UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

ANALOG COMMUNICATIONS

Enrollment year	2019/2020
Academic year	2020/2021
Regulations	DM270
Academic discipline	ING-INF/03 (TELECOMMUNICATIONS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRONIC AND COMPUTER ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	2nd semester (08/03/2021 - 14/06/2021)
ECTS	9
Lesson hours	86 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	GAMBA PAOLO ETTORE (titolare) - 8 ECTS SAVAZZI PIETRO - 1 ECTS
Prerequisites	Knowledge acquired in previous courses in mathematics and circuit theory.
Learning outcomes	Knowledge of the frequency representation of a deterministic signal. Understanding the concept of noise as a stochastic process. Knowledge of the simplest techniques for transmitting information. Ability to analyze deterministic signals and calculate fundamental properties (spectrum, bandwidth, power/energy).
Course contents	Deterministic signals in the frequency domain Fourier series. Fourier series in exponential form. Response of linear systems and properties of transfer functions. Power and energy signals. Power spectral density and energy. The Fourier transform. The convolution theorem. Parseval's theorem. Correlation between waveforms. Auto correlation. Power and

	cross correlation. Periodic autocorrelation functions. Random variables and processes Concept of probability, independent events, random variables. Cumulative probability distribution, probability density function. Noise as a stochastic process. Stationary processes. Ergodic processes. Amplitude modulation? Baseband signal and carrier. Frequency translation. Detection of the baseband signal. Amplitude modulation (DSB, DSB-SC SSB, VSB). Spectrum of amplitude modulated signals. Modulators. Detectors. Multiplexing. Frequency modulation Frequency and phase of a sinusoidal signal. The FM signal. Spectrum of an FM signal with sinusoidal modulation. Wideband and narrowband FM signals. Carson approximation of the bandwidth of a FM signal. FM modulators and demodulators. Digital communication systems Real and actual sampling and PAM signals., Quantization and PCM signals. Representation of arbitrary digital signals using symbol constellations. Baseband and radio frequency digital signals, and their spectra. Performance of communication systems? in the presence of noise Signal to Noise Ratio. Comparison between AM and FM systems. Probability of error in digital communications. Bit Error Rate for arbitrary digital modulations.
Teaching methods	Lectures (hours/year in lecture theatre): 50 Practical classes (hours/year in lecture theatre): 30 Workshops (hours/year in the lab): 0 The lectures are given using slides, providing additional explanations and examples at the backboard. The practical classes consist in the solution of past written tests (or portions of them), duly simplified according to the level of the students during the course.
Reccomended or required readings	S. Haykin, M. Moher. Introduzione alle Telecomunicazioni Analogiche e Digitali. Casa Editrice Ambrosiana.
Assessment methods	The exam starts with a written test including two problems and one open question about all the topics of the course. Additionally, a mandatory oral examination will sum up to the final result. Only a score higher than 11/30 in the written test grants the access to the oral examination. The total score is a weighted average of the results of the written and oral tests. The minimum score to pass the exam is 18, while the maximum is 30 cum laude.
Further information	The exam starts with a written test including two problems and one open question about all the topics of the course. Additionally, a

	mandatory oral examination will sum up to the final result. Only a score higher than 11/30 in the written test grants the access to the oral examination. The total score is a weighted average of the results of the written and oral tests. The minimum score to pass the exam is 18, while the maximum is 30 cum laude.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile