

Content

| Course Code | Course Name | Semester | Theory | Practice | Lab | Credit | ECTS |
|-------------|-----------------------|----------|--------|----------|-----|--------|------|
| MAT417 | Differential Geometry | 8 | 4 | 0 | 0 | 4 | 8 |

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| Prerequisites | MAT116, MAT202 |
| Admission Requirements | MAT116, MAT202 |

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| Language of Instruction | French |
| Course Type | Compulsory |
| Course Level | Bachelor Degree |
| Objective | The aim of the course is to provide the student with basic knowledge and skills in elementary differential geometry of curves and surfaces in local parametric treatment. |
| Content | Curves in R^3 : Frenet formulas and Fundamental Theorem. Regular surfaces. Inverse image of regular values. Differentiable functions on surfaces. Tangent plane; the differential of a map, vector fields, the first fundamental form. Gauss map, second fundamental form, normal, principal curvatures. Manifolds, tangent spaces and Lie bracket |
| References | Millman, R.S. & Parker, G.D., Elements of Differential Geometry Kühnel, W., Differential Geometry: Curves, Surfaces, Manifolds Ethan D. Bloch; A first course in Geometric Topology and Differential Geometry doCarmo, M. Differential Geometry of Curves and Surfaces Montiel, S. & Ros, A. Curves and Surfaces |

Theory Topics

| Week | Weekly Contents |
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| 1 | Recall on smooth functions, inverse function theorem |
| 2 | Curves in the Euclidean space and their reparametrization |
| 3 | Tangent, normal and binormal vectors |
| 4 | Curvature and torsion of space curves |
| 5 | Fundamental theorem of curves |
| 6 | Surfaces in space and coordinate patches |
| 7 | Smooth surfaces |
| 8 | Tangent and normal vectors to a surface, first fundamental form and arc lengths |
| 9 | Second fundamental form and Weingarten endomorphisms |
| 10 | Normal curvature, mean curvature and Gaussian curvature |
| 11 | Theorema Egregium of Gauss and isometries |
| 12 | Gauss - Bonnet formula and its consequences |
| 13 | Manifolds and tangent spaces |
| 14 | Tangent spaces and Lie bracket |