Study programmes: Bachelor (Master / PhD) studies – Mathematics

Course name: Geometry 3

Lecturers: Zoran P. Rakić, Mirjana Đ. Đorić, Vladica S. Andrejić, Miroslava Ž. Antić, Srđan N. Vukmirović, Tijana Šukilović, Ivan Dimitrijević

Status: Compulsory

ECTS: 6

Attendance prerequisites: No

Course aims: Acquiring general and specific knowledge from differential geometry of curves and surfaces in a 3-dimensional Euclidean space; preparing students for advanced courses in this field.

Course outcome: After completion of the course, the students have be mastered the basic concepts of classical theory of curves and surfaces. Motivated by the approach in the 3-dimensional Euclidean space, students are able to understand the basic concepts in the abstract theory of manifolds and are ready for a more detailed study of this and similar fields. In addition to the studying large number of important examples, students have been trained for independent work and the use of acquired knowledge and in the applied sciences.

Course content:

- Recalling basic knowledge of linear algebra, analytical geometry and mathematical analysis needed in the rest of the course
- Parametrized regular curves in the plane and space, examples. Length of the curve. The curvature and torsion of the spatial curve. Moving frame of the curve(Frenet–Serret frame). The Frenet–Serret equation of the curve.
- Determination of a plane curve by its curvature. Determination of a spatial curve by its functions of curvature and torsion. Local canonical form of a spatial curve. Generalizations to the curves in n-dimensional space.
- Parametrized regular surfaces in the space and important examples, and definition of manifold. Tangent vectors, tangent space its dimension and tangent mapping. Vector fields on a surface: tangent and normal vector fields. Gauss mapping.
- The first and second fundamental form of surface. Gauss equations and Cristoffel. Curves on a regular surface. Normal and geodesic curvature of a surface. Meusnier theorem. Geodesic lines. The principal curvatures and vectors, Gauss and mean curvatures. Shape operator. Umbilic points and surfaces, and asymptotic lines and vectors of a surfaces
- Gauss and Weingarten equations. Gauss-Codazzi-Peterson-Mainardi equations. Bonetova theorem. Gauss theorem Egregium. Isometries and local isometries of surfaces.
- Parallel transport along curve. Covariant derivative and its properties.

Literature:

1. M. do Carmo, Differential Geometry of Curves and Surfaces, Prentice-Hall, New Jersey, 1976,
2. R. Millman, G. Parker, Elements of Differential Geometry, Prentice-Hall, New Jersey, 1977,
3. A. Gray, Modern Differential Geometry of Curves and Surfaces with MATHEMATICA, CRC Press, Boca Raton, 1998.
4. А. С. Мищенко, Ю. П. Соловьев, А. Т. Фоменко, Сборник задач по дифференциальной геометрии и топологии, Физматлит 2004.

Number of hours: 5	**Lecures: 3**	**Tutorials: 2**	**Laboratory: -**	**Research: -**

Teaching and learning methods: Frontal / Lectures / Exercises

Assessment (maximal 100 points)

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