AMATH 333/PMATH 365 – Winter 2010
Elementary Differential Geometry
Course outline

Instructor: Ruxandra Moraru
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Office hours (MC 5170): W 14:30 – 15:30 and Th 13:00-15:00 (subject to change) or by appointment.
Lectures: MWF 13:30 – 14:20 (MC 4059).

Course web page: can be found at http://uwace.uwaterloo.ca. This page contains a description of the course, course handouts (class schedule, suggested problems, assignments, solutions, and other), and is used to make announcements to the class. It is important that you register to the site and enter your current email address to receive announcements.

Goals: The purpose of this course is to serve as an introduction to local differential geometry, with a view towards providing the student with a strong background for global differential geometry, general relativity, and other applications in both pure and applied math. The emphasis is placed squarely on calculations -- every geometric object studied will be a subset of R^n -- but without losing sight of the theoretical framework into which the calculations fit.

Outline of topics:

- Parametrized and embedded curves: arc length, curvature and torsion, Frenet formulas, simple closed curves;
- Surfaces in three dimensions: Surface patches, tangent spaces, normal vectors, isometries and conformal maps, first and second fundamental form, minimal surfaces;
- Notions of curvature: normal, principal, Gaussian, and mean curvatures; Weingarten matrix, Gauss map, Gauss' Theorema Egregium;
- Parallel transport: vector fields, covariant derivative, Christoffel symbols, geodesics;
- Gauss-Bonnet theorem;
- Possible additional topics: Differential forms and Stokes Theorem in n dimensions, or introduction to higher-dimensional manifolds.

Prerequisite: AMath 231 or Math 247. Not open to General Mathematics students.

Textbook: M. P. Do Carmo: Differential Geometry of Curves and Surfaces, Prentice Hall.

Optional textbook: A. Pressley: Elementary Differential Geometry, Springer.

Other references (on reserve at UC Davis):

- B. O'Neill: Elementary Differential Geometry.
- W. Kühnel: Differential Geometry, Curves – Surfaces – Manifolds, 2nd Ed., AMS.
- J. Oprea: Differential Geometry and Its Applications (on reserve at UC Davis).

Method of evaluation: Your final grade will be based on 6 assignments, to be handed in class every two weeks, one 50 minute midterm examination, and a 2.5 hour final examination.

Grading scheme: Assignments 25%, Midterm 15%, Final 60%.

Assignments and midterm schedule:

- Friday, 15 Jan.: Assignment 1.
- Friday, 29 Jan.: Assignment 2.
- Friday, 12 Feb.: Assignment 3.
- ***Monday, 22 Feb.: Midterm, 13:30 – 14:20, in class.***
- Friday, 5 Mar.: Assignment 4.
- Friday, 19 Mar.: Assignment 5.
- Monday, 5 Apr.: Assignment 6.