# MATH 550: METHODS OF ASYMPTOTIC ANALYSIS: FALL TERM 2006

## Course Outline

This is the first half of a two-part course in asymptotic and perturbation methods in applied mathematics. The second half will be offerred as Math 605E by Neil Balmforth in January 2007. The topics for the first part, Math 550, will include

- asymptotic expansions, regular perturbation theory, and eigenvalue perturbation theory.
- asymptotic evaluation of integrals, including Laplace's method and the method of stationary phase for oscillatory integrals
- Singular perturbation methods and boundary layer theory, with applications from reaction-diffusion theory, fluid flow, heat transfer, etc.
- Local analysis and the method of dominant balance for ODE's.

One key goal is to apply the theory developed to a wide range of application areas in the sciences. I will provide a set of (hopefully) relatively complete course notes on the web.

## Prerequisites

Math 400 (PDE) and Applied Complex analysis (Math 301) or equivalent is desirable.

## References

- Bender, C. M., Orszag, S. A. : Advanced Mathematicsl Methods for Scientists and Engineers
- Copson, E.: Asymptotic Expansions
- deBruijn, N.: Asymptotic Methods in Analysis
- Erdelyi, A.: Asymptotic Expansions
- Murray, J.: Asymptotic Analysis
- Olver, F.: Asymptotics and Special Functions
- Sirovich, L.: Techniques in Asymptotic Analysis

## Remark

There will be (roughly) eight homework assignments worth 60% of your grade and a take-home final exam worth 40% of your grade.

## Instructor

Instructor Michael Ward 822-8571, Room 311, Director's Office, Institute of Applied Mathematics.

## Math 605E Topics

The topics of the second half of this course, Math 605E, next term are: WKB theory for ODE's and PDE's, method of multiple scales and nonlinear dynamics, Steepest Descent method, homogenization theory, pattern formation and the Ginzburg-Landau equation.