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|  **UNIVERSITY OF NIŠ** |
| **Course Unit Descriptor** | **Faculty**  | Faculty of Sciences and Mathematics |
| **GENERAL INFORMATION** |
| Study program  | Mathematics |
| Study Module (if applicable) |  |
| Course title | Nonlinear Equations and Systems |
| Level of study | [ ] Bachelor [ ]  Master’s [x]  Doctoral |
| Type of course | [ ]  Obligatory [x]  Elective |
| Semester  |  [ ]  Autumn [x] Spring |
| Year of study  | 1 |
| Number of ECTS allocated | 12 |
| Name of lecturer/lecturers | Nebojša Č. Dinčić |
| Teaching mode |  [x] Lectures [ ] Group tutorials [ ]  Individual tutorials [ ] Laboratory work [ ]  Project work [ ]  Seminar [ ] Distance learning [ ]  Blended learning [ ]  Other |
| **PURPOSE AND OVERVIEW (max. 5 sentences)** |
| Introduction to the theory of linear operator equations and a general problem of regularization.Student is qualified for solving nonlinear operator equations by using various methods. Mastering Tikhonov regularization makes it possible to work with ill-conditioned problems. |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** |
| Nonlinear operator equation:• Introductory remarks: non-linear operators and functionals; continuity, boundedness and differentiability of nonlinear operators; Fréchet derivative and integration of abstract functions. Urysohn operator in spaces C and Lp• The existence of solutions: method of successive approximation, principle of contractive mappings, uniqueness of solutions, equations with completely continuous operators; Schauder principle, the use of the theory of completely continuous vector fields; variational methods; transformation of the equations• Qualitative methods in the theory of branching solutions: extension of the solutions, implicit function theorem, branching points, bifurcation points; the principle of linearization Tikhonov regularization for nonlinear problems: The general problem of regularization, ill-posed problems, the concept of regularization of Tikhonov, Introduction to Tikhonov regularization for nonlinear problems, analysis of convergence |
| **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** |  |
| **Practical teaching** |  | **Oral examination** | **50** |
| **Teaching colloquia** | **40** | **OVERALL SUM** | **100** |
| **\*Final examination mark is formed in accordance with the Institutional documents** |