DIFFERENTIAL GEOMETRY

MATH 136

Unit 0: Syllabus

Administrative

1.1. Here are some administrative parts:

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Instructor: Oliver Knill, Office SC 432
Course assistants: Ellie Wiesler, Nick Erickson, Josh Rooney, Duy Thuc Nguyen
Class hours:    MWF 3-4:15
Office hours Oliver:  MWF, 11-12
Weakly homework, individually written. Submitted on Canvas
Midterm paper on a topic of the course.
Cumulative final exam.
Grades: HW 50 percent, midterm 20, final 30
Side reading suggestions: Kuehnel and DoCarmo
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1.2. This is an introduction to Riemannian geometry and in particular to Riemannian geometry of curves and surfaces. We will also will also develop some less technical discrete differential geometry. Low dimensional Riemannian geometry is an extremely active area of mathematics with many open problems and applications, especially in computer science and computer graphics. It is not only the language of gravity, it is an inspiration for art and architecture The subject is also full of unsolved problems.

1.3. Class schedule: We organize into "14 units" which essentially boils down to weeks. We will reach 4 goals: Frenet-Serret theorem, Gauss-Bonnet theorem, Theorema egregium, Riemannian manifold setup, Einstein equations.

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W1    1 Wednesday September 4th:  What is differential geometry? Notations.

W2    2 Monday    September 9:    Parametrized and implicit surfaces, Surface area.
      3 Wednesday September 11:   Parametrization of Curves, Arc length, Curvature

W3    4 Monday    September 16:   The Frenet theorem in two and 3 dimensions
      5 Wednesday September 18:   The Frenet theorem in arbitrary dimensions

W4    6 Monday    September 23:   A global result: The Hopf Umlaufsatz
      7 Wednesday September 25:   A global result: The four vertex theorem

W5    8 Monday    September 30:   The fundamental forms I,II,III
      9 Wednesday October 2:      The Gauss Map A and Curvature K
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W6	10	Monday	October 7:	Euler characteristics and discrete Gauss-Bonnet
	11	Wednesday	October 9:	Review
W7		Monday	October 14:	University Holiday, no class
		Wednesday	October 16:	Midterm Quiz and Midterm
W8	11	Monday	October 21:	Calculus of variations and Geodesics
	12	Wednesday	October 23:	Exponential map and geodesic coordinates
W9	13	Monday	October 28:	1-forms and Green's Theorem
	14	Wedneday	October 30:	The Theorema Egregium
W10	15	Monday	November 5:	Local Gauss Bonnet theorem
	16	Wednesday	November 7:	Global Gauss Bonnet theorem
W11	17	Monday	November 11:	Riemannian manifolds
	20	Wednesday	November 13:	Discrete manifolds
W12	21	Monday	November 18:	The curvature and Ricci tensors
	22	Wednesday	Novemer 20:	General relativity
W13	23	Monday	November 25:	
		November 27 until December 1th		Thanksgiving
W14	24	Monday	December 2:	General review
	25	Wednesday	December 4:	Final quiz

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