

## Theoretical subjects for Data Communications, 2010-2011

1. Basic parameters of a communication system (power, bandwidth, noises), capacity theorems (with examples)
2. Channels: noises
3. Channels capacity (Nyquist and Shannon theorems with computation examples)
4. Digital encoding: key terms (definition, uni/bi-polar encoding, differential vs absolute encoding, baseband transmission, data rate )
5. Digital encoding techniques (NRZ, Binary AMI, bi-phase): principles, versions, advantages and drawbacks
6. Improved versions of AMI (HDB-3, B8ZS): motivation, principles, advantages and drawbacks, examples.
7. Baseband transmission chain (with explanations about the role of each block)
8. Nyquist theorem for ISI-less data transmission in the baseband (deduction)
9. Nyquist filters (infer the mathematical criterion for the raised-cosine Nyquist filters)
10. Transmission with controlled ISI (motivation, the cosine filter: frequency and impulse response, precoding, decision)
11. Modulation: key terms (carrier, message) with one graphical example for binary AM, FM, and PM.
12. AM types (mathematical model of the AM, AM with suppressed carrier, SSB-AM, VSB-AM).
13. Coherent demodulation for AM signals (mathematical model, principles, the importance of the phase synchronization)
14. The Costas loop for receiver's carrier synchronization
15. Frequency modulation: definition, principles, mathematical approach (formulas for frequency modulated signals, instantaneous frequency definition, continuous and discontinuous frequency modulation), advantages and drawbacks
16. Frequency demodulation using a narrowband limiter
17. Frequency demodulation using a wideband limiter
18. Phase modulation: principles, mathematical approach, graphical examples, advantages and drawbacks.
19. QPSK modulator (QPSK principles, modulator's scheme, constellation, phase table, mathematical expression for the generated signals)
20. 8-PSK modulator ((QPSK principles, modulator's scheme, constellation, phase table, mathematical expression for the generated signals)
21. Coherent demodulation of QPSK signals.
22. DBPSK: principles, demodulation.
23. USB (definition, channels, transmission speed, signal encoding at PHY layer, power supply).
24. V.24 (RS232) serial interface: number of pins, data pins, electrical and functional specification (circuit types).
25. Session establishment and communication DTE-DCE using the RS232 interface.
26. Present briefly, the OFDM principles.
27. Explain the OFDM's carriers orthogonality in time and frequency domain (graphical illustration too).
28. OFDM block diagram (transmitter, receiver).