dMath4223-L1 Differential Geometry

Course Outline-Fall 2022

1. **Instructor(s)**

Name: Prof. Li WeiPing

Contact Details:

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2. **Teaching Assistant(s)**

Name: Mr. XIAO Jiazhuo

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3. **Meeting Time and Venue**

Lectures:

Date/Time/Venue:

L1: WF 13:30-14:50 (Room 4503 near Lift 25 & 26)

Tutorials:

Date/Time/Venue:

T01A: Thu 18:00-18:50 (Room 6573)

4. **Course Description**

Credit Points: 3

Prerequisite: MATH 2011/MATH 2023/MATH 3043 and MATH 2121/MATH 2131

Textbook: M.P. do Carmo, *Differential Geometry of Curves and Surfaces,* Prentice-Hall.

Brief Information/synopsis:

This course studies the ``curviness'' of curves and surfaces in space. Anybody who understands calculus and linear algebra should be able to follow the course. We are going to cover most of the materials in chapter one through three and some parts of chapter four. Hopefully after taking this course, you will be able to know how to measure the curviness of curves and surfaces in space and develop some geometric intuition at the same time.

A brief outline: curvature and torsion of space curves, surfaces, the first fundamental form, the Gauss map, principal curvatures, Gaussian curvature of surfaces, the second fundamental form, some example of surfaces, isometries, parallel transport and geodesics, the Gauss theorem.

5. **Intended Learning Outcomes**

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Develop basic skills to calculate curvatures of curves and surfaces.
2	Gain geometric intuition to explain the geometric meanings of calculations
3	Obtain the ability to translate geometric problems to mathematical setups.

6. Assessment Scheme

a. Examination duration: final exam 3 hrs

b. Percentage of coursework, examination, etc.:

Assessment	Assessing Course ILOs
15% by homework	1, 2, 3
30% by midterm	1,2,3
55% by final exam	1, 2, 3

c. The grading is based on students' performance in assessment tasks.

d. The midterm is on Oct. 21 13:30-14:50 at Room 1103

7. Teaching and Learning Activities

Course Schedule

Week	Topics
1	Parametrized curves, regular curves, arc length.
2	The local theory of curves parametrized by arc length.
3	The local canonical form
4	Regular surfaces, inverse images of a regular value.
5	Change of parameters, the tangent plane, the differential of a map
6	The first fundamental form, area.
7	Orientation of surfaces.
8	The Gauss map in local coordinates.
9	Vector fields, ruled surfaces and minimal surfaces.
10	Isometries and conformal maps.
11	The Gauss theorem and the equations of compatibility.
12	Parallel transport and geodesics.
13	Gauss-Bonnet Theorem and its applications.