COURSE CALENDAR

MATHEMATICAL METHODS FOR THE PHYSICAL SCIENCES

SPRING SEMESTER 2025

https://www.phys.uconn.edu/~rozman/Courses/P2400_25S/

Last modified: May 2, 2025

The chapter, section, and the page numbers below refer to the following editions of the course textbook: **HC** – Hung Cheng, *Advanced Analytic Methods in Applied Mathematics, Science, and Engineering*, Luban Press, 2006;

TUESDAY	THURSDAY
Jan 21st **Lecture 1** Computer algebra systems: a very short introduction to *Mathematica* (handout)	Jan 23rd **Lecture 2** Differentiating under the integral sign (handout) Homework 1 assigned: due on 1/30/2025
Jan 28th **Lecture 3** Gamma function, $\Gamma(x)$; Gaussian integrals; (handout)	Jan 30th **Lecture 4** Beta function, $B(x,y)$ (handout) Homework 2 assigned: due on 2/6/2025
Feb 4th **Lecture 5** Complex numbers, **HC**, Ch. 2, pp. 35–41 Euler's formula (handout) Coordinate and polar form of complex numbers; powers of complex numbers	Feb 6th **Classes cancelled due to snow storm**
Feb 11th **Lecture 6** Complex functions. Derivative of a complex function. Analytic functions. Cauchy-Riemann conditions. **HC**, Ch. 2, pp. 41–47. Homework 3 assigned: due on 2/18/2025	Feb 13th **Lecture 7** Cauchy-Riemann conditions, II. Integrals of complex functions. Cauchy's integral theorem (handout).
Feb 18th **Lecture 8** **Midterm I assigned; Due on 2/25/2025** Deformation of integration contours. **HC**, Ch. 2, pp. 49–50. Applications of Cauchy's theorem, (handout) Cauchy's integral formula. **HC**, Ch. 2, pp. 51–53.	Feb 20th **Lecture 9** Applications of Cauchy's theorem, II (handout) Cauchy's integral formula, II. **HC**, Ch. 2, pp. 51–53.
Feb 25th **Lecture 10** Liouville theorem. (handout) Taylor and Laurent series. **HC**, Ch. 2, pp. 53–57. Poles, residues, Cauchy residue theorem. **HC**, Ch. 2, pp. 58–59.	Feb 27th **Lecture 11** Evaluating real integrals (handout); **HC**, Ch. 2, pp. 59–70. Homework 4 assigned: due on 3/6/2025

Tuesday	Thursday
Mar 4th **Lecture 12** Method of residues, II. **HC**, Ch. 2, pp. 59–70.	Mar 6th **Lecture 13** Method of residues, III. Higher-order poles. Constructing "terrible" integrals (handout) Homework 5 assigned: due on 3/13/2025
Mar 11th **Lecture 14** Laplace method for differential equations (handout)	Mar 13th **Lecture 15** Laplace method for differential equations, II (handout) Harmonic oscillator in quantum mechanics (handout). Homework 6 assigned: due 3/27/2025
Mar 18th **Spring Recess – No classes**	Mar 20th **Spring Recess – No classes**
Mar 25th **Lecture 16** Laplace method for integrals (handout).	Mar 27th **Lecture 17** **Midterm II assigned; Due on 4/3/2025** Laplace method for integrals, II (handout).
Apr 1st **Lecture 18** Laplace method for integrals, III (handout). Moving maximama. Asymptotics for Gamma function.	Apr 3rd **Lecture 19** Integration of fast-oscillating functions. The method of stationary phase (handout). Homework 7 assigned: due on 4/10/2025
Apr 8th **Lecture 20** Integration of fast-oscillating functions, II. Integration by parts. (handout).	Apr 10th **Lecture 21** Review of Midterm II. Integration of fast-oscillating functions, III (handout). Homework 8 assigned: due on 4/17/2025
Apr 15th **Lecture 22** Perturbation methods I. Regular perturbations (handout).	Apr 17th **Lecture 23** Perturbation methods II. Singular perturbations (handout). Homework 9 assigned: due on 5/1/2025
Apr 22nd **Lecture 24** Review of HW8 Perturbation methods III. Boundary layers (handout).	Apr 24th **Lecture 25** Boundary layers, II (handout).
Apr 29th **Lecture 26** **Midterm III assigned** **Due on Thu, May 8, 2025, 6 pm – 8 pm, in GS-119** Weakly-nonlinear oscillators. The method of averaging. (handout).	May 1st **Lecture 27** The method of averaging, II (handout).
May 6th **Week of Finals**	May 8th **Week of Finals**