

NOISE AND ELECTROMAGNETIC POLLUTION 

A.A. 2020/2021

Denominazione insegnamento	NOISE AND ELECTROMAGNETIC POLLUTION	
Codice insegnamento	27000193	
Corso di Studio (CdS)	ENVIRONMENTAL AND TERRITORIAL SAFETY ENGINEERING	
Livello CdS	SECOND	
Codice CdS	0773	
Settore Scientifico Disciplinare (SSD)	ING-IND/11	
Crediti Formativi Universitari (CFU)	6	
Tipologia Attività Formativa (TAF)	A SCELTA DELLO STUDENTE	
Tipo attività formativa	SELECTIVE	
Anno di corso	2	
Periodo didattico	FIRST SEMESTER	
Docente responsabile	SABATO ADOLFO	
Altri docenti coinvolti	---	
Organizzazione didattica*	Ore Lezioni	38
	Ore Esercitazioni	12
	Ore Laboratorio	10
	Ore Studio individuale	102
Lingua di insegnamento	ITALIAN	
Propedeuticità	NONE	
Prerequisiti	<i>Excellent knowledge of the concepts of Mathematics; and Classical Physics.</i>	
Contenuti	<p>The teaching aims to make students learn the theoretical concepts and the basic physical quantities of Acoustics to acquire the knowledge necessary for the execution of the measurements of the acoustic quantities and of the characteristics of the sources.</p> <p>The concepts of psychoacoustics indispensable for the analysis of the effects of noise on men's health are illustrated during the lessons.</p> <p>The analysis of national and community legislation in the field of noise pollution provides the reference framework for the identification of the environmental acoustic measures that must be performed and the technical rules for the execution and interpretation of the measures.</p> <p>In the electromagnetic pollution sector, teaching aims to deepen the knowledge of the theoretical principles and fundamental physical quantities and to acquire the knowledge necessary to allow the execution of the measurements of the physical quantities involved and of the characteristics of the sources.</p> <p>The analysis of the national and community legislation of the sector provides the reference framework within which the assessments must be carried out.</p>	
Obiettivi formativi (in termini di risultati di apprendimento attesi)	The course aims to train professional competences capable of carrying out investigation and complex measures in Environmental Acoustics and Environmental electromagnetic pollution produced by non-ionizing sources.	
Programma	<p>Course topics:</p> <ol style="list-style-type: none"> <i>Physical Acoustics: definitions and fundamental physical quantities; sound waves.</i> <p>Introduction: description of propagation phenomena; fundamental acoustic quantities; sound energy density and sound intensity. Equation of wave propagation: plane, cylindrical and spherical waves. Interference and beats. Doppler effect. Phase velocity and group</p>	



	<p>velocity. Absorption, refraction and diffraction. Acoustic variables used for description of sound fields. Notes on sound propagation in confined spaces. Reverberation, reverberation time, insulation and sound absorption.</p> <p>2. <i>Measurements of acoustic quantities. Characteristics of sources.</i> Sound pressure levels, energy density, acoustic intensity. Complex sounds. Multiple sources. Sound field of an acoustic source. Levels evaluation in free sound field. Sources with directional characteristics. Outdoor sound propagation. Propagation in the far reverberant field. Excess attenuation due to environmental and other conditions (absorption, reflection, refraction, atmospheric agents, climatic conditions, ground characteristics). Attenuation by barriers.</p> <p>3. <i>Psycho acoustics.</i> Human hearing mechanism. Analysis of subjective characteristics of sound phenomenon: normal hearing chart; Fletcher-Munson's equal loudness contours; equal loudness contours according to ISOR266. Normalized relationship between loudness and loudness level. Complex sounds: loudness level evaluation using spectral analysis of noise: Stevens's method.</p> <p>4. <i>Field measurements. Equipment and techniques.</i> Sound pressure level meter: electrical weighting networks; time constants. Operation principles; free-field response and pressure response microphones. Condenser, piezoelectric and dynamic microphones. Spectral analyser. Ideal filters. Real filters: low-pass filter, high-pass filter; band-pass filter, band suppression filter. Sound sources. Stamping noise machine. Calibration systems.</p> <p>5. <i>National and Community legislation in the field of noise pollution</i> National regulatory framework and the changes due to European directives. Law 26.10.1995, n° 447 "Legge Quadro sull'inquinamento acustico". DM 16.3.1998 "Tecniche di rilevamento e di misurazione dell'inquinamento acustico". DM 31/10/1997 "Metodologia di misura del rumore aeroportuale ai fini del contenimento dell'inquinamento acustico negli aeroporti civili e negli aeroporti militari aperti al traffico civile"; DPCM 14/11/1997 "Determinazione dei valori limite delle sorgenti sonore in attuazione dell'art. 3, comma 1, lett. a), L. n° 447/1995."; DPCM 5/12/1997 "Determinazione dei requisiti acustici passivi delle sorgenti sonore interne e i requisiti acustici passivi degli edifici e dei loro componenti al fine di ridurre l'esposizione umana al rumore."; D.P.R. 18 novembre 1998, n° 459 "Regolamento recante norme di esecuzione dell'art. 11, L. 447/1995, in materia di inquinamento acustico derivante da traffico ferroviario". Legislazione derivata dalle Direttive comunitarie. Legislazione relativa alla tutela ambientale: Decreto Legislativo 19 agosto 2005, n° 194, "Attuazione della direttiva 2002/49/CE relativa alla determinazione e alla gestione del rumore ambientale." The legislation for workers protection: D. Lgs. 9 aprile 2008, n° 81 "Testo unico sulla salute e sicurezza sul lavoro".</p> <p>6. <i>Statistical analysis of signals</i> Basic concepts of statistics. Errors in measured values. Statistical treatment of random error. Continuous distributions: normal or Gaussian distribution. Statistical Noise Levels, Ln; probability distribution curves; cumulative distribution curves.</p> <p>7. <i>Measurements of environmental noise</i> Definition of basic parameters for executing measures. Technical rules</p>
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	<p>for measuring implementation. Rules for equipment use. Rules for equivalent continuous sound pressure levels measurement. Rules for determining impulsive events. Rules for the recognition of tonal components. Environmental monitoring. Measurement analysis. Criteria and indices for noise evaluation. Basic descriptors. Composite descriptors. Indices to determine effects of disturbance and damage. Day-night average sound level L_{dn}. Day-night sound level, L_{den}. Disturbance effects and effects of damage: specific effects; neuro endocrine and psychological effects; psychosomatic effects.</p> <p>8. <i>Environmental noise</i> Source of noise pollution. Road traffic: noise sources; experimental tests: data analysis. Forecasting models. Computation method of the European Community; comparison with experimental data. CRTN method. Railway traffic: noise sources; experimental tests: data analysis. National and Community technical rules. Forecasting models. computation method of the European Community: a comparison with experimental data. SHALLO3 method.</p> <p>9. <i>Electromagnetic fields: basic concepts.</i> Electric charge. Coulomb's law. Electric field. Magnetic field produced by a closed current loop. Magnetic field of a rectilinear current. Magnetic field of a circular current loop. Magnetic field of a moving charge (nonrelativistic). The static magnetic field. Magnetic flux. Magnetization of matter. The time-dependent electromagnetic field: the Faraday-Henry law. The time-dependent electromagnetic field: the Ampere-Maxwell law.</p> <p>10. <i>Electromagnetic spectrum.</i> Bands division. Ionizing and non-ionizing radiation. High-frequency radiation. Low-frequency radiation.</p> <p>11. <i>Transmission and distribution of electric power.</i> Power lines: supply voltage. Overhead power lines. Underground power lines. Electric power distribution systems. Electric power stations and substation. Power lines and power stations: typical magnetic and electric fields.</p> <p>12. <i>Mobile phone and television antennas; internal sources.</i> Mobile phones systems. Wi-Fi systems. Fixed installations for telecommunications. Mobile phone antennas. TV aerials. Internal sources.</p> <p>13. <i>Legislation; epidemiological studies</i> EM fields effects on health. Biological effects and health effects. Static and variable fields effects. Interaction mechanisms. Specific absorption rate (SAR). European and Italian legislation on EM fields. People protection from electric and magnetic fields. Risk assessment.</p> <p>Exercises topic: Numerical applications and preparation of reports Acoustics and EMC measurements with laboratory equipment.</p>
Modalità di erogazione	FRONT
Metodologie didattiche	TRADITIONAL
Metodi e criteri di valutazione dell'apprendimento	<p><i>The learning assessment method consists of a final exam in a single oral test, which can be accessed after a positive assessment of the exercises and laboratory tests.</i></p> <p><i>In the end, the actual achievement of the set training objectives and the completeness and quality of the response is assessed.</i></p>



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DIPARTIMENTO DI **INGEGNERIA**
DELL'AMBIENTE

	<i>The evaluation is carried out by assigning a mark out of thirty.</i>
Testi di riferimento ed eventuali letture consigliate	The teaching aids are entirely provided by the professor. Notes for further information on specific topics will be indicated if necessary.
Peer review	<i>(Opzionale. Indicare i docenti con i quali ci si confronta su tracce, modalità di esame e impegno studente)</i>
Orario delle lezioni	http://diam.unical.it
Calendario degli esami	http://diam.unical.it
Commissione d'esame	http://diam.unical.it



STIMA DEL CARICO DI LAVORO PER LO STUDENTE				
	Lezioni [Ore]	Esercitazioni [Ore]	Laboratorio [Ore]	Studio individuale [Ore]
Descrizione blocco argomenti 1 <i>Physical acoustics: definitions and fundamental physical quantities, sound waves.</i> <i>Measurements of acoustic quantities and characteristics of sources.</i> <i>Psychoacoustics</i>	20	10		15
Bibliografia e testi blocco argomenti 1 The teaching aids are entirely provided by the professor. Notes for further information on specific topics will be indicated if necessary				
Descrizione blocco argomenti 2 <i>Instrumentation for the execution of acoustic measurements</i> <i>Environmental acoustic measurements</i> <i>Environmental noise pollution</i> <i>National and Community legislation in the field of noise pollution</i> <i>Measurements of environmental noise. Environmental noise</i>	25	10		40
Bibliografia e testi blocco argomenti 2 The teaching aids are entirely provided by the professor. Notes for further information on specific topics will be indicated if necessary				
Descrizione blocco argomenti 3 <i>Electromagnetic fields: fundamental concepts.</i> <i>Electricity transmission and distribution systems</i> <i>Mobile phone and television aerials</i> <i>Legislation;epidemiological studies</i>	10		10	25
Bibliografia e testi blocco argomenti 3 The teaching aids are entirely provided by the professor. Notes for further information on specific topics will be indicated if necessary				
Ore riservate allo sviluppo delle competenze trasversali <i>(possono essere previste anche ore di lezione frontale)</i>	5			10
Tesine/altri homework			10	30
Ulteriori ore da dedicare alla preparazione dell'esame <i>(es. ore che gli studenti dedicano allo svolgimento di precedenti tracce d'esame)</i>				30
TOTALE <i>(Attenzione: i totali devono coincidere con le ore inserire dall'ufficio)</i>	60	20	20	150
ORE COMPLESSIVE	✓ 250			