

804249 - ADIG - Digital Audio

Coordinating unit:	804 - CITM - Image Processing and Multimedia Technology Centre
Teaching unit:	804 - CITM - Image Processing and Multimedia Technology Centre
Academic year:	2019
Degree:	BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory) BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits:	6
Teaching languages:	Catalan

Teaching staff

Coordinator:	Tarres Ruiz, Francisco
Others:	Font Moragas, David

Degree competences to which the subject contributes

Specific:

CEVJ 6. (ENG) Analitzar, decidir i aplicar tècniques de programació gràfica, física, intel·ligència artificial, interacció, realitat augmentada i xarxes a un projecte de videojoc.

CEVJ 7. (ENG) Dominar el gran abanico de herramientas profesionales del sector para la elaboración de contenidos digitales de todo tipo.

Generical:

CGFC1VJ. (ENG) Dissenyar, desenvolupar, seleccionar i avaluar aplicacions i sistemes informàtics d'o per a videojocs, assegurant la seva fiabilitat, seguretat i qualitat, d'acord amb principis ètics i a la legislació i normativa vigent.

CGFB4VJ. (ENG) Interpretar los fundamentos del uso y programación de los computadores, los sistemas operativos, las bases de datos y, en general, los programas informáticos con aplicación en ingeniería.

CGFC4VJ. (ENG) Aplicar los procedimientos algorítmicos básicos de las tecnologías informáticas para diseñar soluciones a problemas, analizando la idoneidad y complejidad de los algoritmos propuestos.

Transversal:

06 URI N3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

06 URI N2. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

804249 - ADIG - Digital Audio

Teaching methodology

The lectures can be of three types in three bands of activity:

1. Realization, exposure, advocacy and discussion of exercises during the previous session and resolution of doubts about them.
2. Activity exhibition by the teacher headed to introduce new knowledge (subjects).
3. Explanation of the next financial year and supplementary materials.

These activities are modulated according to the complexity of the exercises and relevant content.

Learning objectives of the subject

Learn the basics of physics of sound

Understand the principles of representation of audio signals in digital systems

Learn the basic tools for digital signal processing, filtering and generation effects

Understand the tools of production and editing of audio signals and musical games

Learn digital technologies and computer music

Learn compression systems and types of digital audio files

Understand audio engines

Understand interactive music technology or dynamic

Knowledge of speaker systems and multichannel sound systems

Understand the technology of recording and editing audio signals

Study load

Total learning time: 150h	Hours large group:	18h	12.00%
	Hours medium group:	32h	21.33%
	Hours small group:	0h	0.00%
	Guided activities:	10h	6.67%
	Self study:	90h	60.00%

804249 - ADIG - Digital Audio

Content

<p>Sound Physics Fundamentals</p>	<p>Learning time: 25h Theory classes: 9h Self study : 16h</p>
<p>Description: Basic principles of sound generation and musical signals. Time and frequency representation. representation</p> <p>Related activities: practice 1</p> <p>Specific objectives: Production of sound. Type of waves. Characterization of the waves. Propagation of pressure waves. Representations of the waves in the time and frequency domain. The concept of resonance. Examples resonance strings and wind instruments. Interpretation of the audio signal in the time domain and frequency. Basic parameters of the digital audio signal: sampling rate and quantification. The PCM signal. The concept of dynamic range. Representation in frequency. Evolution of the spectrum over time: Short-Time Fourier Transform and spectrogram. Applications: Fingerprinting of music signals - Shazam Measurement of acoustic power. Concepts sound intensity, sound pressure level, basic units and decibels.</p>	
<p>Psychoacoustics of sound perception</p>	<p>Learning time: 11h Practical classes: 4h Self study : 7h</p>
<p>Description: Description and perception of human hearing perception</p> <p>Specific objectives: The concept of psychoacoustics. Parts of the hearing. Basilar membrane and low-level hearing. Perception of the direction of sounds. Perception of Pitch in and inharmonic overtones. Resolution and sensitivity pitch. Just noticeable Pitch Differences. Shepard illusion and perception intervals. MEL scale. Range Phones. Range Sons. Curves Fletcher-Mun. Masking frequency. Masking sequentially. Critical bands.</p>	

804249 - ADIG - Digital Audio

<p>Representation and processing of digital audio signals</p>	<p>Learning time: 19h Practical classes: 6h Guided activities: 3h Self study : 10h</p>
<p>Description: Principles of sampling and quantification of signals, filtering and effects</p> <p>Related activities: Practice 2</p> <p>Specific objectives: Digital representation of the audio signal in PCM. Digital filters. Concept and types of filters. Stability. Low pass filters, band pass and high passes. Concatenation filters. Equalizers. Audio effects: Effects filtering, delay effects, modulation effects, distortion effects. 3D representation of sounds. MPEG Audio-H 3D. Audio 3D models representation. Auralització. Audio objects. Metadata. Vector Base Amplitude Panning. Higher Order Ambisonics.</p>	
<p>Principles of information representation and data compression</p>	<p>Learning time: 20h Practical classes: 6h Guided activities: 2h Self study : 12h</p>
<p>Description: We present the principles of information theory and key technologies for data compression standards and formats used in digital audio</p> <p>Related activities: Practice 3</p> <p>Specific objectives: Introduction to information theory, Shannon. Measuring the Information. Entropia. Variable length codes: Shannon-Fano, Huffman. Golomb-Rice. Arithmetic codes. Application coding lossless audio: FLAC Standard audio coding loss. MPEG-1 Layer I, II and III, MPEG-2 and MPEG-4 AAC. The most significant container formats</p>	

804249 - ADIG - Digital Audio

<p>Game Design Document i Audio Petitions</p>	<p>Learning time: 10h Practical classes: 2h Guided activities: 2h Self study : 6h</p>
<p>Description: Game Design Document i Audio Petitions</p> <p>Related activities: Practice 4</p> <p>Specific objectives: Game Design Document i Audio Petitions</p>	
<p>Audio Systems Evolution</p>	<p>Learning time: 4h Practical classes: 2h Guided activities: 2h</p>
<p>Description: Introduction to digital audio and review of the whole history of digital audio applied to video games</p> <p>Specific objectives: Familiarization with the different hardware and software techniques that have been featured in history to situate themselves with the current state of technology.</p>	
<p>Practical aspects on digital audio</p>	<p>Learning time: 10h Theory classes: 6h Guided activities: 4h</p>
<p>Description: practical digitalization, coding and audio formats</p> <p>Related activities: Practice 6</p> <p>Specific objectives: Discussion of practical aspects on the sampling and coding formats</p>	

804249 - ADIG - Digital Audio

Game Audio Design	Learning time: 10h Guided activities: 4h Self study : 6h
<p>Description: Description of the structure and characteristics of the documentation necessary for the audio part of the Game Design Document and the communication with external audio equipment.</p> <p>Related activities: practice 1</p> <p>Specific objectives: Familiarization with the different hardware and software techniques that have been featured in history to situate themselves with the current state of technology.</p>	
Network resoruces	Learning time: 6h Guided activities: 2h Self study : 4h
<p>Description: Concepts on the different types of licenses for the use of material, free or copyrighted On-line resources to find audio and music samples to use in our projects Creative Commons</p> <p>Specific objectives: Know where to get audio content for projects and the conditions of different types of licenses</p>	

804249 - ADIG - Digital Audio

<p>Waveform Edition</p>	<p>Learning time: 16h Guided activities: 6h Self study : 10h</p>
<p>Description: Theory and practices with Audacity of all theoretical concepts</p> <p>Related activities: Practice 2</p> <p>Specific objectives: Familiarization with Audacity as a wave editor example Editing in freeware temporal domain Basic edition (copy, cut, paste) Channel operations (separate and link channels, mute, phase inversion) Tone, rhythm and speed playback operations Dynamic operations (compression, expansion, limitation, ducking) Generation of basic signals Fairies and envelopes Reverberations and echoes Equalization, step filters, noise-gates, reduction of noise in 2 steps Frequency analysis through FFT</p>	
<p>Recording</p>	<p>Learning time: 9h Practical classes: 7h Guided activities: 1h Self study : 1h</p>
<p>Description: Description of the basic material of a recording studio: Anaecoica camera, types of cables, microphones, mixers, audio adapters.</p> <p>Related activities: Practice 3</p> <p>Specific objectives: Learn the basic notions of recording in study and experiment creating and recording realistic and acoustic sounds.</p>	

804249 - ADIG - Digital Audio

Audio Motors	Learning time: 9h Practical classes: 7h Guided activities: 1h Self study : 1h
<p>Description: Theory on Advanced Audio Motors and Audio Design Practices with Wwise</p> <p>Related activities: Practica 4</p> <p>Specific objectives: General concepts shared by all advanced audio engines Specific exercises with Wwise, level equivalent to the Wwise 101 certification: Integration of a sound with Wwise Design sound panorama Game syncs 2D and 3D spatialization Flow of the audio signal to the motor Mix Optimization</p>	

804249 - ADIG - Digital Audio

Planning of activities

name english	Hours: 1h Laboratory classes: 1h
Description: Representation of waveforms. Identifying the frequency. Analysis of spectrograms	
Practice 2	Hours: 1h Laboratory classes: 1h
Description: Efectes i Filtratge amb Audacity	
Pràctice 3	Hours: 1h Laboratory classes: 1h
Description: Compression and formats comparison	
Practice 4	Hours: 1h Laboratory classes: 1h
Description: Audacity, Nyquist	
Practice 5	Hours: 1h Laboratory classes: 1h
Description: Elaboració del GDD tècnic d'àudio	
Practice 6a and 6b	Hours: 2h Laboratory classes: 2h
Description: Aplicació en Unity del motors i sistemes interactius	
Practice 7	Hours: 1h Laboratory classes: 1h

804249 - ADIG - Digital Audio

practice 8	Hours: 1h Laboratory classes: 1h
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Qualification system

Practical Exercises (20%). Practice exercises, problems and testing software.

Exams. There will be two partial exams and final. Every partial exams have a weight of 20% and the final exam has a weight of 30%.

Participation and attitude is (10%)

The evaluation of student participation / training activities in the field, and attitudes are evaluated by monitoring their interventions in class, questions, resolution of the issues raised in the autonomous exercises studies, etc. This assessment corresponds to 10% of the final grade.

Reassessment. Students who have not passed the subject by continuous assessment have the option to be submitted to the reassessment. This will be an examen of 2 hours and the qualification will substitute those of the partial exams and the final exam. To be eligible you need to have presented the process of continuous assessment.

Regulations for carrying out activities

Practices:

Practical exercises are started during class hours in the Gaza aimed at this and are completed outside class hours scheduled by following the instructions given in the corresponding document Full Practice and indications that such have taken effect in the corresponding class.

The resolution of practical exercises will be delivered using the Athena campus Space delivery enabled for each practice, following the instructions described in the document Leaf corresponding practice in the periods indicated. At the end of practice can deliver files required. The proper management of documentation provided is an aspect related skills acquired and is therefore subject to assessment.

The evaluation of the practice does not involve only the resolution of the exercises, but the defense is made of the results when the / the student will be required for this to the start of classes.

Any incident that it would end the practice within the period specified will be notified by mail by the corresponding professor Campus; after this communication will resolve any relevance or not because it will motivate the presentation of the year and established alternatives to complete the assessment if the reasons are justified. Also consider justified the reasons for not presenting exercises that teachers be communicated by the Head of Studies.

Exams:

The examinations will be conducted in the laboratory with computers through electronic document that the student must complete.

The questions and problems posed in examinations refer to both the theoretical content of the course and the exercises solved in different practices. Besides each question or problem consists in the contribution to the total grade points of the exam.

Reviews and / or complaints regarding examinations will be conducted solely on the dates and times established in the Academic Calendar.

804249 - ADIG - Digital Audio

Bibliography

Basic:

Pohlmann, Ken C. Principles of digital audio. 6th ed. New York: McGraw-Hill, cop. 2011. ISBN 9780071663465.

Gold, Bernard [et al.]. Speech and audio signal processing: processing and perception of speech and music. 2a ed. New York [etc.]: John Wiley & Sons, cop. 2011. ISBN 978-0470195369.

Blackstock, David T. Fundamentals of physical acoustics. New York [etc.]: John Wiley & Sons, cop. 2000. ISBN 97804711319795.