

COURSE CALENDAR

MATHEMATICAL METHODS FOR THE PHYSICAL SCIENCES

SPRING SEMESTER 2023

https://www.phys.uconn.edu/~rozman/Courses/P2400_23S/

Last modified: April 28, 2023

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 17th	Lecture 1	Jan 19th	Lecture 2
Course concepts and logistics Computer algebra systems: a very short introduction to <i>Mathematica</i> (handout)		Course overview, I. Typical problems: (a) products – Birthday paradox (handout) (b) sums – energy of a coulomb chain (handout) (c) integrals – Kelvin’s ship wave pattern (handout) Homework 1 assigned: due 1/26/2023	
Jan 24th	Lecture 3	Jan 26th	Lecture 4
Complex numbers, HC pp. 35–38 Euler’s formula (handout) Differentiating under the integral sign (handout) Class notes on HuskyCT		Gamma function, $\Gamma(x)$, Beta function, $B(x, y)$ (handout) Homework 2 assigned: due 2/2/2023 Class notes on HuskyCT	
Jan 31st	Lecture 5	Feb 2nd	Lecture 6
Beta function, $B(x, y)$ (handout) Applications of Gamma and Beta functions (handout) Class notes on HuskyCT		Applications of Gamma and Beta functions, II (handout) Adding convergence factors to integrals Homework 3 assigned: due 2/16/2023 Class notes on HuskyCT	
Feb 7th	Lecture 7	Feb 9th	Lecture 8
Adding convergence factors to integrals, II Complex numbers; coordinate and polar form; powers of complex numbers Class notes on HuskyCT		Algebra of complex numbers, II Complex functions Derivative of a complex function. Cauchy-Riemann conditions. HC , pp. 35–47. Class notes on HuskyCT	

TUESDAY		THURSDAY	
Feb 14th	Lecture 9	Feb 16th	Lecture 10
Orthogonality contour lines of $u(x,y) = \text{const}$ and $v(x,y) = \text{const}$. Analytic functions. Integral of a complex function. Cauchy's integral theorem (handout). Applications of Cauchy's theorem (handout) Class notes on HuskyCT		Cauchy's integral formula. HC, Ch. 2, pp. 51–53. Homework 4 assigned: due 2/23/2023 Class notes on HuskyCT	
Feb 21st	Lecture 11	Feb 23rd	
Constructing “terrible” integrals (handout) Review Class notes on HuskyCT		Midterm I Take-home part of the exam is due on March 2, 2023.	
Feb 28th		Mar 2nd	Lecture 12
Classes cancelled due to snow storm		Taylor and Laurent series. HC, Ch. 2, pp. 53–57. Poles, residues, Cauchy residue theorem. Calculating residues for first order poles. HC, pp. 58–59. HW 5 assigned: due — 3/9/2023 3/23/2023 Class notes on HuskyCT	
Mar 7th	Lecture 13	Mar 9th	Lecture 14
Method of residues, I (handout). Calculating residues for higher order poles. Class notes on HuskyCT		Method of residues, II. Jordan's lemma (handout). HC, Ch. 2, pp. 60–69.	
Mar 14th		Mar 16th	
Spring Recess – No classes		Spring Recess – No classes	
Mar 21st	Lecture 15	Mar 23rd	Lecture 16
Method of residues, III. Harmonic oscillator in quantum mechanics (handout). Class notes on HuskyCT		Laplace method for differential equations (handout) Homework 6 assigned: due 4/6/2023 Class notes on HuskyCT	
Mar 28th	Lecture 17	Mar 30th	Lecture 18
Laplace method for differential equations, II (handout) Class notes on HuskyCT		Midterm II Due on April 6, 2023. Laplace method for differential equations, III (handout). Class notes on HuskyCT	
Apr 4th	Lecture 19	Apr 6th	Lecture 20
Laplace method for integrals, I (handout). Class notes on HuskyCT		Laplace method for integrals, II (handout). Homework 7 assigned: due 4/13/2023 Class notes on HuskyCT	

TUESDAY		THURSDAY	
Apr 11th	Lecture 21	Apr 13th	Lecture 22
Laplace method for integrals, III. Moving extrema. Asymptotics for Gamma function. Class notes on HuskyCT		Airy equation. The method of stationary phase. (handout). Homework 8 assigned: due 4/27/2023 Class notes on HuskyCT	
Apr 18th	Lecture 23	Apr 20th	Lecture 24
The method of stationary phase, II. (handout). Class notes on HuskyCT		Midterm III, Due on May 4, 2023. The method of stationary phase, III. (handout). Class notes on HuskyCT	
Apr 25th	Lecture 25	Apr 27th	Lecture 26
Fast oscillating integrals. (handout). Class notes on HuskyCT		Weakly-nonlinear oscillators. The method of averaging. (handout). Class notes on HuskyCT	
May 2nd		May 4th	
Week of Finals		Week of Finals	