This is the second course in the geometry-topology graduate sequence 208-211 here at UCSC. The main subject is the exterior differential calculus. The main theorems are Stokes' theorem, the Frobenius theorem in its forms incarnation, its "converse' -the Chow-Rashevsky theorem, and the structure equations for Riemannian surfaces.

Along the way we will touch on Lie groups, Riemannian metrics, and the tensor calculus. We will likely touch upon parallelizability, vector bundles, the de Rham theorem, and its Hodge version.

Homework. I aim to assign about 5 problems a week. Homework is due the Wednesday of the week after it is assigned. I hope to grade one of the problems and to generally tell you beforehand which one.

Ungraded problems may be worked in class by students.

Week by week lecture schedule. A = Monday. B = Wednesday

1. A. Forms on the plane and their integrals. Forms on surfaces. The fundamental theorem of calculus. Green's theorem in the plane. **Reading:** lecture notes: 1forms. H-H, p. 500-520. Burke: sections 10, 11; and sec 21 if you can find it.

B. Forms in general. The full algebra of forms. Superalgebras. The exterior derivative. Operators on forms: the exterior derivative. Operators depending linearly on a vector field: interior product. Lie derivative, maybe. **Reading:** EDS ch. 1. Lecture Notes: superalgebras. Lee: ch. 12.

2. A. n-forms. Orientation. Integrating n-forms. Integrating forms generally. **Reading:** Lee: 325-329. HW 4.

2B. Stokes theorem; some contact forms. Pfaffian systems. **Reading:** for Stokes: Spivak (Calc on Manifolds). Lee: see index. For Pfaffian: EDS Intro; ch. 1.

3. A. Cartan's magic formula.

B. Symplectic forms. Some symplectic geometry.

4A. Riemannian manifolds. Riemannian surfaces. Circle bundle formulation.

B. Structure eqns for Riemannian surfaces. Gaussian curvature. The case of constant curvature. Appearance of Lie groups. **Reading:** lecture notes: SurfaceStructureEqns

5A. Frobenius and its negation: corank 1.

B. Frobenius, Chow-Rashevsky, higher corank. Nilpotentization. **Reading:** for Frob: EDS ch. 1.

6. A. Poincare lemma

B. Statement of deRham. Some computations.

7A. Lie groups, Lie algebras, dual Lie algebras.

B. Examples.

8 A. Vector bundles. Examples.

B. Complex line bundles and H^2.

9 A. Riemannian geometry again. Orthonormal frame bundles. Principal bundles. Associated bundles.

B. Riemann curvature tensor.

10 A Keener Hughen's thesis.

B. Fefferman metric.