

COURSE SHEET

Course name	Analysis and processing of telecommunications signals
Acronym	APST

Level:

1. (BSc)	2. (MSc)
X	

Field of study:

Electronics and Telecommunications	Control Engineering and Robotics	Informatics
X		

Person responsible for the course:

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List of Topics - Lecture

No	Topic	Level of					No of hours
		knowledge			skills		
		A	B	C	D	E	
1.	The role of signal processing in telecommunications. Overview of solutions used in a physical layer of contemporary networks.	X					1
2.	Contemporary digital receiver of data transmission signal.		X				1
3.	Analytic signal and Hilbert filter.			X			1
4.	Quadrature sampling and undersampling of real-valued signals.			X			1
5.	Sinusoidal signal generation. DDS and CFB – implementation and purity criteria for generated signal.			X			1
6.	Single-parameter digital modulators. Typical constellations of symbols. Fundamental structure of digital modulator.			X			1
7.	Phase keying modulation – FSK.			X			1
8.	MSK and GMSK modulations.			X			1
9.	Differential modulators and demodulators (DBPSK and DQPSK).			X			1
10.	Offset modulators and demodulators (OQPSK and pi/4-QPSK)			X			1
11.	Symbol shaping and matched filtering.			X			1
12.	Shaping/interpolation and matched/decimation filters.			X			1
13.	Modems with multiple constellation points - QAM			X			1
14.	Carrier recovery, automatic frequency and phase synchronization.		X				1
15.	Digital phase locking loop DPLL.			X			1
16.	Fundamental symbol timing recovery (STR) algorithms – systems with closed loop.			X			1
17.	Symbol timing signal extraction and its application to symbol sampling in open loop systems.			X			1
18.	Automatic gain correction (AGC) in digital transmission.			X			1
19.	Digital filters in signal analysis.			X			1
20.	Specification, computation and evaluation of frequency responses of digital filters.			X			1
21.	DFT in frequency analysis. Analysis of periodic signals. Relations between DTFT and DFT. Goertzel algorithm.			X			1
22.	Spectral analysis of signals; spectral power density estimation.			X			1
23.	Time-frequency analysis – spectrograph.			X			1
24.	Signal analysis – exemplary implementations in MATLAB.			X			1
25.	Presentation of analysis results – exemplary implementations in MATLAB.			X			1
26.	Architecture of digital signal processors. Digital signal processors commands dedicated to signal processing.		X				1

27.	Limitations of fixed-point arithmetic – effects of rounding and overflow.		X				1
28.	Efficient implementation of nonlinear functions for digital signal processors.		X				1
29.	Problems of digital filter implementation on fixed-point arithmetic processors.			X			1
30.	Robust structures for IIR filter.			X			1
Total							<u>30</u>

List of Topics - Lab

No	Topic	Level of					No of hours
		knowledge			skills		
		A	B	C	D	E	
1.	Introduction.						1
2.	Frequency analysis and time-frequency analysis of data transmission signals.					X	2
3.	Practical limitations of A/D and D/A conversion.					X	2
4.	Sampling of band-limited signals: real-valued undersampling and quadrature sampling.				X		2
5.	Transmitting and receiving filters. Intersymbol interferences.				X		2
6.	Selected techniques of analog channel frequency response measurement.				X		2
7.	Performance evaluation of digital transmission based on observation of demodulated signal.				X		2
8.	Carrier and symbol timing recovery errors in digital receiver.				X		2
Total							<u>15</u>