 9. Maximum Matching theory. Introductory notions 10. Bipatite matching 11. Hall's theorem. Edmonds Matching Algorithm 12. Matriods. Definitions. Examples 13. Independent sets. Bases. Rank function. Circuits 14. Greedy algorithms. Greedoids.
D	**RECOMMENDED READING FOR LECTURES**
	1. C. Croitoru – Tehnici de baza in optimizarea combinatorie 2. C. Smadici – Introduce in analiza combinatorie
E	**SEMINAR CONTENT**
	1. Network flows. Introductory notions. Examples 2. Max-Flow-Min-Cut theorem 3. Edmonds-Karp algorithm 4. Convergence study of the previously described algorithms 5. Flow properties and characterization 6. Minimum cost Flow algorithms – part 1 7. Minimum cost Flow algorithms – part 2 8. Successive Path Algorithms 9. Maximum Matching theory. Introductory notions 10. Bipatite matching 11. Hall's theorem. Edmonds Matching Algorithm 12. Matriods. Definitions. Examples 13. Independent sets. Bases. Rank function. Circuits 14. Greedy algorithms. Greedoids.
F	**RECOMMENDED READING FOR SEMINARS**
	1. C. Croitoru – Tehnici de baza in optimizarea combinatorie 2. C. Smadici – Introduce in analiza combinatorie
G	**EDUCATION STYLE**
LEARNING AND TEACHING METHODS	Lectures: blackboard teaching Seminars/laboratory: blackboard teaching
ASSESSMENT METHODS	Course: weight in the final grade 50% (oral and written final exam, completion of the problems proposed for the 4 homework) Seminars/laboratory: weight in the final grade 50% (activity during the semester, understanding of the problems discussed during the seminars) Minimal requirements: 1. Minimum grade 5 for the written exam 2. Minimum grade 6 for the oral exam
LANGUAGE OF INSTRUCTION	English