SUBJECT TEACHING GUIDE

G820 - Communications

Degree in Telecommunication Technologies Engineering

Academic year 2019-2020

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Compulsory. Year 3
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Signals and Communications Module in Common with the Telecommunications Branch				
Course unit title and code	G820 - Communications				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web	http://www.aulavirtual.unican.es				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
Name of lecturer	BEATRIZ AJA ABELAN
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Other lecturers	EDUARDO ARTAL LATORRE JESUS MARIA IBAÑEZ DIAZ

3.1 LEARNING OUTCOMES
- Knowing the methods of analog and digital modulation signals and transmission and reception systems in communications.
- Working with power, bandwidth and spectrum of signals.
- Having the ability to design a telecommunication system according to the required quality and analyzing the influence and limitations imposed by the noise.
- Solving practical problems and draw graphs representing signals and their spectrum.
- Using decibels and logarithmic magnitudes to characterize signals.

4. OBJECTIVES
Handling the spectral concepts of signal power and energy.
Knowing the types of analog and digital modulations, and how to generate and detect them.
Knowing the sources of noise in communications and their influence on signal transmission.
Understanding the need of the modulations in order to allow the propagation of the communication signal through the transmission channel.
Fundamentals of baseband and passband digital communications systems.
Understanding the main digital modulations, the effect of bandlimited channels, the inter symbol interference (ISI), and the basics of detection.
Comparing and evaluating different digital modulation techniques, depending on parameters such as bandwidth, signal to noise ratio (SNR) and bit error rate (BER).
Understanding the trade-off among power, bandwidth, bit error rate (BER), bit rate and symbol rate.

6. COURSE ORGANIZATION	
CONTENTS	
1	Introduction: Analog and digital communications. Classification of signals.
2	Analog baseband transmission: Transmission system with noise. Equivalent noise bandwidth. Distortions. Equalizers. Nonlinear distortion.
3	Linear Modulations: Amplitude modulation. Spectrum and bandwidth. Average transmitted power. AM modulators and detectors. Double Side Band (DSB) and Single Side Band (SSB) modulations. Coherent detection of DSB and SSB signals. Vestigial Side Band (VSB) modulation.
4	Angular modulations: Phase modulation and frequency modulation. Comparison between PM, FM and AM signals. Single tone frequency modulation, spectrum and bandwidth. FM bandwidth for a low pass modulating signal. Narrow band frequency modulation. Indirect and direct frequency modulation. FM demodulators. Frequency Division Multiplexing.
5	Noise in analog modulations. Noise in linear and angular modulations. Noise in AM, DSB and SSB. Noise in FM: pre-emphasis and de-emphasis.
6	Base band digital transmission. Source and channel coding. Baseband transmitter. Line coding. Pulse transmission through a channel. Inter-Symbol Interference. Eye diagram. Nyquist filters. Raised cosine filters.
7	Detecting digital signals in noise: Optimal digital baseband receiver. Binary channel with white Gaussian noise. Optimal receiver. Matched filter and correlator. Computation of error probability.
8	Bandpass digital transmission: linear modulations. BPSK, ASK, QPSK, M-PSK and M-QAM. Channel effects. Differential modulations: DBPSK.
9	Bandpass digital transmission: nonlinear modulations. M-FSK. Spectral efficiency and power efficiency. Comparison between digital modulation techniques.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Final exam at the end of the four-month period. Minimum score 3.50 over 10 needed.	Written exam	Yes	Yes	60,00
Laboratory works about analog and digital communications. Attendance to laboratory works is compulsory. Written test after each laboratory work.	Laboratory evaluation	No	No	20,00
Two Modular Examinations distributed along the four-month period.	Written exam	No	No	20,00
TOTAL				100,00

Observations

Laboratory works attendance is compulsory. The final course grade is calculated by the following expression:
Final score = max [(60 FE + 20 LP + 20 ME) / 100, (60 FE + 20 LP) / 80]
where:
FE = Final Examination grade; LP = Laboratory Works grade; ME = Modular Examination grades

Observations for part-time students

Assessment method for partial time students is the same method explained above.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

S. Haykin, Communications Systems, 3ª edición, John Wiley & Sons, Inc. (1994)

B. Sklar, Digital Communications, 2ª edición, Prentice Hall (2001)

Apuntes de la asignatura