Program	Level	First cycle		
	Name of the program	Theoretical Computer Science, Applied Mathematics		

COURSE

Course title	**Selected Topics in Graph Theory**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
AMAT 375	VI	Elective course	5	2+2+0
Lecturer				
Course Goals	The aim of the module is to deepen the knowledge acquired in the course Graph Theory through teaching units for which students express a special interest in an agreement with the subject teacher.			
Learning Outcomes	After completing the module, students will deepen and complete the previously acquired knowledge from Graph Theory and acquire the basis for independent creative research work in the directions for which express a special interest.			

COURSE CONTENT

The content of the teaching process for this module is not fixed, but the subject teacher together with the students who choose this module intending to deepen their knowledge of Graph Theory, select the chapters for which students express a special interest. Special attention is paid to the algorithmic approach and the application of Graph Theory. Available topics are:
- Bipartite graphs and applications: determination of maximum maching (Hungarian algorithm); König's theorem; Mantel's theorem.
- Matching in a general graph: Tutte's theorem; Edmonds-Gallai theorem; Edmond blossom algorithm: maximum matching in general graphs.
- Graphs and matrices: Incidence matrix of bipartite graphs; König's theorem on matrices; Birkhoff-von Neumann theorem; König-Egervary theorem;
- Graph colouring and applications: Different algorithms; The Four Color Theorem. Brooks' theorem, Wiesing's theorem. Perfect graphs
- Flow in the network and applications: Maximum flows (polynomial algorithms); Minimum cost flows (basic and polynomial algorithms); Minimum cost flows (network simplex algorithm)
- Extreme problems on graphs
- Graph connectivity and applications: algorithms for finding 2-connected and 3-connected components in a graph

LITERATURE

[1] Armen S. Asratian, Tristan M. J. Denley, and Roland Häggkvist, Bipartite graphs and their applications, Cambridge University Press, Cambridge, 1998.
[2] Béla Bollobás, Modern graph theory,Springer-Verlag, New York, 1998.
[3] J. A. Bondy and U. S. R. Murty, Graph theory with applications. Elsevier, 1976.
[4] Reinhard Diestel. Graph theory, Springer-Verlag, Berlin, third edition, 2005.
[5] Martin Charles Golumbic, Algorithmic graph theory and perfect graphs, Elsevier, 2 ed, 2004.
[6] Jonathan L. Gross, Jay Yellen, and Ping Zhang, editors. Handbook of graph theory. CRC Press, second edition, 2014.
[7] Stasys Jukna, Extremal combinatorics, Springer, second edition, 2011
[8] Dieter Jungnickel, Graphs, networks and algorithms, Springer, Heidelberg, fourth edition, 2013.
[9] William Kocay and Donald L. Kreher. Graphs, algorithms, and optimization. Chapman & Hall/CRC, Boca Raton, FL, 2005.
[10] Bernhard Korte and Jens Vygen. Combinatorial optimization, Springer, 5 ed, 2012.
[11] Douglas B. West. Introduction to graph theory. Prentice Hall, 1996.
[12] Ravindra K. Ahuja, Thomas L. Magnanti, James B. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice Hall, 1996

STUDENT WORKLOAD (hours in a semester)

Lectures	30	Exercises	30	Individual work	65	T o t a l	125

GRADING			REMARKS
Criterion	Maximum points	Minimum points	
Student projects	50	25	
Final exam	50	25	
Total	100	55	