MATH 772

Elementary Differential Geometry

Professor Ricardo Castano-Bernard

Synopsis: This is an introductory course. We will use Calculus to understand the geometric properties of curves and surfaces in Euclidean space. Later in the course we will export our knowledge of Calculus to more general spaces called manifolds. Along the way, we will introduce techniques that are useful in areas beyond Geometry, such as Analysis and Physics.

Course Book: - W. Kuhnel, "Differential Geometry - Curves - Surfaces - Manifolds", AMS, 2nd (English) Edition 2005.

Recommended books: - M. Berger, "Differential Geometry: Manifolds, Curves, and Surfaces" Springer GTM (2007)

- A. Gray, E. Abbena, S. Salamon "Modern Differential Geometry of curves and surfaces with Mathematica" Chapman & Hall/CRC; 3rd edition (2006)

- M. Do Carmo "Differential Geometry of Curves and Surfaces, Prentice Hall (1977)

Dynamics: I will follow Kuhnel closely and make occasional excursions into Berger's book. Depending on the audience and computer facilities, from time to time we could also look at Gray et. al.

Grading: there will be at least one mid-term exam and one final exam. Both exams will be based on a combination of exercises taken from the books and theory. There will be oral presentations that will count towards the final grade. Oral presentations will typically consist of posting a solution to a homework problem on the board. The class will meet *twice a week only.*

Topics:

The course shall include topics such as:

1) Curves and Surfaces in Euclidean space

2) Curvature, torsion, intrinsic geometry 1st & 2nd fundamental forms

3) Gauss-Bonnet Theorem

4) Tensor algebras, differential forms, exterior differentiation

5) Stokes Theorem

6) Introduction to manifolds

7) Riemannian manifolds, curvature tensor, sectional curvature, Ricci curvature.

Prerequisites:

Math 240, a good knowledge of elementary linear algebra and multi-variable calculus.

For more details about the course, please see Professor Castano-Bernard.