

Study programmes: PhD studies – Mathematics-Algebra			
Course name: Rings and modules			
Lecturers: Goran Đanković			
Status: Optional			
ECTS: 9			
Attendance prerequisites: Selected topics of algebra, Algebra 4			
Course aims: Acquisition of general and advanced knowledge of ring theory, module theory and rings with algorithms theory			
Course outcome: Upon completion of the course, students have expanded their knowledge of ring and module theory. They understand the following notions: free modules, injective and projective modules, Artinian and Noetherian modules, semisimple modules and rings, Ore domains, skew polynomial rings. Students know basic and more advanced theorems from these fields and are familiar with main constructions. They are qualified to solve problems from the mentioned areas and follow advanced courses in which algebra plays an important part, as well as current research from the field.			
Course content: Rings and modules Injective and projective modules. Artinian and Noetherian modules. Local rings, Krull-Remak-Schmidt theorem. Semisimple modules and rings. Radical and socle. Flat modules and regular rings. Rings with algorithms. Introduction: matrix rings, projective modules, Hermite rings, the matrix definition of a module, modules over Ore domains. Free ideal rings and their properties. Euclidean rings, euclidean algorithm and its generalization. Factorization - commutative and noncommutative case, primary decomposition. Modules over free ideal rings; normal form of matrices over free algebras. Principal ideal domains; diagonal reduction of matrices and finitely generated modules over principal ideal domains; skew polynomial rings and pseudo-linear transformations.			
Literature: P. M. Cohn, <i>Free rings and their relations</i> , second edition, Academic Press, London Mathematical Society Monograph No. 19, 1985. P. M. Cohn, <i>Algebra</i> , second edition, Volume 3, John Wiley & Sons, Chichester, 1991. F. Kasch, <i>Modules and Rings</i> , Academic Press, 1983.			
Number of hours: 10	Lectures: 4	Tutorials: 6	
Teaching and learning methods: Frontal / Interactive / Tutorials / Lectures / Exercises			
Assessment (maximal 100 points)			
Course assignments	Points	Final exam	Points
Lectures	-	Written exam	30
Exercises / Tutorials	-	Oral exam	30
Colloquia			
Essay / Project	40		