

Department of Mathematics & Statistics, KFUPM

**Math 527 Differential Geometry
Syllabus (Semester 072)**

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 Course page: On WebCT at <https://webcourses.kfupm.edu.sa/>
 Office Hours: 11 am to 1 pm on Saturday, Monday and Wednesday.
 5:15 to 6:15 pm on Saturday, Monday

1. DESCRIPTION

Differential Geometry is the study of geometric questions by means of Calculus. This course introduces the study of curves and surfaces in Euclidean spaces.

- The geometry of curves involves the concept of torsion (the twisting out of a plane) and curvature (the bending away from a line).
- The geometry of surfaces involves the concepts of mean and Gaussian curvature (the bending away from a plane).

The main concepts we will study are

- Parameterization of curves and surfaces
- Frenet frames
- Curvature and torsion of space curves
- Different types of curvatures of surfaces
- Geodesics and some of their properties

These will also lay foundations to introduce the notion of abstract surfaces (2-dimensional manifolds) at the end of the course.

2. TEXTBOOK

Differential Geometry and its Applications by John Oprea, The Mathematical Association of America, 2nd edition (2007).

3. TOPIC-WISE BREAK-UP

Week	Sec.	Topics
1	1.1	Introduction (The Geometry of Curves)
2 & 3	1.2	Arclength Parameterization
	1.3	Frenet Formulas
	1.4	Non-Unit Speed Curves
4	1.5	Some Implications of Curvature and Torsion
	1.7	The Geometry of Curves and Maple
5	2.1	Introduction (Surfaces)
6	2.2	The Geometry of Surfaces
7 & 8	2.3	The Linear Algebra of Surfaces
	2.4	Normal Curvature
9	2.5	Surfaces and Maple
10	3.1	Introduction (Curvatures)
	3.2	Calculating Curvature
11	3.3	Surfaces of Revolution
	3.4	A Formula for Gauss Curvature
12	5.1	Introduction (Geodesics, Metrics and Isometries)
13	5.2	The Geodesic Equation and the Clairaut Relation
14 & 15		Introduction to Manifolds and Riemannian Geometry

4. SOFTWARE

The textbook contains sections where the notions of geometry of curves and surfaces are demonstrated (graphically & computationally) using the software Maple. We will use Maple mostly as a visual tool to understand the concepts intuitively.

No prior knowledge of Maple is required.

5. GRADING

- 30% Class Work (Assignments/Homeworks, Quizzes, Class Participation)
- 30% Mid-Term Exam
- 40% Final Exam

6. REFERENCE BOOKS

- Elementary Differential Geometry, by Andrew Pressley. Springer (2002).
- Diff. Geometry of Curves & Surfaces, by Manfredo Do Carmo.
- Modern Differential Geometry of Curves and Surfaces with Mathematica by A. Gray.