



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fundamentals of multimedia

### Course

Field of study

Electronics and Telecommunications

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

I/I

Profile of study

general academic

Course offered in

english

Requirements

elective

### Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

0

Projects/seminars

-/-

### Number of credit points

5

### Lecturers

Responsible for the course/lecturer:

dr inż. Tomasz Grajek,

tomasz.grajek@put.poznan.pl

Responsible for the course/lecturer:

### Prerequisites

Has a structured and theoretically underpinned knowledge on one-dimensional signal theory which is necessary for understanding the representations of signals in time domain and frequency domain.

Has a structured and theoretically underpinned knowledge on basic methods of digital signal processing.

Can solve typical problems related to signal analysis in time and frequency domains.

Is able to obtain information from literature and databases as well as other sources in English; is able to integrate obtained information, interpret it, draw conclusions and justify opinions.

Knows the limits of his own knowledge and abilities, understands the need for ongoing education.

### Course objective

The goal is to teach the fundamentals of multimedia. The course is particularly advisable for students who did not attend multimedia course before, or the course was limited.

### Course-related learning outcomes

Knowledge



Have a structured and mathematically underpinned knowledge on acquisition, human perception, quality assessment, processing, digital representations, compression and transmission of multimedia data for use in multimedia systems.

#### Skills

Understanding of the technical conditions for transmission, storage and presentation of multimedia data. Can formulate appropriate basic requirements for technical systems implementing multimedia services.

#### Social competences

Knowing the limits of own knowledge and skills, understanding the need for ongoing education. Have awareness of the necessity of professional approach to solving technical problems and take responsibility for the proposed technical solutions.

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired in the lecture is verified on the written and / or oral exam. The exam consists of several open questions with different levels of difficulty with the assigned number of points. The questions relate to the content presented during the lectures. Credit threshold: 50% of points.

Laboratory - the knowledge acquired on laboratories is verified by a series of tests written during classes and/or through the reports of tasks performed during the laboratories. Each of the tests contains several open questions about tasks performed during previous laboratories. Up to three tests are done during the course. Credit threshold: 50% of points.

#### Programme content

Lecture and laboratory topics:

Multimedia and multimedia communication systems - introduction, basic terminology. Continuous vs discrete-time systems. Multimedia data representations. Filters, filterbanks and transforms. Lossless and lossy data compression. Rate-distortion curves.

Theoretic fundamentals of 2D signal processing: two-dimensional signals, spatial frequency.

Colors and their perception. Color components. Additive and subtractive color mixing.

Still images and video: perception, representations. Image sampling, sample representation. Image data formats.

Lossless and lossy compression of images. Subband and transform coding of images. Digital image compression standards.

Digital video compression: techniques and standards: Video data formats. Hybrid video compression - basic tools. Motion estimation and compensation. Intra and interframe coding. Video compression standards.



Sound: properties, perception, processing. Basic representations of audio signals. Speech: properties, representations, data compression techniques: ADPCM and LPC-based coding. ITU-T compression standards for speech.

Audio (music): representations, data compression: audio spectra, DFT and MDCT transforms. Subband and transform coding principles. Perceptual coding principles. MPEG standards for audio coding.

### Teaching methods

Lecture - multimedia presentation, illustrated with examples on the board. Slides available to students after the lecture.

Laboratory - computer classes using software that allows advanced simulation and analysis of audiovisual signals. Solving problems given by the teacher and / or specified in the laboratory instruction. Interpretation of the received solution and drawing conclusions.

### Bibliography

#### Basic

V. Madiseti (ed), Video, Speech, and Audio Signal Processing and Associated Standards (The Digital Signal Processing Handbook, Second Edition), CRC Press, 2009.

J. Ohm, Multimedia communication technology , Springer, 2004.

M. Bosi, R.G.Goldberg, Introduction to Digital Audio Coding and Standards, Kluwer, 2003

A.K.Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989

J.Watkinson, The MPEG Handbook: MPEG-1, MPEG-2, MPEG-4, Focal Press, 2004

#### Additional

D. Karwowski, T. Grajek, et al., 20 Years of Progress in Video Compression - from MPEG-1 to MPEG-H HEVC. General View on the Path of Video Coding Development, Image Processing and Communications Challenges 8, Springer International, 2016, pp. 3-15

J. Watkinson, The Art of Digital Audio, Focal Press, 2001.

N.S.Jayant, P.Noll, Digital Coding of Waveforms, Prentice Hall, 1984

L.R.Rabiner, R.W.Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978



### Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) <sup>1</sup>	55	2,0

<sup>1</sup> delete or add other activities as appropriate