Math 103 Syllabus (cross-listed with Math 73)

1. Abstract Measure Theory (12 Lectures)
    (a) Measures, σ-algebras and all that.
    (b) An Example: Lebesgue measure on $\mathbf{R}$ and/or $\mathbf{R}^n$.
    (c) Integration in an abstract measure space
    (d) The convergence Theorems and applications.
    (e) Product measures, Tonelli and Fubini.
    (f) Sources
        i. We have in mind cherry picking from Rudin's *Real & Complex* (Chapters 2, 6 and 8) since that will be the usual reference for the second part of the course. Instructors will have to develop Lebesgue measure on their own or possibly using Royden & Fitzpatrik as a guide.
        ii. Obviously, time constraints and the instructor's interests will dictate what topics can be covered and at what depth. The topologists would love some attention paid to Lebesgue measure in $\mathbf{R}^n$ at some point.
2. Complex Analysis (15 Lectures)
    (a) Elementary Properties
        i. Complex differentiation, Cauchy Riemann equations and path integrals
        ii. Local Cauchy Theorem
        iii. Holomorphic implies analytic
        iv. Global Cauchy Theorem
        v. Sources
            A. The basic source we have in mind is Chapter 10 of Rudin's *Real & Complex*. This can be followed fairly closely — even if it is fairly sophisticated.
            B. Dana was taught that in an outline, there had to always be at least two sub-parts under any given item.
    (b) Selected Topics — Lecturer's Discretion
        i. Maximum Modulus
        ii. Isolated Singularities and Laurent Series

iii. Residue Theorem and Applications
iv. Argument Principle and Roche's Theorem
v. Normal Families and Riemann Mapping Theorem
vi. Sources
    A. When Dana tried this before, he picked and chose from Chapter's 12–14 of Rudin's *Real & Complex*.
    B. Sample Goal: try to build up enough background to at least pretend to prove Theorem 13.11 (Rudin) (at least $(b) \iff (c) \iff (d) \iff (f)$). That can't be done without leaving the proofs of some of the harder results.