Fall 2015

PHYS 4205/5205

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University of New Orleans

PHYS 4205/5205 Physical Applications of the Fourier Transform

Fall 2015 – TuesThurs 3:30-4:45 pm – LA 234 (interactive video)

Text: Ronald N. Bracewell, "The Fourier Transform and its Applications," McGraw-Hill, Third Edition, 2000, ISBN 0-07-303938-1

Class Date	Chapter	Topics
1 Aug 20	Ch 2	Introduction; Fourier transforms; Integral Theorem
2 Aug 25		transforms in the limit, oddness and evenness, Hermitian functions, complex conjugates and transform pairs
3 Aug 27		sine and cosine transforms, interpretation of formulas
4 Sep 1	Ch 3	convolution
5 Sep 3		examples of convolutions, graphical pictures of convolution
6 Sep 8		convolution of two square pulses: graphically and analytically convolution and serial products
7 Sep 10		serial division and inverses
8 Sep 15		homework and review for test 1
9 Sep 17		Test 1
10 Sep 22		matrix notation, autocorrelation
11 Sep 24		cross correlation, energy spectrum
12 Sep 29	Ch 4	special functions: rect, triangle, exponential, Gaussian, erf integral, sine integral, step function,
13 Oct 1		special functions: ramp, signum, sinc, $sinc^2$
14 Oct 6	Ch 5	delta functions, sampling and shah function, null functions
15 Oct 8	Ch 6	transform pairs
16 Oct 13		Theorems: Similarity, Addition, Shift
Oct 15-16		Fall Break
17 Oct 20		Theorems: Modulation and Convolution
18 Oct 22		homework and review for test 2
19 Oct 27		Test 2
20 Oct 29		variations on the Convolution Theorem, Rayleigh Theorem, Power Theorem
21 Nov 3		Theorems: Autocorrelation and Derivative
22 Nov 5		derivative of convolution integral

23	Nov 10	Ch 7	transforms by integration in closed form
24	Nov 12		numerical transforms, transforms from theorems
25	Nov 17	Ch 8	the two domains, definite integral theorem, first moment and centroid, second moment
26	Nov 19		moment of inertia, smoothness and compactness, smoothness under convolution
27	Nov 24		widths: equivalent, autocorrelation, mean square; variance; some inequalities, uncertainty relation
	Nov 26-27		Thanksgiving holiday
28	Dec 1		first and second finite differences, Central Limit Theorem
29	Dec 3		homework and review for final exam
30	Dec 8		Final Exam – Comprehensive – Tuesday, Dec 8, 3-5 pm

OMIT the following sections

	Bracewell, 3rd edition	Bracewell, 2nd edition, revised
Ch 3	p. 43 middle to p. 45 middle p. 48 (appendix)	p. 43 middle to p. 45 middle p. 48 (appendix)
Ch 5	p. 94 middle to end of chapter	p. 89 middle to end of chapter
Ch 6	p. 127 to end of chapter	p. 120 to end of chapter
Ch 7	p. 139, example 4	p. 130, example 4
Ch 8	p. 160 bottom to p. 162 middle p. 188 bottom half p. 190 top half	p. 144 middle top to p. 146 top p. 171 bottom p. 173 top half

Test 1	100 points	30 %
2	100	30
Final Exam	100	30
Homework	33	10
	333 points	100 %

Final grades are made on a curve based on the total number of points (maximum 333) accumulated by each student.

PHYS 5205 students only: Term paper comparing and contrasting Fourier transforms with one of the following: z transform, Hartley transform, wavelet transform, Hilbert transform, Laplace transform, or transform of your choice (clear with instructor first). Paper should be typed, double-spaced, 5 to 10 pages long, with well-labeled figures, equations, and discussions of equations. Due last day of class.

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Office hours: 1-3 pm MWF, 12:30-3 pm TTh, and any time available or by appointment

Academic dishonesty will not be tolerated. UNO Judicial Code is available online at http://www.uno.edu/~stlf/Policy%20Manual/judicial_code_pt2.htm.

Student Learning Outcomes

* Understand the basic concepts and equations of Fourier transforms
* Understand the relationships between the function domain and the transform domain
* Understand the basic concepts and equations of convolution
* Understand the mathematical theorems relating to Fourier transforms and convolution
* Solve senior/graduate level Fourier analysis problems
* Graduate students: Be able to apply Fourier analysis to real-world applications in signal processing, acoustics, optics, and other physical data of interest

Attendance Policy

Attendance will be monitored for every class. The total number of points (from homework and tests) accumulated by each student will determine the final grade.

Prerequisites
PHYS 2064 (3rd semester physics with calculus)
MATH: differential and integral calculus

Students are expected to conduct themselves according to the UNO Student Code of Conduct, available online at http://www.studentaffairs.uno.edu.

Academic integrity is fundamental to the process of learning and evaluating academic performance. Academic dishonesty will not be tolerated. Academic dishonesty includes, but is not limited to, the following: cheating, plagiarism, tampering with academic records and examinations, falsifying identity, and being an accessory to acts of academic dishonesty. Refer to the UNO Student Code of Conduct for further information. The Code is available online at http://www.studentaffairs.uno.edu.

It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Students who seek accommodations for disabilities must contact the Office of Disability Services prior to discussing their individual needs for accommodation with their instructors. For more information, please go to http://www.ods.uno.edu.

Additional information can be found on Moodle files for this class, Syllabus Attachment.