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|  **UNIVERSITY OF NIŠ** |
| **Course Unit Descriptor** | **Faculty**  | Faculty of Sciences and Mathematics |
| **GENERAL INFORMATION** |
| Study program  | **Computer Science, PhD studies** |
| Study Module (if applicable) |  |
| Course title | I352 Computation of generalized inverses |
| Level of study | [ ] Bachelor [ ]  Master’s [x]  Doctoral |
| Type of course | [ ]  Obligatory [x]  Elective |
| Semester  |  [x]  Autumn [ ] Spring |
| Year of study  | 1 |
| Number of ECTS allocated | 12 |
| Name of lecturer/lecturers | Predrag S. Stanimirović |
| Teaching mode |  [x] Lectures [ ] Group tutorials [ ]  Individual tutorials [ ] Laboratory work [ ]  Project work [x]  Seminar [ ] Distance learning [ ]  Blended learning [ ]  Other |
| **PURPOSE AND OVERVIEW (max. 5 sentences)** |
| *- Investigate direct and iterative methods for computing generalized inverses.**- Symbolic computation of generalized inverses using a Computer Algebra System**- Applications of generalized inverses**- Qualify students to develop their own methods.* |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** |
| **Introduction.** Introduction to basic and advanced methods for symbolical and numerical matrix generalized inverses (Moore-Penrose, weighted Moore-Penrose, Drazin, Group and {i,j,k} inverses) computation. **Direct methods.** Methods based on full-rank factorization, LU decomposition, QR decomposition, Singular value decomposition, URV decomposition. Gauss-Jordan methods for computing generalized inverses. Partitioning methods and Greville partitioning method. Determinant representation. Leverrier-Faddev method.**Iterative methods.** Groetch theorem, generalizations and special cases. Methods based on the first and the second order gradient methods. Methods based on the conjugate-gradient method. Limit representations. Hyperpower and Schultz-type iterative methods.**Generalized inverses of rational and polynomial matrices.** Methods based on QDR decomposition, Partitioning method for rational and polynomial matrices. Leverrier-Faddeev method for polynomial matrices. Effective partitioning and Leverrier-Faddeev-type methods. Interpolation methods for polynomial matrices. Generalized inverses of multivariable rational and polynomial matrices.**Generalized inverses of sparse and structured matrices.** Sparse-matrix representations. Partitioning method for sparse matrices. Determinant representation methods for sparse matrices. Iterative methods.**Recurrent Neural Network approach to computation of generalized inverses.****Implementation.** Symbolic implementation in Mathematica. Implementation in procedural programming language (C, C++). Implementation based on the linear algebra packages (for example Matlab).**Applications of generalized inverses.** Applications in statistics. Application in image deblurring.  |
| **LANGUAGE OF INSTRUCTION** |
| [x] Serbian (complete course) [ ]  English (complete course) [ ]  Other \_\_\_\_\_\_\_\_\_\_\_\_\_ (complete course)[ ] Serbian with English mentoring [ ] Serbian with other mentoring \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **ASSESSMENT METHODS AND CRITERIA** |
| **Pre exam duties** | **Points** | **Final exam** | **points** |
| **Activity during lectures** | **10** | **Written examination** | **30** |
| **Practical teaching** |  | **Oral examination** | **60** |
| **Teaching colloquia** |  | **OVERALL SUM** | **100** |
| **\*Final examination mark is formed in accordance with the Institutional documents** |