

# DIFFERENTIAL GEOMETRY

## MATH 4600/8606

### 1.0 Course Description

- 1.1 **Overview of Content and Purpose:** (3 hours) Curves, surfaces, Gaussian curvature, surfaces with constant mean curvature, holonomy and the Gauss-Bonnet theorem, minimal surfaces and complex variables, hyperbolic surfaces.
- 1.2 **For whom Intended:** To present the ideas, techniques, and applications of modern differential geometry to mathematics and physics majors.
- 1.3 **Prerequisite:** MATH 1970, MATH 2050, MATH 3350

### 2.0 Content and Organization

- 2.1 **Topics:**
1. Curves and the Serret-Frenet equations.
  2. The geometry of surfaces
    - a. normal, principal and Gaussian curvature
  3. Mean curvature and area minimization
  4. Holonomy and parallel vector fields
    - a. Foucault's pendulum, Gauss-Bonnet theorem
  5. Minimal surfaces and complex variables
    - a. Weierstrass-Enneper representations
  6. Hyperbolic surfaces
    - a. negative curvature and the Poincaré plane
    - b. the pseudosphere and punctured sphere

### 3.0 Teaching Methodology

- 3.1 **Methods to be Used:** The course will be taught by the lecture method with questions and discussion encouraged.

### 4.0 Evaluation

- 4.1 **Basis for Evaluating Student Performance:** Students will be evaluated on the basis of written assignments and examinations. Graduate students will be expected to complete additional assignments.

### 5.0 Resource Material

- 5.1 **Textbook(s) or Other Required Readings:**
- 6.1 **Current Bibliography of Resources:**

1. Faber, R.L., *Differential Geometry and Relativity Theory*, Marcel Dekker, 1983.
2. Gray, Alfred, *Modern Differential Geometry*, CRC, 2<sup>nd</sup> Ed., 1998.
3. Oprea, John, *Differential Geometry and its Applications*, Prentice Hall, 1997.
4. Stillwell, John, *Geometry of Surfaces*, Springer, 1992.