Last update: 06-05-2019

230089 - IPAV - Introduction to Audiovisual Processing

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2019

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: FRANCISCO JAVIER HERNANDO PERICAS

Others: Monte Moreno, Enric
Muñoz Medina, Olga
Nogueiras Rodriguez, Albino
Oliveras Verges, Albert
Pascual Iserte, Antonio
Rodríguez Fonollosa, José Adrián
Ruiz Hidalgo, Javier
Villares Piera, Nemesio Javier

Prior skills

See "requisites" section

Requirements

Probability and Statistics (PIE) - prerequisite
Signals and Systems (SSIS) - prerequisite

Degree competences to which the subject contributes

Generical:

3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

Teaching methodology

lectures
laboratory classes
Individual (learning)
Partial exam
Final Exam
Lab

Learning objectives of the subject

The development of intuition of the behavior of audiovisual systems and the characteristics of signals, with special emphasis on audiovisual signals.

Last update: 06-05-2019

230089 - IPAV - Introduction to Audiovisual Processing

Study load

Total learning time: 150h	Hours large group:	52h	34.67%
	Hours small group:	13h	8.67%
	Self study:	85h	56.67%

Last update: 06-05-2019

230089 - IPAV - Introduction to Audiovisual Processing

Content

1. Human Perceptive System

Learning time: 7h
Theory classes: 4h
Self study : 3h

Description:
- User's importance
- Human Auditory System
- Human Visual System

Related activities:
Practice I. Signal analysis with DFT. Application to speech signals

2. The signal in the time and spatial domains

Learning time: 23h
Theory classes: 8h
Self study : 15h

Description:
- Sequences x[n] and x[m,n]
- Quantization
- 1D: Non uniform quantization. Dynamic margin control
- 2D: Grey transformations. Histogram. Histogram equalization

Related activities:
Practice II. Quantization of audio-visual signals
Practice III. Image histrogram and 2D-DFT

3. The signal in the frequency domain

Learning time: 23h
Theory classes: 8h
Self study : 15h

Description:
- Short-term 1D Fourier Transform
  - Spectrogram. Time-frequency analysis
- 2D Fourier Transform
  - 2D-DFT
  - Importance of the phase

Related activities:
Practice III. Image histogram and 2D-DFT

230089 - IPAV - Introduction to Audiovisual Processing

4. Sampling, decimation and interpolation

Learning time: 23h

Theory classes: 8h
Self study : 15h

Description:
- 2D Sampling
- Decimation and interpolation
- Change of samplig rate

Related activities:
Practice IV: Decimation and interpolation of 1D signals
Practice V: Decimation, interpolation and filtering of 2D signals

5. 2D convolution and correlation

Learning time: 30h

Theory classes: 10h
Self study : 20h

Description:
- 2D convolution.
- Correlation (1D). Periodicity estimation.
- Correlation (2D). Pattern detection.

Related activities:
Practice IV. Filtering and equalization

6. Linear time-invariant systems and filtering

Learning time: 23h

Theory classes: 8h
Self study : 15h

Description:
- Z transform
- Systems defined by means of finite difference equations
- Filtering. Filter specification, linear phase, design of filter with Matlab, equalization.

230089 - IPAV - Introduction to Audiovisual Processing

7. Audio-visual signal format	Learning time: 7h Theory classes: 4h Self study : 3h

Description:
- Information compression
- Audio signal formats
- Image signal formats. Colour respresentation

Related activities:
Practice II. Quantization of audio-visual signals
Practice III. Image histogram and 2D-DFT

Last update: 06-05-2019

230089 - IPAV - Introduction to Audiovisual Processing

Planning of activities

Partial controls	Hours: 4h Laboratory classes: 2h Theory classes: 2h
Practice I. Signal analysis with DFT. Application to speech signals	Hours: 2h Laboratory classes: 2h
Practice II. Quantization of audio-visual signals	Hours: 2h Laboratory classes: 2h
Practice III. Image histogram and 2D-DFT	Hours: 2h Laboratory classes: 2h
Practice IV. Decimation and interpolation of 1D signals	Hours: 2h Laboratory classes: 2h
Practice V. Decimation, interpolation and filtering of 2D signals	Hours: 2h Laboratory classes: 2h
Final exam	Hours: 3h Theory classes: 3h

Qualification system

Partial exam (CNT): 30%
Laboratory (LAB): 20%
Final exam (FNL): 50%

Formula: max (0.30*CNT + 0.20*LAB + 0.50*FNL , 0.20*LAB + 0.80*FNL)

Last update: 06-05-2019

230089 - IPAV - Introduction to Audiovisual Processing

Bibliography

Basic:

Mariño, J.B.; Vallverdú, F.; Rodríguez, J.A.; Moreno, A. Tratamiento digital de la señal: una introducción experimental [on line]. 3a ed. Barcelona: Edicions UPC, 1999 [Consultation: 19/02/2015]. Available on: <http://hdl.handle.net/2099.3/36344>. ISBN 8483012928.

Complementary:

Oppenheim, A.V.; Schafer, R.W. Discrete-time signal processing. 3rd ed. Upper Saddle River: Prentice Hall, 2010. ISBN 9780131988422.

Gonzalez, R.C.; Woods, R.E. Digital image processing. 3rd ed. Harlow: Pearson Prentice Hall, 2008. ISBN 9780131687288.