Level: bachelor	
Course title: Combinatorics (M4-11)	
Status: obligatory	
ECTS: 6	
Requirements: none	

Learning objectives

Basic and advanced methods of counting. Existence of particular combinatorial structures and extremal combinatorics (system of distinct representatives, minimal line cover of 1's in (0-1)-matrices, double-stochastic matrices). Block designs. Steiner triples.

Learning outcomes

Students are expected to be able to use and apply different methods and techniques in counting problems. They are also expected to understand basic concepts in extremal combinatorics, block designs, Steiner triples etc.

Syllabus

Theoretical instruction

Basic counting, permutations and combinations. Binomial and polynomial coefficients. Inclusion-exclusion principle, derangements, Stirling numbers of the 2nd kind. Recurrence relations, Fibonacci and Catalan numbers. Generating functions. System of distinct representatives. Hall's and König-Egerváry theorems. Double stochastic matrices. Birkhoff-von Neuman theorem.

Practical instruction

Applying basic counting techniques in standard problems. Using binomial and polynomial formulas and identities. Applying advanced techniques (inclusion-exclusion formula, recurrences, generating functions) in the case of Stirling numbers, Fibonacci numbers, Hanoi tower, triangulations of convex polygon etc.

Weekly teaching load				Other: 0
Lectures: 3	Exercises: 2	Other forms of teaching: 0	Student research: 0	