Program	Type of studies (cycle)	Third cycle
	Name of the program	Doctoral Studies in Mathematical and Computer Science

COURSE

Course title	**Convex Polytopes**

Course code	Semester	Course status	ECTS credits	Contact hours
PMAT-710	II	elective	10	30

Aims and intended learning outcomes

The aim of the course is to introduce students to the fundamental concepts and methods of the theory of convex polytopes, a central area of convex geometry with strong connections to combinatorics, algebraic geometry, graph theory, optimisation, and other branches of mathematics. The course aims to develop students' understanding of the structural and combinatorial properties of convex polytopes, as well as their ability to apply methods and constructions from polytope theory in different mathematical contexts.

Upon successful completion of the course, students will be able to:

- define and explain the fundamental concepts of the theory of convex polytopes;
- state and apply the fundamental theorems of polytope theory;
- describe and use the main constructions associated with convex polytopes;
- recognise connections between polytope theory and other areas of mathematics, particularly combinatorics, graph theory, and optimisation;
- apply methods and results from polytope theory to problems arising in related mathematical areas;
- independently extend their knowledge of convex polytopes using relevant mathematical literature.

Course content/topics

- Convex sets, polyhedral sets and polytopes. H-representation and v-representation of a polytope. Fourier-Motzkin elimination, The Farkas lemma.
- Vertices, faces and facets of polytopes. Face Lattice. Simplicial and simple polytopes.
- Schlegel diagrams. Polyhedral complexes. Duality and Gale diagrams.
- Some special classes of polytopes

LITERATURE

[1] Lectures on Polytopes, G.M.Ziegler, Springer, 2007

[2] Convex Polytopes, B. Grunbaum, Springer, 2002

[3] R.R. Thomas, Lectures in Geometric Combinatorics, AMS, 2006

[4] Regular Polytopes, H.S.M. Coxeter, Dover publications, 2019

Grading

	Criterion	Points	Cut-off points
1.	Assignments	50	30
3	Final exam	50	25
	T o t a l	100	55