MATH 481/681: Fourier Analysis **Fall 2024, 3 credits**

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Lecture hours	MWF 10:00am–10:50am, NDSU South Engineering, Rm 208
Office hours	MWF 11:00am–12:00pm (or by appointment)
Textbook	A recommended (optional) textbook is *Lectures on the Fourier Transform and Its Applications* by Brad Osgood. The pdf of the lecture notes on which the book is based can be found at `https://see.stanford.edu/materials/lsoftaee261/book-fall-07.pdf`
Prerequisites	MATH 265
Course Description	Discrete and continuous Fourier transforms, Fourier series, convergence and inversion theorems, mean square approximation and completeness, Poisson summation, Fast-Fourier transform.
Course Objectives	The goal of the course is to develop experience working with Fourier series and Fourier transform, which can be (somewhat simplistically) described as a technique replacing a given function (or signal, as engineers would say) with a sum of simpler trigonometric functions. Along with the necessary mathematical background (orthogonality, integrable functions, distributions), we will cover quite a few applications culminating in the fast fourier transform algorithm ("the most important numerical algorithm of our lifetime" as some say).
Class Attendance	According to NDSU Policy 333 (`www.ndsu.edu/fileadmin/policy/333.pdf`), attendance in classes is expected. The students are solely responsible for missed handouts or announcements made during the lectures.
Homework	Starting week two of the course there will be a regular weekly homework, which will be collected and graded. No late homework will be accepted. Group work on homework problems is encouraged, however, the final writing of solutions should be entirely your own. 681 section of the course will be assigned additional problems.
Exams	There will be two take home exams. 681 section of the course will be assigned additional problems. Part of the final exam will be an oral defence during the scheduled final exam time slot (Tuesday, December 17, 1pm).
Grading	The grading of the course will be based on the grade throughout the semester [weekly homework (50%), midterm exam (20%), and the final exam (30%)] or on the final exam grade alone, whichever turns out to be bigger. The final grade will be A/B/C/D/F with the thresholds 90/80/70/60.

Academic Responsibility and Conduct

The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at `www.ndsu.edu/academichonesty`.

Any student found guilty of academic dishonesty will receive a grade of 0 for the homework assignment, or quiz, or test, or exam in question. In addition, every such student will be reported to the Chair of Mathematics, the Dean of their major college, the Dean of the College of Science and Mathematics, the Provost, and the Registrar. The Registrar will add any such student to NDSU's Student Academic Misconduct Database. (Multiple entries in this database may result in additional sanctions from NDSU.)

Special Needs

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (`www.ndsu.edu/disabilityservices`) as soon as possible.

Schedule

Note: This is a tentative schedule and subject to a change.

Weeks 1-2. Fourier series. Complex numbers. Euler's formula. Convergence.

Weeks 3-4. Orthogonality and completeness. Integrable functions.

Weeks 5-6. Fourier transform. Convolution.

Weeks 7-8. Distributions and their Fourier transform. (Midterm exam is due, tentatively October 18th).

Weeks 9-10. Distributions and their Fourier transform. Delta function.

Weeks 11-12. Sampling and interpolation.

Weeks 13-16. Discrete Fourier transform. Fast Fourier transform. Review classes.

Week 17. Final exam (December 17, Thuesday, 1pm).