Structure of the study program

The study program Doctoral School of Mathematics represents joint doctoral studies in the field of mathematical sciences at the University of Novi Sad, the University of Niš, the University of Kragujevac and State University of Novi Pazar, which are going to be conducted at the Faculty of Sciences in Novi Sad, Faculty of Sciences and Mathematics in Niš, Faculty of Science in Kragujevac and State University of Novi Pazar. Their duration is 3 years (6 semesters), totalling to 180 ECTS, and upon the completion, the title of PhD in Mathematical Sciences is obtained. Candidates who have achieved at least 300 ECTS in basic academic and master academic studies in mathematics or related disciplines are eligible to enrol in doctoral studies. In accordance with the strategic orientation of the educational institutions to enable active development of young researchers, doctoral studies are based on the free choice of elective courses. The courses are grouped in thematic units and the student chooses at least three courses from one such unit. The student chooses or is assigned a teacher advisor after enrolment. The advisor and the student, based on the candidate's preferences, determine professional and scientific aspects in the implementation of the curriculum. In particular, this means that there is a consistent and goal-oriented choice of elective courses which form the theoretical foundation of the area of ​​the student’s scientific interest. In addition, the student performs independent research work through which they demonstrate and develop the ability of independent research activities. Courses and seminar papers make a legally defined scope of 120 ECTS for the first two years of study. The third year is dedicated to independent research work and the preparation of a doctoral dissertation, which carries the remaining 60 ECTS.

The purpose of the study program

The purpose of the study program Doctoral School of Mathematics is to educate scientific staff to be ready for independent research work in mathematical sciences, as well as for critical evaluation of research in mathematics and related fields. The key element in this regard is to achieve a top level of knowledge and understanding of modern trends in mathematics, as well as to get to know the structure of the scientific research process and skills necessary for successful preparation, publication and presentation of scientific research results, according to standards adopted in mathematical sciences.

The study program includes modern areas of mathematics motivated by the creation and realization of models for the issues that occur in other scientific fields, e.g., in natural sciences, in many areas of information science research, technical-technological, economic research, as well as in medical, agricultural sciences and humanities. In this way, the study program gives an opportunity for young scientists to, in addition to the mathematical sciences domain, acquire knowledge for the practical implementation and inclusion in a global social context, with the aim to use and apply mathematics in order to increase general level of social development.

The goals of the study program

The goals of the study program Doctoral School of Mathematics are:

• mastering fundamental mathematical disciplines and mastering modern techniques in the fields of Mathematical Analysis and Algebra and Mathematical Logic in order to acquire the necessary tools for formulating and solving mathematical models

• acquiring knowledge from selected areas of related sciences by choosing courses that deal with content related to the formulation and use of mathematical models

• mentoring and training young staff in teaching at universities and colleges

• involvement of young researchers in current global trends in scientific research through the study of contemporary literature and papers published in leading world journals

• acquiring the necessary knowledge necessary for the development of scientific cooperation and communication with the mathematical and wider scientific audience, through the presentation of independent results, as well as the results of other authors

Competencies of graduated students

Students who complete their doctoral studies will be young scientific researchers who possess the modern specialist and scientific knowledge necessary for following global scientific trends in the fields of their interest. They will have at least one paper published or accepted for publication in well-known international journals in the field of mathematics, which is their focus, and thus they will receive a confirmation that they are able to continue successful scientific research independently and in cooperation with other researchers. These young PhD holders will acquire the knowledge necessary for inclusion in the university teaching process in the fields of mathematics in undergraduate and master studies of mathematics, as well as studies in other fields. They will have the necessary knowledge and techniques to be included in specialist and scientific teams in other institutions of direct and indirect production, where their knowledge will contribute to the quality of scientific models with direct application. Successful mastering of this study program provides knowledge and methodological approach in the analysis of various problems thanks to the specifics of mathematical formulations of proof and statements, which are particularly important in mathematics.

Curriculum

The study program has 6 elective courses that are taken in the first four semesters and carry 12 points, 4 seminar papers (SIR) that carry 6 points, 2 scientific research papers (SIR) with 12 points in the fourth semester, while two courses for the final dissertation and the completion of the final dissertation in the third year of study carry 60 points in total.

The student chooses (or is assigned) an advisor when enrolling. The role of the advisor is taken over by the mentor at the time of the doctoral dissertation application.

Elective courses are classified into groups

1. Microlocal analysis

2. Operator theory

3. Partial differential equations

4. Numerical analysis

5. Stochastic analysis and mathematical statistics

6. Dynamic systems and differential geometry

7. Mathematical logic

8. Algebra

9. Set theory and topology

Each student chooses at least three subjects from one of the groups

Schedule of courses by semester and years of study

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| rb | Code | Course Name | Sam. | Status | Active Classes | | | ESPB |
| T | SSW | REST |
| **First year** | | | | | | | | |
| 1 | MDS0I1 | Elective course 1 | 1 | E | 5 |  |  | 12 |
| 2 | MDS0I2 | Elective course 2 | 1 | E | 5 |  |  | 12 |
| 3 | MDS001 | Seminar work 1 – SIR 1 | 1 | O | 2 | 10 |  | 6 |
| 4 | MDS0I3 | Elective course 3 | 2 | E | 5 |  |  | 12 |
| 5 | MDS0I4 | Electoral Case 4 | 2 | E | 5 |  |  | 12 |
| 6 | MDS002 | Elective course 2 – SIR 2 | 2 | O | 2 | 10 |  | 6 |
| **Total active teaching classes and points**  **of year** | | | | | **24** | **20** |  | **60** |
| **Sophomore year** | | | | | | | | |
| 7 | MDS0I5 | Elective course 5 | 3 | E | 5 |  |  | 12 |
| 8 | MDS0I6 | Elective course 6 | 3 | E | 5 |  |  | 12 |
| 9 | MDS003 | Seminar work 3 – SIR 3 | 3 | O | 2 | 10 |  | 6 |
| 10 | MDS004 | Scientific -Research Work 1 – SIR 4 | 4 | O | 0 | 10 |  | 12 |
| 11 | MDS005 | Scientific -Research Work 2 – SIR 5 | 4 | O | 0 | 10 |  | 12 |
| 12 | MDS006 | Seminar work – SIR 6 | 4 | O | 0 | 8 |  | 6 |
| **Total active teaching classes and points**  **of year** | | | | | **12** | **38** |  | **60** |
| **Third year** | | | | | | | | |
| 13 | MDS007 | Scientific Work 1 – Subject of Final Work 1 | 5 | O |  | 20 |  | 30 |
| 14 | MDS008 | Scientific Work 2 – Subject of Final Work 2 | 6 | O |  | 20 |  | 15 |
| 15 | MDS009 | Doctoral dissertation | 6 | O |  | 10 |  | 15 |
| **Total active teaching classes and points**  **of year** | | | | |  | **50** |  | **60** |
| **Total hours of active teaching and points**  **in the study program** | | | | | **36** | **108** |  | **180** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No | Code | Subject | Teacher | S | ECTS | Area | Т |
| **Microlocal Analysis** | | | | | | | |
| 1 | MDSMA1 | Analysis on manifolds | Sanja Konjik | 1 | 12 | Mathematics | E |
| 2 | MDSMA2 | Locally convex spaces | Jason Vindas  Stevan Pilipović | 1 | 12 | Mathematics | E |
| 3 | MDSMA3 | Time-frequency analysis | Ville Turunen,  Nenad Teofanov | 2 | 12 | Mathematics | E |
| 4 | MDSMA4 | Generalized functions | Danijela Rajter Ćirić,  Nenad Teofanov | 2 | 12 | Mathematics | E |
| 5 | MDSMA5 | Integral transformations | Stevan Pilipović  Dijana Dolićanin-Đekić | 2 | 12 | Mathematics | E |
| 6 | MDSMA6 | Microlocal Analysis | Nenad Teofanov,  Stevan Pilipović | 3 | 12 | Mathematics | E |
| 7 | MDSMA7 | Pseudodifferential and Furier' integral operators | Sandro Corriasco,  Stevan Pilipović | 3 | 12 | Mathematics | E |
| **Operator Theory** | | | | | | | |
| 8 | MDSTO1 | Measure and integration | Dora Seleši | 1 | 12 | Mathematics | E |
| 9 | MDSTO2 | Functional Analysis | Dragan Đorđević,  Vladimir Rakočević | 1 | 12 | Mathematics | E |
| 10 | MDSTO3 | Banach algebras and spectral theory | Snežana Živković Zlatanović,  Suzana Aleksić | 2 | 12 | Mathematics | E |
| 11 | MDSTO4 | Generalized inverses | Dijana Mosić | 2 | 12 | Mathematics | E |
| 12 | MDSTO5 | Functional Analysis 2 | Snežana Živković Zlatanović,  Bogdan Đorđević | 2 | 12 | Mathematics | E |
| 13 | MDSTO6 | Unbounded linear operators | Nebojša Dinčić | 3 | 12 | Mathematics | E |
| 14 | MDSTO7 | Fredholm theory | Snežana Živković Zlatanović | 3 | 12 | Mathematics | E |
| 15 | MDSTO8 | Functional Analysis 3 | Milica Kolundžija,  Dragan Rakić,  Martin Ljubenović | 3 | 12 | Mathematics | E |
| 16 | MDSTO9 | Operator algebras and Hilbert's C\*-modules | Dragan Đorđević,  Stefan Ivković | 3 | 12 | Mathematics | E |
| **Partial Differential Equations** | | | | | | | |
| 17 | MDSPD1 | Linear partial differential equations | Marko Nedeljkov | 1 | 12 | Mathematics | E |
| 18 | MDSPD2 | Numerical solutions of partial differential equations | Endre Sülli,  Marko Nedeljkov | 1 | 12 | Mathematics | E |
| 19 | MDSPD3 | Hyperbolic partial differential equations | Günther Hörman  Marko Nedeljkov | 2 | 12 | Mathematics | E |
| 20 | MDSPD4 | Final Elements Method | Endre Sülli,  Nataša Krejić | 2 | 12 | Mathematics | E |
| 21 | MDSPD5 | Mathematical methods in continuum mechanics | Srboljub Simić,  Milana Čolić | 2 | 12 | Mathematics | E |
| 22 | MDSPD6 | Mathematical aspects of quantum mechanics | Günther Hörman,  Marko Nedeljkov | 3 | 12 | Mathematics | E |
| 23 | MDSPD7 | Symmetry groups | Sanja Konjik | 3 | 12 | Mathematics | E |
| 24 | MDSPD8 | Nonlinear partial differential equations | Marko Nedeljkov,  Srđan Trifunović | 3 | 12 | Mathematics | E |
| 25 | MDSPD9 | Mathematical methods in kinetic gas theory | Milana Čolić,  Srboljub Simić | 3 | 12 | Mathematics | E |
| **Dynamical Systems and Differential Geometry** | | | | | | | |
| 26 | MDSD01 | Lee groups and algebra | Borislav Gajić,  Vladimir Dragović,  Božidar Jovanović,  Milena Radnović | 1 | 12 | Mathematics | E |
| 27 | MDSD02 | Differential geometry | Michael Kunzinger,  Mića Stanković,  Sanja Konjik | 1 | 12 | Mathematics | E |
| 28 | MDSD03 | Riemann manifolds | Michael Kunzinger,  Ljubica Velimirović,  Božidar Jovanović,  Milan Zlatanović | 2 | 12 | Mathematics | E |
| 29 | MDSD04 | Semi-Riemanian geometry | Michael Kunzinger,  Emilija Nešović,  Ljubica Velimirović | 2 | 12 | Mathematics | E |
| 30 | MDSD05 | Riemann surfaces and algebraic curves | Borislav Gajić,  Vladimir Dragović,  Božidar Jovanović,  Milena Radnović | 2 | 12 | Mathematics | E |
| 31 | MDSD06 | Simplectic geometry and analytic mechanics | Борислав Гајић,  Vladimir Dragović,  Božidar Jovanović,  Milena Radnović | 3 | 12 | Mathematics | E |
| 32 | MDSD07 | Generalized Riemann spaces | Mića Stanković,  Milan Zlatanović | 3 | 12 | Mathematics | E |
| 33 | MDSD08 | Geodesic mappings | Mića Stanković | 3 | 12 | Mathematics | E |
| 34 | MDSD09 | Dynamic Systems | Jelena V. Manojlović | 1 | 12 | Mathematics | E |
| 35 | MDSD10 | Regularly varying functions and differential equations | Jelena V. Manojlović | 2 | 12 | Mathematics | E |
| **Mathematical Logic** | | | | | | | |
| 36 | MDSL01 | Nonclassical logics | Zoran Ognjanović | 1 | 12 | Mathematics | E |
| 37 | MDSL02 | Mathematical logic | Silvija Gilezan,  Zoran Petrić | 1 | 12 | Mathematics | E |
| 38 | MDSL03 | Cryptology 1 | Miodrag Mihaljević | 1 | 12 | Mathematics | E |
| 39 | MDSL04 | Теорија модела | Predrag Tanović | 2 | 12 | Mathematics | E |
| 40 | MDSL05 | Automated and interactive theorem provers | Silvija Gilezan | 2 | 12 | Mathematics | E |
| 41 | MDSL06 | Formalization of uncertain reasoning | Zoran Ognjanović | 2 | 12 | Mathematics | E |
| 42 | MDSL07 | Cryptology 2 | Miodrag Mihaljević | 2 | 12 | Mathematics | E |
| 43 | MDSL08 | Blockchain | Miodrag Mihaljević | 3 | 12 | Mathematics | E |
| 44 | MDSL09 | Proving and category theory | Zoran Petrić | 3 | 12 | Mathematics | E |
| 45 | MDSL10 | Computability theory | Zoran Ognjanović,  Silvija Gilezan | 3 | 12 | Mathematics | E |
| **Numerical Analysis and Optimization** | | | | | | | |
| 46 | MDSPD1 | Approximation theory | Marija Stanić,  Tatjana Tomović Mladenović | 1 | 12 | Mathematics | E |
| 47 | MDSN02 | Linear programming and optimization | |  | | --- | | Tatjana Davidović | | 1 | 12 | Mathematics | E |
| 48 | MDSN03 | Numerical optimization | Nataša Krejić | 1 | 12 | Mathematics | E |
| 49 | MDSN10 | Graph Theory | Bojana Borovićanin | 1 | 12 | Mathematics | E |
| 50 | MDSN04 | Numeric linear algebra | Marko Petković | 2 | 12 | Mathematics | E |
| 51 | MDSN05 | Numerical integration | Marija Stanić,  Tatjana Tomović Mladenović | 2 | 12 | Mathematics | E |
| 52 | MDSN06 | Multiple Criteria Optimization | Ivan Stanimirović | 2 | 12 | Mathematics | E |
| 53 | MDSN07 | Metaheuristic methods | Bogdana Stanojević | 2 | 12 | Mathematics | E |
| 54 | MDSN08 | Distributed optimization | Dušan Jakovetić | 3 | 12 | Mathematics | E |
| 55 | MDSN09 | Time-varying nonlinear optimization | Predrag S. Stanimirović | 3 | 12 | Mathematics | E |
| 56 | MDSN11 | Stohastic optimization | Nataša Krklec Jerinkić | 3 | 12 | Mathematics | E |
| 57 | MDSN12 | Introduction to machine learning | Lazar Velimirović,  Miloš Radovanović,  Miloš Savić | 3 | 12 | Mathematics | E |
| 58 | MDSN13 | Artificial neural networks | Branimir Todorović,  Vladimir Kurbalija,  Nemanja Milošević | 3 | 12 | Mathematics | E |
| **Set Theory and Topology** | | | | | | | |
| 59 | MDST01 | Algebraic topology | Đorđe Baralić | 1 | 12 | Mathematics | E |
| 60 | MDST02 | Introduction to set theory | Miloš Kurilić | 1 | 12 | Mathematics | E |
| 61 | MDST03 | Toric Topology | Đorđe Baralić | 2 | 12 | Mathematics | E |
| 62 | MDST04 | Models of set theory` | Stevo Todorčević | 2 | 12 | Mathematics | E |
| 63 | MDST05 | Set theoretic topology | Miloš Kurilić,  Boriša Kuzeljević | 2 | 12 | Mathematics | E |
| 64 | MDST06 | Descriptive combinatorics | Stevo Todorčević | 3 | 12 | Mathematics | E |
| 65 | MDST07 | Theory of polytopes | Đorđe Baralić | 3 | 12 | Mathematics | E |
| 66 | MDST08 | Регуларност и комбинаторне структуре | Luka Milićević | 3 | 12 | Mathematics | E |
| 67 | MDST09 | Boolean Algebras | Miloš Kurilić | 3 | 12 | Mathematics | E |
| **Algebra** | | | | | | | |
| 68 | MDSA01 | General algebra | Miroslav Ćirić,  Andreja Tepavčević | 1 | 12 | Mathematics | E |
| 69 | MDSA02 | Тheory of ordered sets | Andreja Tepavčević | 1 | 12 | Mathematics | E |
| 70 | MDSA03 | Semigroup theory | Igor Dolinka,  Miroslav Ćirić | 1 | 12 | Mathematics | E |
| 71 | MDSA04 | Universal algebra | Petar Marković | 1 | 12 | Mathematics | E |
| 72 | MDSA05 | Ordered algebraic structures | Jelena Ignjatović,  Zorana Jančić | 2 | 12 | Mathematics | E |
| 73 | MDSA06 | Semiring theory | Nada Damljanović,  Aleksandar Stamenković | 2 | 12 | Mathematics | E |
| 74 | MDSA07 | Lattice theory | Andreja Tepavčević | 2 | 12 | Mathematics | E |
| 75 | MDSA08 | Fuzzy sets and systems | Jelena Ignjatović,  Ivana Micić | 3 | 12 | Mathematics | E |
| 76 | MDSA09 | Group theory | Igor Dolinka,  Petar Marković | 3 | 12 | Mathematics | E |
| 77 | MDSA10 | Relational systems | Miroslav Ćirić,  Stefan Stanimirović | 3 | 12 | Mathematics | E |
| **Stochastic and Mathematical Statistics** | | | | | | | |
| 78 | MDSS01 | Mathematical statistics | Aleksandar Nastić | 1 | 12 | Mathematics | E |
| 79 | MDSS02 | Stochastic analysis | Jasmina Đorđević,  Marija Krstić | 1 | 12 | Mathematics | E |
| 80 | MDSS03 | Probability theory and stochastic processes | Danijela Rajter-Ćirić,  Marija Milošević | 1 | 12 | Mathematics | E |
| 81 | MDSS04 | Stochastic differential equations | Miljana Jovanović,  Marija Milošević | 2 | 12 | Mathematics | E |
| 82 | MDSS05 | Time series analysis | Miroslav Ristić | 2 | 12 | Mathematics | E |
| 83 | MDSS06 | Stability theory of stochastic differential equations | Miljana Jovanović,  Marija Milošević | 2 | 12 | Mathematics | E |
| 84 | MDSS07 | Generalized stochastic processes | Dora Seleši,  Danijela Rajter Ćirić | 2 | 12 | Mathematics | E |
| 85 | MDSS08 | Statistical modeling | Predrag Popović | 3 | 12 | Mathematics | E |
| 86 | MDSS09 | Singular stochastic partial differential equations | Dora Seleši,  Danijela Rajter Ćirić | 3 | 12 | Mathematics | E |
| 87 | MDSS10 | Monte-Carlo Method | Miodrag Đorđević | 3 | 12 | Mathematics | E |