HKUSTx: ELEC1200.2x A System View of Communications: From Signals to...

Course Objectives:

By the end of this course, you will be able to:

- Understand the practical context of the concepts that you will study in more detail in later classes.
- Explain typical problems and tradeoffs encountered in electronic and computer engineering systems.
- Analyze simple approaches to deal with these problems and tradeoffs.
- Use software tools, such as MATLAB to investigate potential solutions to these problems and tradeoffs in order to validate the above analysis, as well as to handle cases not amenable to simple analysis.

Course Outline:

Week	Release Dates	Weekly Learning Objectives	Topics / Subtopics	Quiz and Lab Exercise Due Dates
1	27 Oct 2015 09:00 (GMT+8)	By the end of this week, you will be able to: • understand the difference between lossless and lossy source coding • calculate the entropy of a discrete random variable • state the relationship between the entropy and the average code length • find a Huffman code for a set of symbols	**Topic 1: Introduction** 1.1 Course Overview **Topic 2: Lossless Source Coding: Huffman Codes** 2.1 Source coding 2.2 Sequence of Yes/No questions 2.3 Entropy of a bit 2.4 Entropy of a discrete random variable 2.5 Average code length 2.6 Huffman code 2.7 Lab 1 - Source coding	2 Nov 2015 23:30 (GMT+8)

2	3 Nov 2015 09:00 (GMT+8)	By the end of this week, you will be able to: • understand the parameters that control the shape of continuous and discrete time sinusoids • recognize that signals can be represented as sums of sinusoids • reconstruct a signal given its Fourier coefficients • understand the key steps in MP3 encoding	**Topic 3: The Frequency Domain** 3.1 Music 3.2 Continuous-time sinusoids 3.3 Discrete-time sinusoids 3.4 Fourier series 3.5a Lab 2 - Frequency analysis 3.5b MATLAB demo - Frequency analysis for voice signal 3.5c MATLAB demo - Signal reconstruction **Topic 4: Lossy Source Coding** 4.1 Perceptual coding 4.2 Time frequency analysis 4.3 Masking 4.4 Non-uniform quantization	9 Nov 2015 23:30 (GMT+8)
3	10 Nov 2015 09:00 (GMT+8)	By the end of this week, you will be able to: • understand the frequency response of a linear time invariant system • recognize different types of filters from their frequency response • predict the output of a filter given the Fourier coefficients of its input and its frequency response • understand the complex exponential • understand the relationship between the discrete Fourier series and the discrete Fourier transform	**Topic 5: Filters and the Frequency Reponse** 5.1 Channels as filters 5.2 Frequency response 5.3 Filter examples 5.3a: Low pass filter example 5.3b: High pass filter example 5.3c: Band pass filter example 5.4 Frequency response of the IR channel 5.5 Lab 3 - Frequency response **Topic 6: The Discrete Fourier Transform** 6.1 Complex numbers 6.2 Complex exponentials 6.3 Aliasing 6.4 Discrete Fourier transform	16 Nov 2015 23:30 (GMT+8)
4	17 Nov 2015 09:00 (GMT+8)	By the end of this week, you will be able to: • understand the concept of	**Topic 7: Signal Transmission - Modulation** 7.1 Radio spectrum 7.2 Modulation 7.3 Modulation with complex	23 Nov 2015 23:30 (GMT+8)

		frequency division multiplexing • understand how modulation and demodulation can be used to shift signals from one part of the frequency spectrum to another • Analyze modulation and demodulation using sine waves • understand the effect of frequency and phase mismatches between the transmitter and receiver	exponentials **Topic 8: Signal Transmission - Demodulation** 8.1 Demodulation 8.2 Analysis of mixing using cosines 8.3 Analysis of mixing using complex exponentials 8.4 Filtering 8.5 Non-ideal effects 8.6 Lab 4 - Modulation 8.7 MATLAB demo - Frequency division multiplexing	
5	24 Nov 2015 09:00 (GMT+8)	By the end of this week, you will be able to: • understand how digital data can be transmitted wirelessly using binary phase shift keying • understand how quadrature phase shift keying can be used to double the rate information sent over the same channel • interpret eye and constellation diagrams as indicators of the performance of a digital communication channel	**Topic 9: IQ Modulation** 9.1 Binary phase shift keying 9.2 I/Q modulation 9.3 Quadrature phase shift keying 9.4 Constellation diagrams 9.5 Lab 5 - BPSK and QPSK **Topic 10: Summary and Review** 10.1 Source coding 10.2 Filters and the frequency domain 10.3 Sharing a channel	30 Nov 2015 23:30 (GMT+8)
6	1 Dec 2015 09:00 (GMT+8)		**Final Exam**	7 Dec 2015 23:30 (GMT+8)