

Department of Electrical Engineering, IIT Madras

Q-Slot (Tuesday, 2pm to 5pm)

9 credits; Feb-May, 2021

EE 6323: Wireless Systems Design

Motivation: Wireless systems are digital communication systems today and are invariably packet transport oriented with a block-modulated air interface. This course gives an exposure to block modulation fundamentals and air-interface design to ensure high quality signal recovery. A good portion of the course will present three case studies drawn from some of the industry funded projects executed by the TelWiSe group (www.ee.iitm.ac.in/TelWiSe).

Part-1: Introduction to block modulation

- 1.1 How to map a continuous time channel to an equivalent discrete time channel?
- 1.2 The good and bad of TDMA and DS-CDMA – spectral efficiency, power-control, peak power
- 1.3 Why the evolution from symbol-by-symbol modulation to block modulation?
- 1.4 Generalised block modulation with special focus on OFDM
- 1.5 The impact of Cyclic Prefix in OFDM links

Part-2: Estimation and Detection in OFDM Links

- 2.1 Synchronisation in OFDM links (timing, frequency, frame-boundary)
- 2.2 Channel estimation in OFDM links – from the sublime to the ridiculous
- 2.3 Coded OFDM – LLR estimation and bit detection

Part-3: Case studies of wireless links designed by TelWiSe group for Indian industry and organisations. Each of these will be presented in part by PhD scholars in the TelWiSe group.

- 3.1 **CS#1** -- Fail-safe point-to-point TDMA link through helicopter rotor blades ([Mr. C. Ramanathan](#))
- 3.2 **CS#2** -- Increasing spectral efficiency of mobile TV broadcast links in UHF bands ([Mr. Abhay Mohan](#))
- 3.3 **CS#3** – Covert point-to-multipoint sat-com using generalised block modulation ([Mr. Krishna Madan](#))

Textbooks: OFDM basics from “*Baseband Receiver Design for Wireless MIMO-OFDM Communications*”, Tzi-Dar Chiueh, Pei-Yun Tsai, I-Wei Lai, Wiley-Blackwell; 2nd Edition (June 2012), and a few sections from “*Fundamentals of Wireless Communications*”, David Tse, Pramod Viswanath.

Assessment Method:

Simulation Assignments – 30; Mini-Project – 30; End Sem (TBD) – 40; The two TAs for this course will be [Mr. Abhay Mohan](#) (abhay@tenet.res.in) and [Mr. Dibyajyoti Basak](#) (dbasak@tenet.res.in). Contact me at ESB-334B, x4420, giri@tenet.res.in, for more details. Soft-copies of additional material will be made available at www.ee.iitm.ac.in/giri and/or on Moodle.