Program	Level	Second cycle
	Name of the program	All study programs

COURSE

Course title	**Integer and Combinatorial Optimization**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
AMAT 535	III	Elective course	7	3+2+0
Lecturer				
Course Goals	This module aims to introduce students to the basic techniques for solving integer optimization problems. In addition, Branch-and-bound algorithms and approximate algorithms for solving some NP-hard problems will be covered.			
Learning Outcomes	After passing this module, the student is expected to master the techniques for solving optimization problems.			

COURSE CONTENT

- Theory and algorithms of integer programming: Formulation; Geometric representation; Unimodularity (uniextremity), Duality in linear programming; Algorithms of integer programming: Gomory Cutting Plane Algorithm; Branch-and-bound algorithm;
- Approximate and heuristic search methods;
- Mixed and combinatorial linear programming; Knapsack problem 0-1;
- Exact algorithms for NP-hard problems: Dynamic programming; Reduction of the number of states; Restrictions; Branch-and-bound algorithms; Branch-and-cut algorithms; Branch-and-price algorithms;
- Branch-and-bound algorithms: Branching scheme; Lagrangian, surrogate; Application to the multiple knapsack problem; Reduction procedure;
- Approximate algorithms: Experimental analysis; Probability; Worst case; Heuristic and metaheuristic algorithms;
- Application of discussed techniques to Traveling Salesman problems;
- Using software tools to solve integer and mixed linear programming problems;

LITERATURE

[1] Donald A. Pierre: Optimization Theory with Application, Dover Publications, Inc.
[2] Charles S. Beightler, Don T. Phillips, Douglass J. Wile: Foundations of Optimization, Prentice Hall
[3] P. Toth, Discreet D. Vigo (edited by): The Vehicle Routing Problem, SIAM Monographs on Mathematics and Applications, 2002
[4] S. Hammer, P. Toth; Knapsack Problems: Algorithms and Computer Implementations, J. Wiley, 1990
[5] G. Gutin, To Punnen (edited by): The Traveling Salesman Problem and its Variations, Kluwer, 2002
[6] C. Papadimitriou, K. Steiglitz: Combinatorial Optimization, Prentice Hall, 1982
[7] S. Martello, P. Toth: Knapsack Problems: Algorithms and Computer Implementations, J. Wiley, 1990

STUDENT WORKLOAD (hours in a semester)

Lectures	45	Exercises	30	Individual work	100	T o t a l	175

GRADING			**REMARKS**
Criterion	Maximum points	Minimum points	
Projects	50	25	
Final exam	50	30	
T o t a l	100	55	