SYLLABUS FOR MATH 416, Spring 2024

(As of February 10, 2025)

Tuesday, Thursday 9:30 a.m. - 10:45 a.m.
PHY 2211

Prerequisites: MATH 240 (or equivalent), MATLAB.

Text: Instructor's notes

Instructor: Dr. Wojciech Czaja
Office Hours: Tuesday, Thursday 11:00 - 12:00 p.m., or by appointment
Email: czaja (at) umd (dot) edu

Exams: There will be 3 midterm exams during the semester, each for the total of 100 points. The lowest score is dropped. They are tentatively scheduled on February 27, April 3, and May 1. The final exam is worth 200 points. The final exam is on May 19 (Monday), 2025, at 1:30 p.m. - 3:30 p.m.

Calculators: Calculators (and other electronic devices) will NOT be allowed for the exams, but small (5 x 3 in.) note cards will be allowed during the midterm exams.

It is the policy of the Department of Mathematics not to allow note cards on final exams.

Homework: On Thursday of the week that has no exam scheduled, homework will be assigned. (Homeworks are due the next Thursday at the start of the class.) Each one is worth 25 points, and there will 10 such assignments. The lowest 2 scores (including absences) are dropped. Late homework will not be accepted.

Grading: The maximum point total is 600 points and the total used to calculate the final grade is the minimum of the two numbers: 600 points and the largest score in the class. The setting of letter grades will be based on the number of points and will be no worse than: 50% - D-, 60% - C-, 75% - B-, 90% - A-. Cutoffs for plus/minus grades will be determined at the end of semester.

Academic integrity: The University makes me remind you about its academic integrity policies. So I do. Nobody, however, has to remind me that part of my job is to make sure that these policies are obeyed.

Attendance and absences: You are responsible for the material covered in class, whether you attend or not. You are also responsible for the announcements made during class; **they may include changes in the syllabus**.

The instructor will adhere strictly to the official university policy on makeup exams. In particular, it is the policy of the University to excuse the absences of students that result from the following causes: illness of the student, or illness of an immediate family member; religious observance (where the nature of the observance prevents the student from being present during the class period); participation in university activities at the request of University authorities; and compelling circumstance beyond

the student's control. Students claiming excused absence must apply in writing and furnish documentary support for their assertion that absence resulted from one of these causes. Moreover, foreseeable absences (such as those resulting from religious holidays or participation in university-sponsored events) must be submitted in writing to the instructor by February 10, 2025. See the UMD's Course Related Policy website for more details.

Due to a University requirement for timely assessment, make ups for excused major grading events must be scheduled within the first 3 class days of the student returning to campus, and at a time that is convenient for both parties.

Disabilities: If you have a disability disallowing you to test under the usual time or in-class conditions, or if you need some other accommodations, you may contact the office of Accessibility and Disability Service (ADS). Please let me know by February 10, 2025, if you think you may require these services. If they assess you as meriting private conditions and/or extra time, then you may arrange to take your tests at ADS, with extra time as they indicate. You must arrange this well in advance of a test. Remember: I need to sign the document.

Emergency closures: In case of an emergency that closes the University for an extended period of time (for example, due to a pandemic), be sure to access your email for instructions from me. Should any classes or exams be cancelled, please check the class schedule page for updated schedule information.

Course communications: Will be done via UMD email. Please make sure you have updated yours on ELMS.

Course evaluations: Your participation in the evaluation of courses through CourseEvalUM is important to us, and helps improve teaching and learning at the University. CourseEvalUM will be open for you to complete your evaluations for the Fall semester. Evaluations are anonymous and will not be available to faculty until next semester, so they cannot possibly affect your grade.

OUTLINE OF MATERIAL

This course introduces students to the mathematical concepts arising in signal analysis from the applied harmonic analysis point of view. Topics include applied linear algebra, Fourier series, discrete Fourier transform, Fourier transform, Shannon Sampling Theorem, filtering transforms, wavelet bases, multiresolution analysis, and discrete wavelet transform.

Complex Numbers, Vector Spaces and Linear Transformations [1 week]

Finite frames and bases, Principal Components, Laplacian Eigenmaps [4 weeks]

Fourier Series, Discrete Fourier Transform [4 weeks]

Wavelet Bases, Discrete Wavelet Transform, [4 weeks]

Sampling, Quantization, Precision [2 weeks]