Study program: Multimedia communication technologies

Course title: Processing of multimedia signals

Professor/assistant: Zoran N. Milivojević

Type of course: elective

ECTS credits: 8

Pre-requisites: none

Aims of the course:

This course provides students with the multimedia signals, specifically, audio, speech and image, in the time and frequency domain. Application of the multimedia signal processing software package.

Learning outcomes:

The student will be trained for independent analysis of multimedia signals using analytical methods in time and frequency domain. The student will be qualified for designing and applying filters and algorithms for repairing the quality of the multimedia signal. The student will be qualified to apply the Matlab software package for analyzing multimedia signals.

Syllabus

Theoretical part

Electrical signals and systems. Signal processing. Time-domain. Frequency-domain.

Periodical and non-periodical signal transformation. Fourier transform. Fourier transform of discrete signal. FFT. 2-D transform. Spectrogram. Z-transform. Unit circle. Transfer function.

Digital filters. Linear time invariant filters (LTI). Non-recursive filters (FIR). Recursive filters (IIR). Window function. Low-pass filters. High-pass filters. Band-pass filters. Band-stop filters.

Ear anatomy. Cochlea. Psychoacoustic. Audio masking. Musical signals. Musical signs and symbols. Intervals. Fundamental frequency. Consonant and dissonant intervals. Musical instruments.

Speech production. Vocal tract. Speech signal modelling. Vowels and consonants. Fundamental frequency of speech signal. Estimation of fundamental frequency. Speech coding. Speech recognition.

Human visual system. Luminance and chrominance perception. Black and white image. Color image. Image processing. Image quality improve. Image transform. Image compression.

Practical part

Practical exercises follow theoretical lessons. Computer -aided exercises. Projects design.

Literature

1. Бојковић, З., Мартиновић, D., *Основе мултимедијалних технологија*, Висока школа електротехнике и рачунарства, Београд, 2011.

2. Станковић, С., Оровић, И., Сејдић, Е., *Multimedia Signals and Systems*, University of Pittsburgh, Swanson School of Engineering, Department of Electrical and Computer Engineering.

3. Vaseghi, S., *Multimedia Signal Processing – Theory and Applications in Speech, Music and Communications*, Wiley, 2007.

Number of active classes			Other forms of teaching:
Lectures: 45	Practical classes: 30	Research work:	

Teaching methods

Combination of interactive approach with practical problem solving.

Grading system (maximum 100 points), **grading scale** from 5 to 10: below 51 points grade 5, grade 6 from 51-60 points, grade 7 from 61-70 points, grade 8 from 71-80 points, grade 9 from 81-90 points, grade 10 from 91-100 points.

Pre-exam obligations	**points**	**Final exam**	**points**
activity during theoretical lectures	**20**	written exam	
practical training	**40**	oral exam	**30**
colloquium(s)/seminar papers	**10**		
Sum	**70**	**Sum**	**30**