

MATH 4708/5408 Asymptotic Methods of Applied Mathematics
Fall 2020

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Text	<i>Advanced Mathematical Methods for Scientists and Engineers</i> C. Bender and S. Orszag Springer
Lectures	Tuesday and Thursday 8:30-10:00 (online)
Problem Sets	There will be four problem sets on a roughly bi-weekly basis.
Grading	Problem Sets 30 % Midterm 20 % Exam 50 %

Course Outline

1. Approximate Solution of Ordinary Differential Equations (~ 4 Weeks)
 - Review of exact methods. [Ch. 1]
 - Classification of Singular Points. [3.1]
 - Series Solutions around Ordinary and Regular Singular Points. [3.2-3]
 - Series Solutions around Irregular Singular Points. [3.4]
 - Behaviour at Infinity. [3.5]
 - Asymptotic Series and Asymptotic Relations. [3.7-8]
 - Extension to Nonlinear Equations. [Ch. 4]
2. Asymptotic Expansion of Integrals (~ 2 Weeks)
 - Elementary approaches. [6.1-3]
 - Laplace's Method. [6.4]
 - Method of Stationary Phase. [6.5]
 - Method of Steepest Descents. [6.6]
3. Perturbation Theory (~ 4 Weeks)
 - Classification of perturbation problems. [7.1-2]
 - Regular perturbation and Multiple Scale Analysis [11.1-2]
 - Perturbation of eigenvalue problems [7.3]
 - Singular perturbation and Boundary Layer Theory [9.1-6]
4. WKB Theory (~ 2 Weeks)
 - Description of WKB Expansion and Validity. [10.1-2]
 - Application to Turning Point and Wave Propagation problems. [10.4-10.6]