COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	8002001	**SEMESTER**	2
COURSE TITLE	Audio, Video and Broadcasting Technology		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS (ECTS)**
Lectures	4	9
E-learning	2	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific Area
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek and English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://audio.teipir.gr/sound_systems/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The objective of this course module is to provide the students with an introductory coverage of a wide scientific field, covering audio, video and broadcasting technologies.

Upon successful completion of this course, the students possess advanced knowledge, skills and competences that enable them to:

1. Know and explain orally and by drawing diagrams the notions of sound and sound waves; understand and explain the phenomena governing the acoustics of open areas and rooms and design key parameters of the acoustic behavior of the second ones.
2. Understand the principles of physiological acoustics and psychoacoustics, as well as

the perception of sound by humans.

3. Recognize and comprehend the role of the structural elements of electroacoustic recording and playback chain.
4. Use laboratory grade microphones and appropriate measuring instruments to conduct applied acoustics and electroacoustic systems' measurements.
5. Choose electroacoustic actuators and sensors, depending on the application, as well as design loudspeakers.
6. Design electroacoustic installations / public address systems.
7. Know basic concepts of image and video signals as well as the characteristics which are exploited for their processing.
8. Understand the basics of moving picture perception.
9. Recognize and comprehend the role and the impact of each digitization component on signal fidelity.
10. Be in position to conduct audio, image and video processing using appropriate software.
11. Design video and audio reception and distribution installations.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team work
- Production of free, creative and inductive thinking

(3) COURSE CONTENT

This module focuses on the presentation of advanced topics related to the technology and applications of sound and image in telecommunications, entertainment and art. It is organized in eight (8) teaching units.

UNIT 1	3 x 2h lectures	**Introduction – Audio and Image/Video** In this introductory unit, a presentation of the topics covered by the specific module is provided by relating audio and image/video with everyday applications in the fields of telecommunications, entertainment and art. Specifically, the background that is necessary, for an engineer dealing with sound and image, to build in order to cope with contemporary technological applications of the specific sector of

		electronics is discussed. Finally the targets, the content and organization of the module in teaching units are summarized.
UNIT 2	3 x 2h lectures	**Sound: production, propagation, measurable quantities.** In the second unit, the notion of sound as a mechanical spatiotemporal variation is introduced, while practical solution of wave equations for typical sound wave cases is performed. Moreover, topics concerning sound production (sound sources, source directivity), sound propagation in open areas (with emphasis on propagation in the atmosphere), as well as sound observables (measurable quantities) are studied. Finally, special topics on the study (with reference to available software tools) and legislation concerning acoustic noise in open areas are presented.
UNIT 3	3 x 2h lectures	**Room acoustics and introduction to physiological acoustics and psychoacoustics.** Sound propagation in small and large rooms is analyzed in unit 3 through the wave, geometrical and statistic study of sound field deployment. Characteristic quantities defining the quality of speech and music reproduction in closed areas (rooms) are defined in close relation to the human perception of sound (physiological acoustics/ psychoacoustics). Finally, software tools for room acoustics simulation are presented.
UNIT 4	4 x 2h lectures	**Electroacoustic systems** The fourth unit deals with the complete electroacoustic recording and playback chain, the analysis of its structural elements, the electroacoustic systems' measurements and the design of electroacoustic installations / public address systems. In more detail, after the presentation of the structural elements of the electroacoustic chain, the modeling, structure and operation of actuators (speakers) and sensors (microphones) is analyzed. Emphasis is placed on loudspeaker systems and electroacoustic measurements. Finally, the electronic elements of the reproduction chain are presented and examples of electroacoustic installations' / public address systems' designs are provided.
UNIT 5	3 x 2h lectures	**Basic concepts of images and video** In the fifth unit the concept of the three-dimensional image signal in terms of brightness and color space is introduced. A brief overview of the analog television technology with emphasis on synchronization features, analysis, interlaced image, color coding standards and television signal transmission standards is given. An analysis of the video signal characteristics such as correlation and the information content as well as details of the properties of the video signal perception, such as spatial and temporal masking concludes the unit.
UNIT 6	3 x 2h lectures	**Digitization and Digital Processing of Sound and Images** The sixth unit begins asserting the requirements that led to the use of digital technology in the area of audiovisual systems. After a brief reference to fundamental concepts of digital signals, the commonly used audio, image and video digitization standards are presented. Digital processing of audio and video signals in the time domain (eg averaging,

		contrast, luminosity) is introduced, followed by a presentation of the frequency domain analysis of signals, digital filters of finite and infinite impulse response and their use in sound and image processing.
UNIT 7	4 x 2h lectures	**Audio and Video Compression** In the seventh unit strategies for the compression of audio and video signals are introduced. The unit begins with prediction encoding, which refers to entropy coding and motion compensation, refers to transformations in the frequency domain (Fourier, DCT), and proceeds with emphasis on audio signals on perceptual coding (psychoacoustics, subband filters, implementation of cosine modulation filters). The section closes with a presentation of the MPEG1 and MPEG2 standards for audio and video signals and with a reference to the MPEG4 standard.
UNIT 8	3 x 2h lectures	**Audio and Video Digital Transmission** The eighth unit introduces transmission fundamentals such as channel characteristics, configuration, equalization and channel coding, and propagation model. The digital terrestrial video broadcasting (DVB-T) standard is analyzed, emphasizing on the modulation, coding and channel capacity. The single frequency terrestrial networks (SFN) technology, the assignment of channels / network planning, spectrum usage and adjacent interference (eg LTE) are highlighted. The unit concludes with references to mobile broadcasting standards (DVB-H) and transmission over IP networks.

In parallel with lecturing, practice and / or laboratory exercises are conducted either using real instruments or in a simulated environment, using analysis tools for audio, video and transmitted signals. A visit to a modern digital studio is organized in order to highlight the use of digital media for the production / processing / storage and transmission of audiovisual signals.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	• Face to face lectures in class • E-learning
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of electronic presentation with multimedia content in class, • Student support through the course webpage and the departmental e-learning platform (moodle), • Electronic communication of instructors and students, through the course webpage and by e-mail.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning*	Lectures, lab practice, homework assignments / project, study.

Activity	***Semester workload (hours)***
Lectures	52

activity are given as well as the hours of non-directed study according to the principles of the ECTS	E-learning	26
	Study lecture material	52
	Lab practice	26
	Report on lab practice	26
	Homework assignments or project and report	50
	Study and preparation for the exams	36
	Visit a company / production plant / institution	2
	Course Total	**270**
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	• Homework assignments / project report (30%) • Lab practice and class participation (20%) • Final written exam (50%)	

(5) ATTACHED BIBLIOGRAPHY

-Essential reading

1. SKARLATOS D., Applied Acoustics, Gotsis Publications ISBN-13: 978-9608771017 (in Greek).
2. BERANEK L., MELLOW T., Acoustics: Sound Fields and Transducers, Academic Press, 2012, ISBN-13: 978-0123914217.
3. KLEINER M., Electroacoustics, CRC Press, 2013, ISBN-13: 978-1439836187.
4. ALTON EVEREST F., POHLMANN K. C., Master Handbook of Acoustics, McGraw-Hill/TAB Electronics, 2009, ISBN-13: 978-0071603324
5. ROSSING T. D., DUNN F. (ed.): Springer Handbook of Acoustics, Springer; 2nd Edition 2014, ISBN-13: 978-1493907540.
6. COLLOMS M., High Performance Loudspeakers, 6th Ed., ISBN-13: 978-0470094303
7. BENOIT, H., Digital Television. Satellite, Cable, Terrestrial, IPTV, Mobile TV in the DVB Framework, Taylor & Francis Ltd
8. Digital Television, Elsevier Science & Technology, ISBN: 978-024-051-695-0
9. Digital Video Broadcasting, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, ISBN: 978-354-060-946-9
10. Lecture Notes provided by the instructors.

-Recommended Books

1. OLSON H. F., MASSA F., Applied Acoustics, Literary Licensing, LLC, 2013, ISBN-13: 978-1258824280.
2. BERANEK L., Acoustics, Amer Inst of Physics; Rev Sub edition, 1986, ISBN-13: 978-0883184943.
3. BALLOU G., Electroacoustic Devices: Microphones and Loudspeakers, Focal Press, 2009, ISBN-13: 978-0240812670.
4. ALTEN S. R., Recording and Producing Audio for Media, Cengage Learning PTR, 2011, ISBN-13: 978-1435460652
5. FAHY F. J., Foundations of Engineering Acoustics, Academic Press, 2000, ISBN-13: 978-0122476655.
6. DAVID EGAN M., Architectural Acoustics, J. Ross Publishing Classics, 2007, ISBN-13: 978-1932159783.
7. DVB The Family of International Standards for Digital Video Broadcasting, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, ISBN: 978-354-043-545-7
8. FISCHER, W., Digital Video and Audio Broadcasting Technology, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, ISBN: 978-354-076-357-4

-Relevant Journals:

1. Journal of the Audio Engineering Society
2. Applied Acoustics
3. Acta Acustica united with Acustica
4. Signal Processing
5. Digital Signal Processing
6. IEEE Transactions on Audio, Speech, and Language Processing
7. IEEE Transactions on Circuits and Systems for Video Technology