

# Asymptotic Analysis, Spring 2024, Syllabus

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1. **Overview.** This is a graduate level course in asymptotic analysis and perturbation theory. It pertains to a fundamental issue in mathematics: there are only a few problems we know how to solve in closed form: maybe a few dozen integrals and ODE tricks, diagonalizing matrices (which are not too big), solving linear equations, finding the roots of polynomials up to degree 4, etc. But mathematical structures (be it in physics, biology, pure and applied math) tend to be much more involved and varied. In asymptotic analysis, we look at complicated problems where there is a very small (or very big) parameter, and try to find a systematic and rigorous way to reduce them to solvable models. This approach is pervasive in its applicability, but also relies on deep and beautiful mathematical theory which cuts across many disciplines, such as complex, multivariate, and functional analysis.
2. **Logistic.** The course will be taught in English. We meet Wednesday and Thursday, 10:30-12:30, in Amado 719. *Office Hours* are most welcome, and will be set on a need basis.
3. **Assignments and grades:** The course grade will be based on 80% final assignment and 20% homework average.
  - **Homework.** There will be no more than 7 assignments during the semester. The worst grade will be dropped from the average. Besides unforeseen personal circumstances (medical, miluim, etc.), late submission will not be allowed, and assignments which are not submitted will be graded as 0/100.
  - **Final assignment.** Will include a written report and a presentation based on a research paper or an advanced textbook. The assignment could be submitted in groups of one or two, but no more than that. Details, such as format, potential topics, and resources, will be provided in mid June.
4. **Resources:** I will release my own notes as we go along. The two main books I'm basing the course on are:
  - (a) E.J. Hinch, *Perturbation Methods*, which is a good introductory text, very brief and not too cumbersome (but sometimes a little too brief and informal).
  - (b) P.D. Miller, *Applied Asymptotic Analysis*, which is longer, more detailed, and more rigorous.

There are plenty of other books, like *Bender and Orzag*, *Lin and Segal*, etc.

*Good Luck!*