

Math 118, Fall 2022

Instructor: Prof. Jon Wilkening

Office: 1051 Evans Hall

Office Hours: Tues 3:45-4:45, Wed 2:30-3:30

e-mail: wilkening@berkeley.edu (emergencies & administration only. No questions about HW, please)

online discussion forum for our class: edstem.org

Course Announcements, Homework Solutions, etc.: <https://bcourses.berkeley.edu/>

Lectures: TTh 2:10-3:30 PM, 202 Wheeler

Required textbook: "A First Course in Wavelets with Fourier Analysis, 2nd Edition," by Boggess and Narcowich.

Recommended reading: "Approximation Theory and Approximation Practice, Extended Edition," by Lloyd N. Trefethen

Prerequisites: Math 53 and 54 or equivalent. (Math 104 and 110 helpful but not required.)

Syllabus: This course will cover the basic mathematical theory and practical applications of Fourier analysis, polynomial approximation, and wavelets, including one-dimensional signal processing and multi-dimensional image processing.

- Vector spaces, inner products, norms, convergence
- Fourier series, orthogonal systems, sampling and aliasing, FFT
- Fourier integrals and transforms, linear filters, sampling theorem, uncertainty principle, two-dimensional Fourier analysis
- Polynomial approximation, orthogonal polynomials, numerical quadrature, Chebyshev interpolation
- Haar wavelets, Daubechies wavelets, scaling functions, multiresolution analysis, filter banks
- Approximation with wavelets, linear and nonlinear techniques, image compression, JPEG-2000

Grades: Each exam will have a formula for converting your raw score into a scaled score (to account for the fact that the exams may not be of equal difficulty.) The curve will never lower your score – if everyone does well on an exam, we will use the raw scores. These scores are combined into a final grade using the following weights:

Homework: 40%. 11 assignments, 2 lowest scores dropped

Midterm: 20% or 0% (Thursday, October 20, in class.) (Replaced by scaled score on final)

Final: 40% or 60% (Dec 13, 8:00-11:00 AM, Location TBA) (if it is higher)

No make-up exams for any reason.. don't miss the Final exam!

Grade cutoffs: 98 A+, 90 A, 86 A-, 82 B+, 78 B, 74 B-, 70 C+, 66 C, 62 C-, 58 D+, 50 D (no D- given)
(scaled scores will be determined with these grade cutoffs in mind)

Incomplete grades: (University policy) A grade of I will only be given if "your work in a course has been of passing quality but is incomplete for reasons beyond your control"

Homework: Homework must be uploaded to gradescope by 11:59 PM each Wednesday. Late assignments will not be accepted. **Please write dark and legibly and keep the problems ordered.** There are many inexpensive scanning apps for smart phones (e.g. turboscan). It's also worthwhile to learn latex and prepare your homework solutions that way. You may discuss the homework problems with your classmates, but **you must write up your own solutions.** Searching for solutions on the internet or copying your friends' homework solutions is *cheating* and defeats the purpose. We will have records of all your submitted work and it is usually easy to tell if copying has occurred, even with changes of variable names, etc. The two lowest homework scores will be dropped. **Some homework problems will involve a computational component to try out the theory on a computer.** This will not involve extensive coding. Matlab or Python are suggested languages, but if you prefer another programming language, just let me know.