Department of Electrical Engineering – Jan-Apr, 2013

EE6002: Multi-Carrier Communications – Slot: C, Venue: ESB-350

Course Contents:

Digital Communication Review: Linear symbol-by-symbol modulation, Optimal Detection in AWGN channels, ISI channels, Equalization, Multiple Access using TDMA/FDMA/CDMA schemes

Multi-carrier Systems: Motivation for Block Modulation, Single-carrier vs Multi-carrier, OFDM system, Role of FFT, Sensitivity to timing and frequency errors, Linear Precoding, PAPR reduction, Distributed and Localized mapping

OFDM Receiver Algorithms: Synchronization, Channel Estimation and Equalization, Zero forcing and MMSE algorithms, Training sequence design

Adaptive Modulation: Information theoretic approach, Water-filling solution, SNR Gap analysis, Bit loading algorithms

Generalised Multi-carrier Systems – Block modulation with zero-padding, PN sequences, MC-DS-CDMA, interleaved FDMA (IFDMA), and DFT-precoded OFDM (SC-FDMA) – Comparing their performance

Multi-user OFDM: Multi-user diversity, Resource allocation algorithms

MIMO-OFDM: Fundamental MIMO concepts, Spatial diversity, Spatial Multiplexing, Space-Frequency coding

About the Course: Adequate background in Linear Algebra and Digital Communications is required. There will be 2 quizzes, including a take-home quiz, and 2 computer-based assignments which have to be submitted for credit. A 10mark mini-project + presentation is also planned, and the End-Sem will be for 40marks. The tutorial sessions will be handled by the instructor and the TAs. The material underlined is new, and the *topics in italics* will be covered in depth or only introduced, based on available time. Contact **K. Giridhar** (giri@tenet.res.in) for queries.

Text Book:

L. Hanzo, M. Munster, B.J. Choi, and T.Keller, "OFDM and MC-CDMA for Broadband Multiuser Communications, WLANs, and Broadcasting", Wiley, 2003.

- Cho,Kim,Yang, and Kung – MIMO-OFDM Wireless Comm. With Matlab (Wiley – soft copy)

References :

(i) T.D.Chiueh and P.Y.Tsai, OFDM Baseband Receiver Design for Wireless Communications, Wiley, 2007
(ii) J. Proakis, Digital Communications, New York - McGraw Hill, 2001
(iii) J. Cioffi, Advanced Digital Communications - Course notes, Stanford University
(iv) D. Tse and P. Vishwanath, Fundamentals of Wireless Communications, Cambridge Press, 2005
(v) R. Van Nee and R. Prasad, OFDM for Wireless Multimedia Comm. , Artech House Publishers, 1999
(vi) G. Strang, Linear Algebra and Applications, New York Academic, 1980

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