

Name	Fundamentals of noise, vibration and human vibration		
Code	CTC-BL-03		
ECTS	4		
Location	KTC Banja Luka, Univesity of Banja Luka Faculty of Mechanical Engineers, Stepe Stepanovica 71, 78000 Banja Luka, BiH		
Trainers	PhD Valentina Golubovic-Bugarski		
Purpose	<p>Since man began to build machines for industrial use, especially since the engines have become drivers of these machines, problems associated with vibration reduction and their isolation are inevitably present and engineers are trying to adequately respond on it. Techniques applied to reduce the impact of vibration and vibration isolation itself became an integral part of the machine construction process, and the need for accurate measurement and analysis of mechanical vibration becomes higher. Noise is an inevitable companion of mechanical vibration. To treat the problem of noise in an appropriate manner it is necessary to perform reliable measurements of noise, so one first has to know the terminology and basic principles of noise measurement.</p> <p>Vibration of the human body results from mechanical vibrations produced in human environment. Prolonged exposure to whole body vibration can lead to permanent physical damage to the body or nervous system damage. The risk of emergence of irreversible physical damage is particularly pronounced in vibrations associated with the work process, where the magnitude of vibration can be considerable, long exposure to vibration occurs regularly or daily. Typical high-risk groups are truck drivers, the drivers of agricultural, construction and forestry machines, certain helicopters pilots and workers who work with hand tools and manually operated machines, or who adhere to the workpiece. In order to avoid the risk of permanent damage to human health it is necessary to examine ways of transmitting vibrations from their source to the human body, methods of measurement of vibration and protection measures.</p>		
Recommended entry level	Recommended VII level of professional qualification, mechanical engineering		
Specials requires	Knowing in Technical Mechanics		
Duration	20 classes		
General objectives	<p>Participants of this training will acquire basic knowledge about mechanical vibration, noise, vibration of the human body and methods of their measurements.</p> <p>Participants will be demonstrated some modern equipmen for measurment of noise and vibration through a certain number of classes held in laboratory work.</p>		
Topics	<ol style="list-style-type: none"> 1. Introduction to vibration 2. Fundamentals of vibration measurement and analysis 3. Basic concept of sound 4. Fundamentals of sound frequency analysis 5. Human vibration 		
Specific learning outcomes in topics	Topic 1: Introduction to vibration	No. of classes	4
	<p><u>Summary</u> This lesson provides an introduction to vibration through the description of the most commonly used mechanical parameters which describes the movement of a simple mechanical system mass-spring. Different types of signals are shown, conversion between different parameters is graphically and numerical explained. Units of measurement are defined.</p> <p><u>The content of lesson</u></p> <ul style="list-style-type: none"> • Definitions • What is vibration? • Mechanical parameters • Mass-spring system • How to measure vibration? • Types of signals 		

Specific learning outcomes in topics

- A description of the signal in time domain
 - Conversion: acceleration, velocity, displacement
 - Units
- The outcome of the lesson
 On this lesson you get basic understanding of:
- Fundamental nature of vibration
 - Mechanical parameters that describe the vibration
 - Types of signals
 - The relationship between displacement, velocity and acceleration of the vibrating motion
 - Measurement units
 - The importance of measuring chain

Topic 2: Fundamentals of vibration measurement and analysis	No. of classes	4
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Summary
 This lesson explains the different modes of signal processing using vibration detector and analyzer filter. Explanations for the presentation of data using different axes, combining of type of analysis to the type of scale, the fundamental rule of BT products and choose the type of filter / analysis, the choice of the parameters of the analysis are shown. Finally, the analysis of signals and systems analysis are explained.

- The content of lesson
- Why performing frequency analysis?
 - The spectrum or overall level?
 - Filters
 - Linear and logarithmic scale
 - Amplitude scale
 - Parameters of vibration
 - Detector / averaging
 - Analysis of signals and systems analysis

The outcome of the lesson
 On this lesson you get basic information on:

- Choosing the right parameter for the assessment of vibration
- Presentation of the measured data in an appropriate manner
- Understanding the basic parameters of filters and analysis and existing restrictions
- Understanding the difference between the signal analysis and systems analysis

Topic 3: Basic concept of sound	No. of classes	4
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Summary
 This lesson explains the sound and measuring the sound through the sound pressure value, the level of sound and units for measuring sound levels. Before you perform the measurement of sound, it is important to know the terminology of acoustics, basic rules of sound propagation, and the types of measuring equipment.

- The content of lesson
- Definitions
 - dB conversion
 - Types of sound fields
 - Addition and subtraction of noise level

The outcome of the lesson
 This lesson describes the different measures of sound, such as sound pressure, sound intensity, sound level, units for measuring sound levels, and how to add and subtract the sound levels.

Topic 4: Fundamentals of sound frequency analysis	No. of classes	4
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Summary
 This lesson contains three sections:

- Frequency and wavelength of sound
- Frequency analysis of sound
- Perception of sound

A basic understanding of measuring the sound level and its frequency analysis are given

through these three sections. The structure of the instrument for analyzing sound, that is the sound level meter, is explained.

The outcome of the lesson

This lesson provides the basic knowledge regarding:

- Concepts related to the frequency range of audible sound and the sound wavelength
- Diffraction, reflection and diffusion of sound
- Frequency analysis using FFT and digital filters
- The basic concept of 1 / 1 and 1 / 3 octave filters
- Human perception of sound and meaning of the weight functions A, B, C, D
- Flowe and analysis of signals in the sound level meter

Topic 5: Human vibration	No. of classes	4
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Summary

This lesson explains two type of the human body vibration, that are hand-arm vibrations and the whole-body vibrations, explains the metrics and the weighing curves that is used to measure the vibrations of the human body, the legislation in this area is presented.

The content of lesson

- Whole-body vibration
- Hand-arm vibration
- Frequency response of the human body
- Measurement parameters and weighing curves
- Measurement of vibration of the human body
- Legislation in the human body vibration

The outcome of the lesson

This lesson provides the basic knowledge related to the vibrations of the human body:

- Why knowing the human vibration
- How to measure the human vibrations
- What actions should be taken to reduce human exposure to vibration

Portfolio assessment

Trainer evaluates level of succes in overcoming the training of each student, through testing.

Examination: Test is defined by trainer on basis of examination which can assess the cognitive skills and their application. For this purpose it is necessary to respond to a range of questions. Answers to questions are provided in writing and orally, in a conversation with trainer evaluator.

Evaluation: Meet 50 - 64%

Successful 65 - 79%

Excellent 80 - 100%

Performance criteria and the percentage of representation of these techniques in the evaluation module will be given later.