Calculus III - Math 253.

Syllabus Spring 2013

Syllabus written by Hal Sadofsky.

Text: *Calculus, Concepts and Contexts, 4th edition*, Stewart. We will cover roughly chapter 6.8, chapter 8, and power series solutions to differential equations.

Chapter 6.8 is on probability, viewed as an application of differentiation (so this should refresh skills from Math 252).

Chapter 8 should be thought of as building to Taylor Polynomials and Taylor's Remainder Theorem, and also to power series representation of functions. Along the way, one considers sequences and sequence convergence, series and series convergence.

Finally, as an additional application of power series, we'd like to cover power series solutions to differential equations. This isn't covered by the text, but should only be covered in the most elementary way considering differential equations of the form

$$y' + p(x)y = q(x) \text{ and } y'' + p(x)y' + q(x)y = r(x)$$

for p, q, r polynomials, and thus staying away from discussions of things like ordinary points, singular points, regular singular points, etc.

I've attached a pdf scanned from Blanchard, Devaney and Hall's ODE book that could be used to cover this. It includes homework problems.

Course Goals: The primary goal of the course is to bring students to a point where they can ***use*** **Taylor's theorem in a reasonably effective way**; at least on standard Taylor polynomial approximations like those for $\sin(x)$, $\cos(x)$, e^x and $\log(x)$.

This means they need to be able to compute the Taylor polynomials, and then (this is the difficult part) *use Taylor's theorem to estimate the error!*. The remainder theorem appears in 8.7, and applications of the remainder theorem are section 8.8. Note that this comes well into the term, and you want be sure and reach this point when there are enough weeks left in the term to give students practice doing the sorts of exercises that occur in 8.8 before the final.

Here is a list of course goals that includes some less central points

- Calculate probabilities by integrating an appropriate pdf.
- Show sequences *don't* converge by using ϵ-N definition of limit.
- Use standard series convergence tests.
- Estimate sums using the integral test when possible, the alternating series test when possible and the comparison test when possible. See section 8.3, 8.4.
- Calculate radii of convergence for a power series, calculate Taylor series, represent common transcendental functions as power series.
- **Use Taylor's remainder theorem to approximate values of transcendental functions to given levels of accuracy.**
- Give power series solutions to appropriate differential equations. Recognize solutions when common transcendental functions.

Note that the course goals above emphasize applications and this is what the course should do in general. But it is appropriate to introduce the precise definition of limit of a sequence (it is in Appendix D) and explain that one needs this definition to prove various facts that will be stated without proof in the course. In addition, one could then use that definition to prove a very small number of elementary things. E.g. one could prove that a given sequence can't have two different limits, and one could use the definition to prove that certain sequences don't have limits.

Approximate Schedule

Week 1	6.8	Week 6	8.7, 8.8.
Week 2	8.1, A32-33	Week 7	8.8.
Week 3	8.2, 8.3	Week 8	8.8, review (exam 2).
Week 4	8.3, 8.4 (exam 1).	Week 9	Power series and DEs
Week 5	8.5, 8.6	Week 10	review.

This schedule may be a little bit agressive in the first half of the course. Keep in mind that this syllabus is being written before any of us have taught out of the new textbook.