UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Environmental Acoustics

2627-2-F7503Q024

Aims

The aims of the course are to provide the tools to address the problems of environmental acoustics in its various and to use the soundscape as an environmental indicator . The first lessons will illustrate the foundations of acoustics, thanks to which, later, it will be easy to describe and understand the phenomena concerning noise and soundscape. In particular, the student will be able to characterize the main sources of noise and how they influence the environment and human health. The course will also let you know which are the main regulations of the sector (regional, national, European) and how these must be applied. Much space will be given to the analysis of real cases, even complex ones (from the urban to the forest environment, from the mountains to the sea), and in the laboratory hours the notions acquired during the frontal lessons will be applied to simple real cases. During the laboratory it will be possible to learn to use measuring instruments and software that meet the requirements of current regulations for carrying out environmental assessments in the field of noise pollution. As regards the soundscape measurements, after having obtained and analyzed the main bio-acoustic indicators, the investigated sites will be evaluated from the point of view of environmental quality.

Contents

- Fundamental of Sound Waves, Main parameters. Bio-acoustic indicators. Equipments

- Sources of noise (road, railway, air port traffic, port, particular noise sources, antropic noise, biophonies)

- Propagation and Transmission of Air-borne Sound (air, ground attenuation, thermal gradient, atmospheric events, obstacles)

- Noise Reduction (at the source, barriers, special asphalt); noise reduction at parks, reserves, school and hospitals

- Outlines of Regulations and Laws

-Evaluation of Environmental Impact. Acoustics Classification. Action plan

- Computer simulation and Acoustic Models

- Bioacoustics and impact of human noise on biodiversity

- Use of bio-acoustic indicators for environmental quality assessment

- Room Acoustics (measurements, isolation, impact, vibration)

Detailed program

Introduction

- General reminders of acoustics (acoustic waves, speed, propagation, reflection, diffraction, absorption).
- Environmental quantities (SPL, LeqT, SEL, frequency and time weightings, acoustic bands). Spectral analysis and FFT
- Instrumentation (sound level meters, hydrophones, spectrum analysers, calibrators, terrestrial (SMM and SET) and aquatic (Urec) soundscape recorders, acoustic and soundscape software).
  Environmental Acoustics - Soundscape
- Sources of noise in terrestrial and marine environments (road traffic, rail traffic, air traffic, port traffic, naval traffic, specific sound sources).
- Noise propagation outdoors and in water (basic equation, divergence attenuation, effect of obstacles, vegetation attenuation, atmospheric absorption, ground effect, geometric divergence attenuation of noise, effect of thermal gradient and thermocline, effect of weather conditions).
- Bioacoustics and impact of human noise on biodiversity: sound communication of fauna (terrestrial and marine) and effect of human noise (at individual, population and community level)
- Evaluation of terrestrial and marine soundscape through eco-acoustic indices (definition of the most common indices and examples of applications)
- Noise reduction (reduction at the source, urban and regional planning [traffic regulation], protection of buildings, residential areas [barriers, draining asphalts], particularly protected areas [parks, reserves, schools, hospitals]).
- Overview of Regulations and Legislation and future developments on monitoring the impact on ecosystems
  Interior acoustics
- Dimensions for interiors (reverberation time, absorption coefficient, materials, geometries, acoustic insulation, facade insulation, impact noise insulation, noise from systems).
- Instruments and methods of measurement (microphone, dodecahedral case, pulsed techniques, impact machine, radiofrequency systems, software).
- Applications to real cases (fundamental concepts, materials, measurement techniques).
  Experiments outdoors and in the laboratory:
  • evaluation of a disturbing road source (acoustic) through field testing and data processing in the laboratory
  • evaluation of the soundscape of the park (biophony, geophony and anthrophony) through fieldwork and data processing in the laboratory (eco-acoustic indexes) analysis of the internal acoustics of a building (reverberation and transmission indexes and acoustic insulation)

Prerequisites

Good knowledge of general physics and early mathematics.

Teaching form

- 16 lessons of 2 hours of delivered didactics (4 credits)
- 10 laboratory activities of 2 hours of interactive teaching in presence (2 credits)

Textbook and teaching resource

Didactic material provided by the teacher and available on UNIMIB elearning website.
Textbooks will also be recommended.

Semester

- first semester

Assessment method

The exam consists of an oral exam in which the topics presented in the lessons are discussed. In addition to learning the concepts presented in the course, students' skills and attitudes are also assessed to apply what has been learned in theory to simple applicative cases; the expositive ability and adequacy of the student's language is also assessed.

Office hours

Every day but during the teaching activities, After appointment to be taken via email: giovanni.zambon@unimib.it

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | SUSTAINABLE CITIES AND COMMUNITIES | LIFE BELOW WATER | LIFE ON LAND