

3M103	Elective Year 2 and 3	Mathematics Competitions	L	S	E	ECTS 4
			0	0	3	

The aim of the course. Prepare students for participation at various mathematical competitions. Except establishing basic knowledge obtained from courses at undergraduate university study programme in mathematics, lectures will provide a lot of new techniques and ideas for solving challenging mathematical problems. Students will be taught to analyze and solve difficult problems which typically appear at mathematical competitions for university students. Other aims: encourage students for individual work, develop competitive spirit and spread math culture.

Prerequisites. Differential Calculus. Integral Calculus. Elementary mathematics. Linear algebra I.

Course content.

1. Introduction. Challenging problems in Inequalities.
2. Challenging problems in Combinatorics and Discrete Mathematics.
3. Challenging problems in Mathematical Analysis.
4. Challenging problems in Linear Algebra.
5. Challenging problems in Elementary Geometry.
6. Challenging problems in Number Theory and Group Theory.

LEARNING OUTCOMES

Num.	LEARNING OUTCOMES
1.	Individually analyze and discuss problems and solutions of problems that occur at mathematical competitions such as International Mathematics Competition and Vojtech Jarnik.
2.	Individually, fully or partially, solve difficult mathematical problems.
3.	Correctly and thoroughly build and write down solutions of math problems in English, in accordance with the expectations of the Jury at math competitions for the purpose to obtain the maximum number of points.
4.	Use and apply basic knowledge from mathematical analysis, linear algebra, combinatorics and discrete mathematics, elementary geometry, number theory and group theory, to challenging problems on mathematical competitions.
5.	Connect different areas of mathematics which are previously studied in separate manner.

CONNECTING LEARNING OUTCOMES, ORGANIZATION OF TEACHING PROCESS AND ASSESSMENT OF STUDENT LEARNING OUTCOMES

TEACHING PROCESS ORGANIZATION	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	SCORE	
					min	max

Lecture attendance	2	1-5	Attending lectures, discussions, teamwork and individual work on tasks	Participant lists, monitoring activities on class	20	40
Homework assignments	1	1-5	Individual work on solving math problems	Evaluation	15	30
Probationary competition	1	1-5	Participation on probationary and on actual math competitions	Achieved results on probationary and on actual math competitions	15	30
TOTAL	4				50	100

Teaching and evaluation of knowledge. Exercises are mandatory. All topics will be processed by using lots of examples. In this way, student will adopt various techniques and ideas for solving challenging mathematical problems. By solving homework students shall additionally familiarize with presented topics, and solutions of their homework shall be presented at lectures or/and submitted in written form. Participation and activities of students at lectures will be monitored, correctness of solutions will be checked. There will be a probationary math competition, which will be organized in order to decide which students should participate at the actual math competition.

Can the course be taught in English: Yes.

Basic literature:

1. M. Becheanu, International Mathematical Olympiads 1959-2000. Problems. Solutions. Results, Academic Distribution Center, Freeland, USA, 2001.
2. L. Fehér, G.Kós, A. Tóth, Mathematical Analysis-Problems and Exercises II, Eötvös Loránd University, Faculty of Sciences, Typotex 2014.
3. A.S. Posamentier, C.T. Salkind, Challenging Problems in Algebra, Dover Books in Mathematics, 1996.
4. C.J. Bradley, Challenges in Geometry: for Mathematical Olympians Past and Present, Oxford University Press, 2005.
5. I. Tomescu, R.A. Melter, Problems in Combinatorics and Graph Theory, John Wiley and Sons, 1985.
6. M.Th. Rassias, Problem-Solving and Selected Topics in Number Theory : In the Spirit of the Mathematical Olympiads Foreword by Preda Mihailescu, Springer, New York, 2011.

Additional literature:

1. G. Polya, How to Solve It: A New Aspect of Mathematical Method, Princeton University Press, 2014.
2. A. Engel, Problem Solving Strategies, Springer-Verlag, 1999.
3. W. Rudin, Principles of Mathematical Analysis, Third Edition, McGraw-Hill Inc., 1976.
4. <http://www.imc-math.org.uk/>
5. <https://www.imo-official.org/>
6. <http://kskedlaya.org/putnam-archive/>