COURSE CALENDAR

MATHEMATICAL METHODS FOR THE PHYSICAL SCIENCES

Fall semester 2020

https://www.phys.uconn.edu/~rozman/Courses/P2400_20F/

Last modified: December 8, 2020

The chapter, section, and the page numbers below refer to the following editions of the course textbooks: **HC** – Hung Cheng, *Advanced Analytic Methods in Applied Mathematics, Science, and Engineering*, Luban Press, 2006; **LJ** – Lorella M. Jones, *Introduction to Mathematical Methods of Physics*, Benjamin/Cummings, 1979

Monday	Wednesday
Aug 31st **Lecture 1** Course logistics	Sep 2nd **Lecture 2** Course overview, I. Typical problems and their examples: (a) products – Birthday paradox (handout); sums – energy of a coulomb chain (handout) Computer algebra systems: a very short introduction to *Mathematica* (handout) Homework 1 assigned: due 9/9/2020
Sep 7th **Labor day – no classes**	Sep 9th **Lecture 3** Course overview, II. Typical problems and their examples: (a) differential equations – oscillations of a hanging chain (handout); integrals – Kelvin wake (handout)
Sep 14th **Lecture 4** Euler's formula (handout) Gamma function, $\Gamma(x)$; recurrence relation for $\Gamma(x)$; Gamma function and factorial Gaussian integrals	Sep 16th **Lecture 5** Beta function, $B(x,y)$ Gamma function and n-dimensional sphere (handout) Homework 2 assigned: due 9/23/2020
Sep 21st **Lecture 6** Differentiating under the integral sign (handout) 1d potential motion (handout), Duplication formula for Gamma function (handout) More Gaussian-type integrals (handout)	Sep 23rd **Lecture 7** Differentiating under the integral sign (handout) 1d potential motion (handout), Homework 3 assigned: due 9/30/2020

Monday	Wednesday
Sep 28th **Lecture 8** Complex numbers; coordinate and polar form; powers of complex numbers; logarithms of complex numbers Complex functions, real and imaginary parts of complex functions, $f(z) = u(x,y) + iv(x,y)$. Derivative of a complex function. Cauchy-Riemann conditions. HC, pp. 35–47.	Sep 30th **Lecture 9** **Midterm I: take-home, due Oct 7, 2020** Analytic functions. Integral of a complex function. Cauchy's integral theorem (handout). Applications of Cauchy's theorem (handout)
Oct 5th **Lecture 10** Liouville theorem. Cauchy's integral formula. HC, Ch. 2, pp. 51–53.	Oct 7th **Lecture 11** Taylor and Laurent series. HC, Ch. 2, pp. 54–57. Poles and residues. HC, Ch. 2, pp. 58–59. Homework 4 assigned: due 10/14/2020
Oct 12th **Lecture 12** Method of residues, I, handout	Oct 14th **Lecture 13** Method of residues, II. Jordan's lemma (handout). Homework 5 assigned: due 10/21/2020
Oct 19th **Lecture 14** Method of residues, III. Advanced choices of integration contours.	Oct 21st **Lecture 15** Laplace method for differential equations (handout). Homework 6 assigned: due 11/4/2020
Oct 26th **Lecture 16** Laplace method for differential equations, II (handout). Laplace method for integrals (handout).	Oct 28th **Lecture 17** Laplace method for integrals, II (handout).
Nov 2nd **Lecture 18** **Midterm II: take-home, due Nov 9, 2020** Laplace method for integrals, III. (handout). HW6 review	Nov 4th **Lecture 19** The method of stationary phase. (handout). Homework 7 assigned: due 11/18/2020
Nov 9th **Lecture 20** The method of stationary phase, II. (handout).	Nov 11th **Lecture 21** The method of stationary phase, higher order corrections. Integration by parts. (handout).
Nov 16th **Lecture 22** Regular perturbation theory (handout).	Nov 18th **Lecture 23** Singular perturbation theory (handout).
Nov 23rd **Thanksgiving recess – No classes**	Nov 25th **Thanksgiving recess – No classes**
Nov 30th **Class cancelled – video-conferencing problems**	Dec 2nd **Lecture 24** **Midterm III: take-home, due Nov 9, 2020** Singular perturbation theory, II. Boundary layers. (handout).

Monday	Wednesday
Dec 7th **Lecture 25** Course Review	Dec 9th **Reading days – No classes** **Office hours during the regular class times**
Dec 14th **Week of Finals**	Dec 16th **Week of Finals**