Study programmes: PhD – Mathematics

Course name: Riemannian geometry A

Lecturers: Zoran P. Rakić, Mirjana Đ. Đorić, Miroslava Antić, Srđan N. Vukmirović

Status: Optional (compulsory for students in Geometry)

ECTS: 9

Attendance prerequisites: Differential geometry

Course aims: Acquisition of general and specific knowledge in foundations of Riemannian geometry. Preparing student for advanced courses in this area.

Course outcome: Upon completion of the course, the student has necessary knowledge about basic notions in differential geometry: manifold, tangent space, tangent bundles, vector fields, Riemannian metric on manifold, connection and covariant derivative, the Levi-Civita connection, geodesic lines, exponential mapping, normal neighborhoods, curvature tensor, torsion, sectional curvature, Bianchi identities. Student is qualified to individual understanding basic examples and solving problems from this area.

Course content: Differentiable manifolds. Immersions and embeddings. Vector fields. Topology of manifolds. The Whitney theorem and the Sard theorem. Riemannian manifolds. Isometries. Left invariant and bi-invariant metrics. Vector fields along curve. Existence of Riemannian metric. Affine connection. Covariant derivative. Parallel transport of vector fields. Riemannian connection. Torsion. Symmetric connection. The Levi-Civita connection. Symmetric connection. The Cristoffel symbols. Geodesic flow. Geodesics in local coordinates. Geodesics and tangent bundles. Minimizing properties of geodesies. Gauss' lemma. Normal neighborhoods. Exponential mapping. Convex neighborhoods. Basic properties. The Bianchi identity. Sectional curvature. Spaces of constant sectional curvature. Ricci and scalar curvature. Tensors on Riemannian manifolds.

Literature:

1. M. P. do Carmo, Riemannian Geometry, 1992, Birkhauser, Boston.
2. T. Aubin, Differential Geometry, 2002 American Mathematical Society.

Number of hours: 10	**Lecures: 4**	**Tutorials: -**	**Laboratory: -**	**Research: 6**

Teaching and learning methods: Lectures/ Tutorials

Assessment (maximal 100 points)

Course assignments	**points**	**Final exam**	**points**
Lectures	-	Written exam	30
Exercises / Tutorials	-	Oral exam	30
Colloquia	-	Written-oral exam	-
Essay / Project	40		