INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Noise pollution			Field of study	Environment Protection		
Bachelor in	Environmental Engineering			School	School of Agriculture		
Academic Year	2022/2023	Year of study	3	Level	1-3	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9099-309-3105-00-22		

Workload (hours)	162	Contact hours	T	TP	PL	TC	S	E	OT	O
			30	-	30	-	-	-	20	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Artur Jorge de Jesus Gonçalves

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Describe, analyse and model the behavior of sound waves.
2. Know the main noise impacts on human an on the environmnet.
3. Perform noise measurements in different situations.
4. Assess environmental and workplace noise in accordance with legal criteria.
5. Develop plans to reduce noise levels.
6. Implement measures to improve bulding acoustics and control unwanted noise.

Prerequisites

Before the course unit the learner is expected to be able to:
Basic knowledge in mathematics and physics.

Course contents

1. Basic Concepts 2. Analysis of Sound Waves 3. Propagation of sound waves in the air 4. Hearing Mechanism and Subjective Rate 5. Noise impacts on the environment and humn health 6. Measuring Sounds and Sound Evaluation 7. Environmental Noise 8. Workplace noise 9. Building Acoustics

Course contents (extended version)

1. Basic concepts
   - sound and noise.
   - physical properties of sound waves.
   - sound power, sound intensity and sound pressure.
2. Analyses of sound waves
   - decibel definition.
   - sound power, sound intensity and sound pressure levels.
   - sound arithmetic.
   - spectral analysis.
   - types of sounds.
3. propagation of sound waves in the air
   - behaviors of sound waves- reflexion, diffraction, diffusion, refraction, transmission and absorption
   - sound fields
   - ideal and non-ideal sound sources.
   - sound sources directivity.
   - geometric attenuation for punctual and linear sound sources.
   - atmospheric and surface factors with influence in sound propagation.
   - acoustical barriers.
4. hearing mechanism and fundamentals of psychoacoustics
   - anatomy and physiology of hearing.
   - subjective rates: fones and sones.
5. Noise impacts
   - global impacts on human beings
   - hearing effects.
   - other effects.
6. Measuring sound and sound evaluation
   - measuring equipment.
   - calibration and signal acquisition and processing.
   - measuring procedures.
   - corrections and uncertainties analyses.
7. Environmental noise
   - basic concepts and quantitative indicators.
   - environmental noise sources.
   - noise prevention and control.
   - noise modelling and noise maps.
   - legal framework.
   - evaluation of noise impacts.
8. Noise at work
   - basic concepts and main indicators.
   - noise sources at work.
   - Methods for assessing daily personal exposure.
   - noise prevention and control.
   - legal framework.
9. Building acoustics
   - sound hearing in closed spaces
   - sound absorption
   - reverberation and reverberation time
   - sound transmission loss and sound insolation
   - legal requirements.

Recommended reading

1. Beraneck L. L. e Vér I. L. 1992. Noise and vibration control engineering: principles and applications. John Wiley & Sons, USA.
2. Fahy F. J. and Walker J. , 1998. Fundamentals of Noise and Vibration, Spon Press.
3. Foreman J. E. K. , 1990. Sound analysis and noise control. Van Nostrand Reinhold. USA.

Recommended reading

4. Kinsler L. E. , Frey A. R. , Coppens A. B. , and Sanders J. V. 2000. Fundamentals of Acoustics, 4th Ed. , Wiley, New York.
5. Davies M. L. e Cornwell D. A. , 1998. Introduction to environmental engineering. McGraw-Hill, Singapura.

Teaching and learning methods

Conventional lectures with oral presentation of subjects. Pratical classes based upon development of practical exercises and field experiments. In tutorial classes, students receive further assistance in ongoing research activities.

Assessment methods

1. Alternative 1 - (Regular) (Final, Supplementary, Special)
   - Practical Work - 30%
   - Final Written Exam - 70%
2. Alternative 2 - (Student Worker) (Final, Supplementary, Special)
   - Practical Work - 30%
   - Final Written Exam - 70%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Artur Jorge de Jesus Gonçalves	Manuel Joaquim Sabença Feliciano	Artur Jorge de Jesus Gonçalves	Maria Sameiro Ferreira Patrício
08-12-2022	12-12-2022	17-12-2022	19-12-2022