

ENG BE 747 - Advanced Signals and Systems in Biomedical Engineering

This course is based on a distributed set of class notes, “Notes for ENG BE 747 Advanced Signals and Systems in BME” together with the required textbook Discrete-Time Signal Processing by Alan V. Oppenheim & Ronald Schaffer published by Prentice Hall (THIRD edition). References are indicated in the dated syllabus below. Topics covered include: Orthogonal function representations; review of Fourier transforms; phase effects in Fourier analysis, including Hilbert transforms; short-time Fourier analysis, including wavelet representations; random processes, including Gaussian and Poisson; Optimum decision and estimation theory.

In the following syllabus, the abbreviation OS represents the textbook by Oppenheim and Schaffer. The indication “Notes” refers to the distributed Class Notes.

Date	Day	Topic	Text Sections
Jan 22	M	Review. Signal spaces; Orthogonality	Notes 1-3
Jan 24	W	Review. Discrete-Time Signals & Systems	Notes 4; OS 1-2
Jan 29	M	z -Transforms; Poles and Zeros	OS 3
Jan 31	W	Sampling; up and down sampling	OS 4
Feb 5	M	LTI Systems; group delay	OS 5.0-5.5
Feb 7	W	Minimum-phase systems	OS 5.6-5.7
Feb 12	M	Discrete Fourier Transform (DFT)	OS 8
Feb 14	W	LTI systems analysis with the DFT	OS 10.0-10.2
Feb 20	T	Narrowband Signals & Hilbert Transforms	OS 12 & Notes 5
Feb 21	W	Bandwidth-duration constraints	handout
Feb 26	M	Two-dimensional Fourier transforms	handout
		EXAM I - approximate date	
Feb 28	W	Time-frequency representations (STFT)	OS 10.3-10.4
Mar 3–11		SPRING BREAK	
Mar 12	M	Filter Banks and Reconstruction	TBA
Mar 14	W	Wavelets; MultiResolution Analysis	Notes 6
Mar 19	M	Discrete Wavelet Transform	Notes 6
Mar 21	W	EXAM II - approximate date	
Mar 26	M	Stochastic Processes - Introduction	Notes 7
Mar 28	W	Processes through linear systems	Notes 7
			OS App A,2.10,10.5-6
Apr 2	M	Statistical Decision Theory	Notes 7
Apr 4	W	Gaussian Random Processes	Notes 8
Apr 9	M	Signal Detection - Reverse Correlation	Notes 8
Apr 11	W	Poisson Processes - filtered Poisson	Notes 9
Apr 16	M	Patriot’s Day	
Apr 18	W	Poisson models of neural patterns	Notes 9
Apr 23	M	Ideal Processing of neural data	handout
Apr 25	W	Exam Review	
Apr 30	M	EXAM III	
May 2	W	Project presentations	
May 3-7	?	FINAL EXAM	