

Department of Electrical Engineering, IIT Madras
EE 5140: DMC -- Revised Aug.17, 2017

Qualcomm MTech Program

Aug-Dec., 2017

Lesson 1 – Single shot communication, introduction to matched filter receiver, basis function, signal representation using vectors, and signal constellation

Lesson 1a -- Finding the basis signal set using Gram-Schmidt orthogonalisation

Lesson 1b – Determining the power spectrum (band-width) of digitally modulated signals using the stationarity properties of the random binary wave thro LTI system

Lesson 2 -- Digital communications thro (band-unlimited) AWGN channels – Signal representation, PAM signals and quick look at timing recovery, PSK and QAM signals, quick look at carrier recovery, orthogonal and multi-dimensional signals, [non-linear modulation \(FSK and CPM signals\)](#)

Lesson 2a -- Optimum receiver for AWGN measurement model, decision boundary and decision region for memoryless signals

Lesson 2b -- Probability of error P_e for symbol detection (Sec. 7.1 thro 7.6 in Chap-7), approximate P_e using Union bound, Chernoff bound, [P_e for fading channels](#)

Lesson 3 -- Digital communications thro band-limited “flat” channels – Symbol-by-symbol modulation based signal design for band-limited channels (Nyquist criterion), [partial response signaling](#)

Lesson 3a -- Timing and frequency synchronization for linearly modulated digital signals (from Sec. 7.8 in Chap-7)

Lesson 4 -- Digital communications thro distorting channels – Sequence estimation, MLSE and the Viterbi algorithm for ISI channels (Sec. 8.6 and only some parts of Sec. 8.5 in Chap-8), [and practical issues in MLSE](#)

Lesson 4a -- Channel equalization : Zero-forcing, LMMSE, fractionally-spaced structures

Lesson 4b -- Adaptive equalization for ISI channels (Linear and Decision Feedback structures)

Lesson 5 -- Channel coding preview : Random coding argument, Channel capacity theorem and its implications

Lesson 5a – Source coding theorem, Huffman code, Lempel-Ziv code

Lesson 6-- Wireless communications preview : *Noise figure and receiver sensitivity, link budget, wireless repeaters and regenerators, wireless multipath fading channel*

Lesson 6a -- Why the evolution from single-carrier symbol-by-symbol modulation to multi-carrier block modulation, and broadband cellular communications measurement models



(**Note:** The topics in **blue** color are not from the text book, and topics in *italics* will be covered if sufficient time is available.)

Text Book:

“*Communication Systems Engineering 2nd Ed*” J.G.Proakis & M.Salehi (Prentice Hall Intl. Edition); either hard-copy or E-book can be followed.

Assessment Method: (*tentative*)

Quiz-1 and Quiz-2 for 15 marks each; End Sem Exam: 40 marks; the remaining 30 marks will be awarded based on 4 assignments (which may include simulation problems) that have to be submitted from time to time.

There are 4 TAs for this course; Contact me at +91 44 2257 4420 or email me at giri@tenet.res.in for more details. Soft-copies of additional material will be made available at www.ee.iitm.ac.in/~giri/teaching and/or on IIT Madras Moodle site.

K. Giridhar, ESB-334B, August 17, 2017