Testi del Syllabus

Docente	**FARINA ANGELO**	Matricola:	**004484**

Anno offerta:	**2013/2014**
Insegnamento:	**1005233 - APPLIED ACOUSTICS**
Corso di studio:	**5052 - COMMUNICATION ENGINEERING - INGEGNERIA DELLE TELECOMUNICAZIONI**
Anno regolamento:	**2013**
CFU:	**6**
Settore:	**ING-IND/11**
Tipo attività:	**C - Affine/Integrativa**
Partizione studenti:	**-**
Anno corso:	**1**
Periodo:	**Primo Semestre**
Sede:	**SEDE DIDATTICA DI PARMA**

Testi in italiano

Tipo testo	*Testo*
Lingua insegnamento	Inglese
Contenuti	English Only...
Testi di riferimento	English Only...
Obiettivi formativi	English Only...
Prerequisiti	English Only...
Metodi didattici	English Only...
Altre informazioni	English Only...
Modalità di verifica dell'apprendimento	English Only...
Programma esteso	English Only...

Testi in inglese

Tipo testo	*Testo*
Lingua insegnamento	English
Contenuti	The course of Applied Acoustics is an introductory course to a scientific and technological field undergoing a very rapid development, which offers great employment opportunities, and which involves disciplines apparently very different: architecture, structural engineering, physiology, psychology, statistics, physics, electronics, vibration mechanics, fluid dynamics, digital signal processing, telecommunications, measurements, hygiene of the workplace, music, musicology, virtual reality. Obviously in a course of 6 CFUs we can only provide the methodological basis of the topic, which must then be furthered in more in-depth courses, such as courses for Competent Technicians in Environmental Acoustics or Master Courses available at some Italian or foreign universities (for example Perugia , Naples , Florence , Rome), or even dedicated post-graduate degrees (these are usually abroad, but in Italy it must be evidenced the post-graduate (advanced) degree in Sound and Music Engineering of Politecnico di Milano, taught entirely in English, delivered at the Como Campus). Because of its multidisciplinary and transversal nature, the Course of Applied Acoustics is attended by students from various degree programs (almost all branches of Engineering, but also some Architecture students, and even the students of the course in Techniques of Prevention in the Environment and at the Workplace of the Faculty of Medicine, for which attendance is compulsory only to the first part of the course, with the exclusion of the final part dedicated to electroacoustic and musical applications).
Testi di riferimento	The official textbook for the Applied Acoustics course is: P. Fausti: Acustica in Edilizia , Rockwool Italy, Milan (2005) - in Italian - free download in PDF format, you can also request for a free hardcopy to Rockwool. Thanks Rockwool! The books RECOMMENDED (not required) for thorough preparation of the exam are: R. Spagnolo: Manuale di Acustica Applicata - Citta' Studi Editore, Milano (2001/2007). S. Cingolani, R. Spagnolo : Acustica Musicale ed Architettonica , Citta' Studi Editore, Milano (2004/2007) Thomas D. Rossing (ed.): Springer Handbook of Acoustics , Springer Science + Business Media, New York (2007). The support material for the course (Powerpoint presentations, Excel spreadsheets, WAV files, etc..) used during the lessons is available in the "Public" section of this website: http://pcfarina.eng.unipr.it/Public/Acoustics-Course/- It is recommended to download especially Powerpoint slides and Excel spreadsheets containing the exercises done in the classroom.
Obiettivi formativi	Knowledge and understanding: For students of all branches of engineering this is a key course, it is practically the only opportunity to see (or, rather, hear) the techniques learned in previous courses, in which the purely theoretical foundations of modern advanced mathematical methods are taught. When the "numbers" are transformed into sound, abstruse and difficult mathematical procedures (such as differentiation and integration) quickly become very clear and immediate, and the possibilities offered by sound editing systems on the PC, used extensively both during lectures and during laboratory exercises, make it possible to listen immediately

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	(usually in real time) to the "effects" of filters or other devices (compressors, gates, convolvers, denoising, etc.). Applying knowledge and understanding: The course is tailored to practical application, not to theoretical knowledge. Great emphasis is given to measurement methods, simple computations performed in Excel, and solution of practical problems. The student will learn to use the decibel scale, to “think in decibels”, and to perform the common math operations on dB values. Making judgments: In the whole course the judgment method is always based on human listening experience, not on numerical evaluation of the results. Acoustics is a perceptual science, and the final judgement can only by given by our hearing system, and not by means of “objective” numerical quantities. The students are consequently trained to listen and evaluate perceptually the most relevant acoustical effects, such as frequency-domain filtering, reverberation, echo, noise contamination, etc. Communication skills: The goal of this course is not, definitely, to train the students to perform as actors on stage. However, a significant part of the course is devoted to the study of the verbal and musical communication between performers and audience. In this part of the course, the students learn some tricks employed by professional actors and musicians, and become skilled in diagnosis and correction of communication problems due to room acoustics, improper design of the electro acoustical systems, or improper use of them by the performers and the audience.
Prerequisiti	None
Metodi didattici	Audio / Video recording of the lessons Starting from academic year 2010/2011, we are performing the audio / video recording of the lessons, in AVI format, thanks to the Open Source program CamStudio . The following links point to the list of these recordings for the A.Y. 2010/2011, 2011/2012 and 2012/2013 (the latter will be updated as the lessons are made) Progressive list of lessons carried out in the A.Y. 2010/2011 Progressive list of lessons carried out in the A.Y. 2011/2012 Progressive list of lessons carried out in the A.Y. 2012/2013 We recommend to use the Open Source program VLC Mediaplayer for viewing and listening to these AVI files on any platform (Win/Mac/Linux). We also recommend to first download the AVI files to a local directory, and then to open the files form the local HD employing VLC mediaplayer. Playing back directly in the browser, from the course web site, is NOT recommended... These audio / video recordings are made available primarily to facilitate learning for students with disabilities, but all students can view them comfortably, providing an opportunity to recover, at least partially, the lack of presence in the classroom during the lesson. It must be remembered, however, that attending the lessons in person is always the best way to assimilate the material. The various experiments in telematic didactics have shown, unfortunately, that the students get a level of preparation significantly lower than that obtainable with a good traditional "face to face" didactics. This occurs due to the "intelligibility barrier" caused by the recording/playback "filter". This effect on the intelligibility of speech will be explained during the course...
Altre informazioni	http://pcfarina.eng.unipr.it/Acoustics-2013.htm

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Modalità di verifica dell'apprendimento	The examination is formally oral, but it is usually required to first carry out some written exercises in numerical form (so the student is required to carry pen, paper, a calculator, as well as charts, tables, handouts, etc..). During the written exercises it is possible to employ all of the above material, including a computer, handouts and/or textbooks; instead, during the final oral "theoretical" question, the student is not allowed to consult his handouts or books, but he can still employ charts and tables - so it is advisable to keep them separate from the handouts. The written exercises typically provide a a score up to 25-30 points. At least 15 points are required for passing the written exercises and being admitted to the subsequent oral question, which is mandatory, and provides +/-10 points. At least one written exercise is always mandatory, even for students who take the examination during receiving hours (see later). Students of the Engineering courses are requested to use English both for the written and oral parts of the examination, even if they followed the course in previous years, when it was named "Acustica Applicata" and taught in Italian. Students of the degree in Techniques of Prevention, instead, are allowed to take the examination in Italian, if preferred, although of course they are also allowed to take it in English, at their choice. The oral examination is MANDATORY, even for students who passed the written exercise with maximum score. The evaluation of the oral examination, which usually is positive, in some cases can provide a NEGATIVE score, reducing the score obtained in the written part. And, independently from the sum of the scores, if the oral examination is judged unsatisfactory, the student can always be rejected. So the students must be trained to sustain a formal oral examination, and are discouraged to only train on exercises. For optimal training to the oral examinations, the students are encouraged to assist to the previous session of exams. For optimal training to the exercises, it is strongly discouraged to "study" the solution of already-solved problems. The only way to be trained correctly is by attempting to solve problems without any preliminary knowledge of the correct solution.
Programma esteso	Physical Acoustics: definition of quantities, propagation of mechanical disturbances in an elastic medium, sound pressure, particle velocity, speed of the sound wave. Equation of the acoustic waves. Energetical Acoustics: sound propagation seen as energy transport. Definition of Sound Intensity and Sound Energy Density. Active and Reactive energy, propagating and stationary sound fields. The Reactivity Ratio (or index). Psychoacoustics: physiological and psychological mechanisms of sound perception by humans. The logarithmic scale of decibels (dB), elementary operations on quantities expressed in dB. Frequency weighting curves, methods of Loudness assessment, frequency analysis with constant bandwidth, with constant percentage bandwidth (octaves, etc.), with critical bands (Bark). Masking phenomena in time and in frequency. Use of psychoacoustics for encoding "lossy" and "lossless" audio signals with large reduction of the "bitrate" required (MP3, WMA, AAC, FLAC, OGG, etc.). Sound Propagation: plane waves, spherical waves, standing waves. Reflection and absorption. Specular and diffuse reflection . Definition of sound absorption coeff. and scattering coeff. . Measurement techniques of the absorption coeff. and of the scattering coeff. . Propagation outdoors: ground absorption, effect of temperature and wind

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	gradients, of air absorption, of shielding or obstacles. The Maekawa and Kurze-Anderson formulas for the estimation of shielding attenuation. Propagation indoors: the phenomenon of multiple reflections, stationary reverberant field. Formulas of the reverberant field and of the semi-reverberant field. Transients when a sound source is switched on and off: sound tail, impulse response of a room, Schroeder backward integration. Definition of Reverberation Time T60 and other quantities related to the acoustic transients. Sabine formula for the estimation of the reverberation time. The apparent sound absorption coefficient, and its measurement by tests in reverberation room. Propagation through building structures: insulation of partitions, windows, tapping noise. Measurement techniques and Italian law. Digital Signal Processing applied to audio and acoustics. Sampling sound, artefacts due to limited amplitude resolution and temporal discretization. Basic algorithms for digital filtering (FIR, IIR): a complex theory made easy. The FFT algorithm, fast convolution, partitioned convolution. Effects of nonlinearities and of time variance. Advanced method for impulse response measurement (MLS, ESS, etc.). Sound quality in concert halls and opera houses. ISO3382 acoustical parameters. Temporal and spatial parameters. Use of directive microphones for assessing the spatial properties of the sound field inside a room. Speech intelligibility in classrooms, auditoria and over telecommunication systems. The signal-to-noise ratio, effect of reflections and reverb. The Speech Transmission Index (STI) and its measurement. Electroacoustics: transducers (microphones, loudspeakers). Devices for processing analog and digital acoustic signal: amplifiers, equalizers, reverbs, compressors, etc... Applications in the audio/electronics industry, in the field of telecommunications and broadcasting, in the recording industry and in entertainment industry automotive, in aviation and marine sectors. Techniques for numerical simulation of sound propagation: finite element models, boundary elements, ray tracing, beam tracing. Using simulation programs, with hands-on practice in the laboratory. Instrumentation and equipment for acoustical measurements: sound level meter, spectrum analyzer, impulse response measurement system. Virtual Instrumentation on PC, software for acoustical measurements, with practical exercises in the laboratory. Numerical processing of the acoustic signal: from general theory to practical applications on PCs. Auralization, virtual acoustics reality. Outline of modern applications in the entertainment industry, and future uses for "live" real time applications. "Plugins" for digital processing of acoustic effects; FIR and IIR filters, fast convolution, calculation of Inverse numerical filters, active cancellation of sound. The 4 modern methods for measuring absorption coefficients: ISO 354 (reverberation room), ISO 10534 (standing wave tube), the Intensimetric Method (Farina/Torelli), the Impulsive Method (EN 1793/5). lab sessions : measurement of impulse response and other major acoustic parameters employing Aurora, numerical simulation of the sound field inside a room by making use of two calculation programs (Ramsete, Comsol).