Course guides
230089 - IPAV - Introduction to Audiovisual Processing

Last modified: 29/04/2020

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

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

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: 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.

STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	52,0	34.67
Hours small group	13,0	8.67

Total learning time: 150 h

CONTENTS

1. Human Perceptive System

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

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

Full-or-part-time: 7h
Theory classes: 4h
Self study : 3h

2. The signal in the time and spatial domains

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

Full-or-part-time: 23h
Theory classes: 8h
Self study : 15h

3. The signal in the frequency domain

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

Full-or-part-time: 23h
Theory classes: 8h
Self study : 15h

4. Sampling, decimation and interpolation

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

Full-or-part-time: 23h
Theory classes: 8h
Self study : 15h

5. 2D convolution and correlation

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

Related activities:
Practice IV. Filtering and equalization

Full-or-part-time: 30h
Theory classes: 10h
Self study : 20h

6. Linear time-invariant systems and filtering

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

Full-or-part-time: 23h
Theory classes: 8h
Self study : 15h

7. Audio-visual signal format

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

Full-or-part-time: 7h
Theory classes: 4h
Self study : 3h

ACTIVITIES

Partial controls

Full-or-part-time: 4h
Theory classes: 2h
Laboratory classes: 2h

Practice I. Signal analysis with DFT. Application to speech signals

Full-or-part-time: 2h
Laboratory classes: 2h

Practice II. Quantization of audio-visual signals

Full-or-part-time: 2h
Laboratory classes: 2h

Practice III. Image histogram and 2D-DFT

Full-or-part-time: 2h
Laboratory classes: 2h

Practice IV. Decimation and interpolation of 1D signals

Full-or-part-time: 2h
Laboratory classes: 2h

Practice V. Decimation, interpolation and filtering of 2D signals

Full-or-part-time: 2h
Laboratory classes: 2h

Final exam

Full-or-part-time: 3h
Theory classes: 3h

GRADING 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)

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 [on line]. 4th ed.; global ed. New York: Pearson, 2018 [Consultation: 03/07/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=5573669. ISBN 1292223049.