Department of Mathematics

Course Profile

Course Number: MATH 462	**Course Title: Differential Geometry**
Required / Elective: Required	**Pre-requisite:** None
Catalog Description: Space curves, Frenet formulas; surfaces in three dimensional Euclidean space, Gauss map. First and second fundamental forms, geodesics.	**Textbook / Required Material:** "Differential Geometry of Curves and Surfaces", by M.P. do Carmo, Published by Prentice-Hall, 1976.
Course Structure / Schedule: (3+0+0) 3 / 8 ECTS	
Extended Description: The goal of this course is to study the differential geometry of curves and surfaces. The first part of the course is about curves (parametrized curves, regular curves, arc length, the local theory of curves parametrized by arc length). The second part of the course is devoted to surfaces (regular surfaces, inverse images of regular values, change of parameters, differentiable functions on surfaces, the tangent plane, the differential of a map, the first fundamental form, area, the definition of the Gauss map and its fundamental properties, the Gauss map in local coordinates, isometries, conformal maps, the Gauss theorem and the equations of compatibility, parallel transport, geodesics). Most of the material to be covered can be found in chapters 1-4 of the textbook.	
Design content: None.	**Computer usage:** No computer usage required

Course Learning Objectives:

By the end of the course the students should be able to:

1. understand curves in three-dimensional space and know the notion of regular curve **[2, 3,6],**
2. calculate length, curvature, torsion for given curves, first and second fundamental forms **[2,3,6],**
3. explain basic differential-geometric concepts, interpret their meaning and solve appropriate problems involving these ideas **[2,3,6]**
4. analyse curves and surfaces in three-dimensional space, by calculating various quantities (e.g., length, curvature, torsion; first and second fundamental forms, area) for given examples and by relating properties of curves and surfaces to such quantities (e.g., curves with constant curvature and torsion; the first fundamental form as a complete invariant for isometry; geodesics) **[2,3,6],**
5. understand and prove properties of curves in space **[3,6]**
6. understand and prove properties of surfaces in space **[3,6]**
7. understand fundamental notions for geodesics and curvature **[3,6]**
8. use mathematical software to model geometric relationships **[3,6]**
9. gain an understanding of the concepts of curve, surface, curvatures (principal, normal, Gaussian, mean), geodesics, covariant differentiation, Gauss map/shape, Gauss-Bonnet theorem **[3,6].**

[2] demonstrate knowledge of mathematics to construct, analyze and interpret mathematical models,

[3] demonstrate the ability to apply mathematics to the solutions of problems,
[6] have a basic knowledge of the main fields of mathematics, including analysis, algebra, differential equations, differential geometry.

Recommended reading
"Elementary Differential Geometry", by B. O'Neill, Published by Academic Press, Inc., 1997.

Teaching methods: Preparatory-readings, lectures, discussions, assignments

Assessment methods: Midterm exams, final exam

Student workload:

Preparatory reading	66 hrs
Lectures	42 hrs
Assignments	69 hrs
Discussions	14 hrs
Midterm exams	6 hrs
Final exam	3 hrs
TOTAL ……	**200 hrs … to match 25 x 8 ECTS**

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