<table>
<tr><td>COURSE NAME</td><td colspan="6">Metric spaces</td></tr>
<tr><td>Code</td><td>PMM912</td><td>Year of study</td><td colspan="4">1st or 2nd year of graduate study</td></tr>
<tr><td>Course teacher</td><td>Vlasta Matijević</td><td>Credits (ECTS)</td><td colspan="4">6</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td></td></tr>
<tr><td>45</td><td>15</td><td></td><td></td></tr>
<tr><td>Status of the course</td><td>Compulsory and elective</td><td>Percentage of application of e-learning</td><td colspan="4">30%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">The course objective is to introduce students with advanced knowledge of metric spaces applying already known topological concepts and results about topological spaces. A special emphasis is on studying complete metric spaces, function spaces and Banach algebra of continuous real functions on compact space. This gives the basics for more advanced studies in modern functional and numerical analysis.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Successfully completed course: Introduction to topology</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">It is expected that a student will
- understand special properties of basic topological concepts (convergence, continuity, compactness) in metric spaces
- understand metric concepts (boundedness, total boundedness, Cauchy sequences, completeness, uniform continuity) and their dependence on metric.
- be able to state and prove standard results regarding (compact, complete) metric spaces and (uniformly) continuous functions
- be able to apply the theory in the course to reason about concrete metric spaces and their properties
- be able to decide whether a simple statement about metric spaces and continuous functions is true, providing a proof or counterexample as appropriate
- develop critical and analytical thinking and demonstrate skills in communicating mathematics orally and in writing</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">- Metric spaces (6 hours)
Bounded and totally bounded sets in metric space. Metric topology. Metrizability. Metrizability of product space.
- Convergence and continuity (6 hours)
Cauchy and convergent sequences in metric space. Continuous functions between metric spaces. Perfectly normal spaces. Theorem of Vedenisoff. Uniformly continuous functions. Heine-Cantor theorem. Topologically equivalent metrics. Uniformly equivalent metrics. Lipschitz equivalent metrics.
- Function spaces (10 hours)
Pointwise, uniform and compact convergence. Pointwise convergence topology. Uniform topology. Compact convergence topology. Compact-open topology.
- Completeness (11 hours)
Complete metric spaces. Cantor theorem. Completeness and operations on metric spaces. Banach fixed point theorem. Baire theorem. Uniform boundedness principle. Completion of metric space. Kuratowski embedding theorem. Uniqueness of completion.
- Banach algebra of continuous real functions on compact space (6 hours)
Arzela-Ascoli theorem. Stone-Weierstrass approximation theorem
- Metrization theorems (6 hours)
Urysohn metrization theorem. Nagata-Smirnov metrization theorem.</td></tr>
<tr><td>Format of instruction</td><td colspan="6">Lectures and seminars</td></tr>
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Student responsibilities	Attendance at lectures and seminars, written assignments, self-study using required and optional literature
Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Lecture attendance 0,5 ECTS Exam 5,5 ECTS
Grading and evaluating student work in class and at the final exam	The exam consists of written and oral part. The oral part comes after positively graded (at least 50%) written part Both parts of the exam are equally evaluated in the final grade
Required literature (available in the library and via other media)	J. Munkres, *Topology*, Pearson Education International, New York, 2000. S. Shirali, H. Vasudeva, *Metric spaces,* Springer-Verlag, London 2006. S. Mardešić, *Matematička analiza u n-dimenzionalnom realnom prostoru I*, Školska knjiga, Zagreb, 1974.
Optional literature (at the time of submission of study programme proposal)	J. Dugundji, *Topology*, Allyn and Bacon Inc., Boston, 1966. R. Engelking, *General Topology*, PNW, Warszawa, 1977
Quality assurance methods that ensure the acquisition of exit competences	Exam statistics and students' quality evaluation through anonymous poles
Other (as the proposer wishes to add)	