1.   COURSE TITLE

Communication Electronics (EleCom)

1.1.   Course area

Electronics Systems

1.2.   Year

3rd

1.3.   Semester

2nd

1.4.   Faculty data

Please add @uam.es to all email addresses below.

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1.5.   Course contents

Contents Outline:

PART I. INTRODUCTION TO ELECTRONIC COMMUNICATION SYSTEMS
    Unit 1. Basic concepts of Communication Electronics
    Unit 2. Noise and Distortion in Communication Systems

PART II. PASSIVE CIRCUITS
    Unit 3. Radiofrequency Filters
    Unit 4. Other passive devices

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PART III. ACTIVE CIRCUITS
    Unit 5. Amplifiers
    Unit 6. Mixers
    Unit 7. Oscillators and frequency synthesizers

PART IV. TRANSCEIVER SYSTEMS
    Unit 8. Transceiver Architectures
    Unit 9. Modulators and Demodulators

Detailed Contents:

PART I. INTRODUCTION TO ELECTRONIC COMMUNICATION SYSTEMS
Unit 1. Basic concepts of Communication Electronics
    1.1. Blocks of a Communication System
    1.2. Transmission Lines and Microwave Networks
        1.2.1. Transmission Lines
        1.2.2. The Smith Chart
        1.2.3. Microwave network characterization
        1.2.4. Impedance Matching
Unit 2. Noise and Distortion in Communication Systems
    2.1. Noise
        2.1.1. Noise Power
        2.1.2. Noise Figure and Noise Equivalent Temperature
        2.1.3. Noise Figure of Microwave Networks
    2.2. Distortion
        2.2.1. Linear Distortion
        2.2.2. Non-linear Distortion

PART II. PASSIVE CIRCUITS
Unit 3. Radiofrequency Filters
    3.1. Lumped Filters
        3.1.1. Low-Pass Filter Prototype
        3.1.2. Impedance and Frequency Transformations
    3.2. Semi-lumped filters and filters with transmission lines
        3.2.1. Richard's and Kuroda's transformations
        3.2.2. Stepped-impedance synthesis
        3.2.3. Transmission-Line resonator filters
Unit 4. Other passive devices
    4.1. Two-port circuits
    4.2. Three-port circuits
    4.3. Couplers

PART III. ACTIVE CIRCUITS
Unit 5. Amplifiers
    5.1. Functions and types of amplifiers
        5.1.1. Characteristic parameters
        5.1.2. Tuned amplifiers

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    5.1.3. Wideband amplifiers
    5.1.4. Power amplifiers
5.2. Characterization of two-port networks with transistors
    5.2.1. Transistor models
    5.2.2. Gain concept in a two-port network
    5.2.3. The problem of stability
5.3. Amplifier design
    5.3.1. Design in terms of gain
    5.3.2. Low-noise amplifier design
    5.3.3. Power amplifier design

Unit 6. Mixers
6.1. Mixer parameters
    6.1.1. Image frequency, conversion loss and noise
    6.1.2. Return loss, isolation and distortion
6.2. Mixer circuits
    6.2.1. The diode as a mixer
    6.2.2. The transistor as a mixer
    6.2.3. Balanced mixers and image reject mixers

Unit 7. Oscillators and frequency synthesizers
7.1. Radiofrequency Oscillators
    7.1.1. Elements, basic parameters and types
    7.1.2. Design principles
    7.1.3. Phase noise: Leeson's model
7.2. Phase-Locked Loops (PLL)
    7.2.1. Operation analysis
    7.2.2. Frequency synthesis

PART IV. TRANSCEIVER SYSTEMS
Unit 8. Transceiver Architectures
8.1. Receiver system
    8.1.1. Types of receivers
    8.1.2. Intermediate Frequency choice
    8.1.3. Characteristic parameters
    8.1.4. Automatic gain control
8.2. Transmitter system
    8.2.1. Types of transmitters
    8.2.2. Characteristic parameters
    8.2.3. Automatic gain control

Unit 9. Modulators and Demodulators
9.1. Linear modulations
    9.1.1. Modulator subsystems
    9.1.2. Demodulator subsystems
9.2. Phase and frequency modulations
    9.2.1. Modulator subsystems
    9.2.2. Demodulator subsystems

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1.6. Course bibliography

Basic:

- D.M. Pozar, "Microwave and RF wireless systems", John Wiley & Sons, 2001.
- M. Sierra Pérez, B. Galocha, J.L. Fernandez y M. Sierra Castañer, "Electrónica de Comunicaciones", Editorial Prentice Hall, 2003.

Advanced:

- D. M. Pozar, "Microwave engineering", New York, John Wiley & Sons, 2005.
- R. E. Collin, "Foundations for microwave engineering", IEEE Press, 2001.
- R. Sorrentino, "Microwave and RF engineering", John Wiley & Sons, 2010.
- M. Steer, "Microwave and RF design: a systems approach", SciTech, 2010.
- J. M. Golio, "The RF and microwave handbook", CRC Press, 2008.

Additional:

- Kai Chang, "RF and Microwave Wireless Systems", J. Wiley & Sons, 2000
- D. O. Pederson, "Analog integrated circuits for communication principles, simulation and design", Springer, 2008.
- G. M. Miller, "Modern Electronic Communication", Prentice Hall, 2002.
- S. J. Erst, "Receiving System Design", Prentice Hall, 1992.
- S. A. Maas, "Microwave Mixers", Artech House, 1993.
- G. L. Matthaei, "Microwave filters, impedance-matching networks, and coupling structures", Artech House, 1980.
- J.G. Proakis, M. Salehi, "Communication systems engineering", 2nd ed., Prentice-Hall, 2002.
- S. Haykin, "Communication Systems", 4th ed., John Willey & Sons, 2001.
- B. Sklar, "Digital Communications: Fundamentals and Applications", 2nd ed., Prentice-Hall, 2001.