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|  **UNIVERSITY OF NIŠ** |
| **Course Unit Descriptor** | **Faculty**  | Faculty of Science and Mathematics |
| **GENERAL INFORMATION** |
| Study program  | **Mathematics** |
| Study Module (if applicable) |  |
| Course title | Nonlinear dynamic and chaos |
| Level of study | [ ] Bachelor [ ]  Master’s [x]  Doctoral |
| Type of course | [ ]  Obligatory [x]  Elective |
| Semester  |  [ ]  Autumn [x] Spring |
| Year of study  | II |
| Number of ECTS allocated | 12 |
| Name of lecturer/lecturers | Jelena V. Manojlović |
| 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)** |
| *Course is an advanced introduction to nonlinear dynamics and chaos with applications.* It emphasis on geometric thinking, computational and analytical methods and makes extensive use of demonstration software. Course focuses on applications of nonlinear dynamics to different disciplines, e.g., ecology, engineering, neurobiology, and fluid dynamics. As learning outcomes student should mastered the theoretical basis of the stability theory of differential equations such as bifurcation, chaos, iterated maps, fractals and strange attractors and should be able to apply the theory developed for the qualitative analysis of nonlinear dynamical systems with the use of software packages for graphic interpretation of the phase portraits. |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** |
| Phase portraits of linear systems in the plane. Linearization and Hartman’s Theorem. Topological classification of dynamical systems. Constructing Phase Plane Diagrams. Existence and nonexistence of limit cycles in the plane. Poincare-Bendixson Theorem. Bifurcation of one-dimensional and two-dimensional dynamical systems. Three-dimensional dynamical systems and chaos: The Rossler system and chaos. The Lorenz equation and attractor. Chua’s Circuit. Poincare maps. Chaos on strange attractors: Lyapunov exponent. Chaotic orbits. Strange attractors. Fractals: Koch snowflake. Cantor set. Iterated maps. Mandelbrot and Julia sets. Sierpinski carpet. Fractal dimension. The Second Part of Hilbert’s Sixteenth Problem |
| **LANGUAGE OF INSTRUCTION** |
| [x] Serbian (complete course) [ ]  English (complete course) [ ]  Other \_\_\_\_\_\_\_\_\_\_\_\_\_ (complete course)[x] Serbian with English mentoring [ ] Serbian with other mentoring \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **ASSESSMENT METHODS AND CRITERIA** |
| **Pre exam duties** | **Points** | **Final exam** | **Points** |
| **Activity during lectures** |  | **Written examination** |  |
| **Seminars** |  | **Oral examination** | **50** |
| **Teaching colloquia** | **50** | **OVERALL SUM** | **100** |
| **\*Final examination mark is formed in accordance with the Institutional documents** |