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

Course				

Course title	**Abstract algebra and graphs**			
Course code	Semester	Course status	ECTS credits	Contact hours
PMAT 610	I	Optional	10	30
Teaching staff	Teacher	Prof. dr. Amir Džambić		
	Other staff			

Course goals	The aim of this course is to give an introduction to the fruitful interaction between the groups presented, graph theories and arithmetic in simple algebras over local and global fields. In doing so, there are indispensable applications start from arithmetic applications of determining the number of classes of ideals in imaginary square fields of numbers across applications in hyperbolic geometry to applications in theory of groups and graphs (construction of infinite expander families, cohomology group, etc.)

Course content/topics
Group SL2(Z) and upper half-level H and the theory of reduction of integral binary square forms
Modular curve
Abstract theory of quaternion algebra
Local and global fields
Structure of integral rings in quaternions and local and global fields, tree of maximum ranks
Arithmetic groups resulting from quaternion algebra and the applications
Free groups, group presentations
Cayley's graphs
Fundamental groups of graphs, Bass-Serre theory
Burhata-Titsa T wood
Operations of discrete groups on T, definite algebra quaternions
Expanders and Ramanujan graphs

LITERATURE
[1] J.-P. Serre: Trees, Springer Monographs in Mathematics;
[2] M-F Vigneras: Arithmetique des algebras de quaternions, Springer Lectures Notes in Mathematics 800;
[3] C Maclachlan, A Reid: The arithmetic of Hyperbolic manifolds, Springer Graduate Texts in Mathematics 219;
[4] A. Lubotzky: Discrete groups, expanding graphs and invariant measures, Birkhauser Progress in Mathematics 125

Grading			
	Criterion	Points	Cut-off points
1.	Written assignment		
2.	Project	50	25
3	Final exam	50	30
	Total	100	55