TOPICS FOR MATHEMATICS 138A, WINTER 2006

I. Classical differential geometry of curves

0. Partial differentiation (O'Neill, § 1.1)
1. Cross products (O'Neill, § 2.2)
2. Parametrized curves (O'Neill, § 1.4)
3. Arc length and reparametrization (O'Neill, §§ 1.4, 2.2)
4. Curvature and torsion (O'Neill, § 2.3)
5. Frenet-Serret Formulas (O'Neill, §§ 2.3–2.4)

II. Topics from multivariable calculus

1. Differential forms (O'Neill, §§ 1.5–1.6)
2. Smooth mappings (O'Neill, §§ 1.7, 3.2)
3. Inverse and implicit function theorems (O'Neill, § 1.7)
4. Congruence of geometric figures (O'Neill, §§ 3.1, 3.4–3.5)

III. Surfaces in 3-dimensional space

1. Mathematical descriptions of surfaces (O'Neill, §§ 4.1, 4.8)
2. Parametrizations of surfaces (O'Neill, § 4.2)
3. Tangent planes (O'Neill, § 4.3)
4. The First Fundamental Form (O'Neill, § 4.6)
5. Surface area (O'Neill, § 6.7)
6. Curves as surface intersections

IV. Oriented surfaces

1. Normal directions and Gauss maps (O'Neill, § 4.7)
2. The Second Fundamental Form (O'Neill, § 5.1)
3. Quadratic forms and adjoint transformations
4. Normal, Gaussian and mean curvature (O'Neill, §§ 5.2–5.3)
5. Special classes of surfaces (O'Neill, §§ 5.4–5.5)
6. Map projections