

## Mechanical vibrations (Agriculture, EMIAIA 3<sup>rd</sup> Year, 2<sup>nd</sup> Sem.)

**Credit value (ECTS): 3**

**Course category: optional**

**Course holder:**

**Prof.dr.ing. Carmen BUJOREANU**

### Discipline objectives (course and practical works)

Understanding and use of vibration and noise characteristics, highlighting the importance of vibroacoustic study in engineering issues solving.

Terminology knowledge and fundamentals techniques and methods for linear vibrations evaluation in elastic systems with one or more degrees of freedom.

Highlighting the characteristic noise parameters and the correlation between vibration and noise.

Analysis of the main sources of vibration and noise in engineering equipments as well as the most used active and passive methods to combat vibration and noise.

Solving some technical problems and vibroacoustic diagnosis methods.

Particularization and integration of the specific notions of vibration and noise pollution in the field of agricultural engineering.

### Contents (syllabus)

Course (chapters/subchapters)
<b>Introductory elements</b>
The objectives of the vibration and noise study. Vibration - noise – environment relationship. The importance of this relationship in the context of the modern world.
<b>Vibrations characteristic parameters</b>
Mechanical vibration classification. Simple harmonic movement. Elastic systems - characteristic elements. Parameters describing the vibration waveform.
<b>Natural frequencies</b>
The resonance phenomenon. Measurement of the vibrations amplitudes. Resonance tests. Examples.
<b>Free and forced vibration in one degree of freedom systems</b>
Theory fundamentals. Modeling and simulation. The notion of vibration transmissibility. Examples.
<b>Frequency analysis</b>
Spectral analysis: definition and approaches. Deterministic and non-deterministic signals, measurements. Examples of waveforms and their associated spectra.
<b>Vibration and noise transducers</b>
Motion, speed, acceleration transducers. The FFT analyzer. Professional microphone. Schemes and examples.
<b>Machines/equipments vibration analysis</b>

Vibration analysis steps. Criteria for assessing the severity of vibrations. Applicable standards and allowable limits.
<b>Noise - a physical phenomenon</b>
Acoustic pressure, sound pressure level. Acoustic intensity, acoustic intensity level. Vibration-noise correlation.
<b>Equipments monitoring and their vibroacoustic diagnosis</b>
Imbalances, misalignments, bearings, pumps, belts transmissions, gears, piston equipments. Practical considerations.
<b>Control of vibration and noise</b>
Sources of vibration and noise. Active and passive methods of control. Structures and materials used to combat vibration and noise. Examples.

Practical works
Presentation of the Laboratory of Mechanical Vibrations (Faculty of Mechanics, UT Iasi). Anechoic chamber for the measurement of noise and vibration. Equipments and tools.
Vibration sensors and transducers. Calibration of the measuring and vibration analysis chain. Example.
Experimental determination of the damping in an elastic system. Application.
Simple linear dynamic absorber. Use. Application.
Diagnosis and vibroacoustic monitoring of gears and bearings.
Basics of the LabView programming soft. Theoretical considerations. LabView features.
The structure of a program in LabVIEW. The opening of an IV. Steps. Front panel. Block diagram.
Controls and indicators. Types. Consultation of the group of numeric type components; boolean type; character string. Consulting the group of type components and data grouping; graphics. General notions.
Functions for the numeric type; for the Boolean type; for the string type; for table type and data grouping. Instructions for controlling the execution of the programs.
Methods for graphical representations. Examples.
Making an IV. Steps. Creating the front panel. Signature IV. Saving. Building the block diagram.
Noise pollution. Measurement of the noise physical characteristics. Standards and regulations.
Discussions. Case presentations (noise measurement in the anechoic chamber).

### **Bibliography**

- Bujoreanu C., *Analiza datelor experimentale în sisteme mecanice*, Ed. Tehnopress, Iași, ISBN 978-606-687-239-3, 224 pg., 2015
- Bujoreanu C., *LabView - prietenul nostru*, <https://mec.tuiasi.ro/studenti/informatii-utile/manuale-electronice/>, 122 pg., 2016
- Bujoreanu C., *Prelucrarea datelor experimentale*, 127 pg., <https://mec.tuiasi.ro/studenti/informatii-utile/manuale-electronice/>, 2016
- Bujoreanu C., *Vibrații mecanice*, <https://mec.tuiasi.ro/studenti/informatii-utile/manuale-electronice/>, 2017
- Preumont Andre., *Active control of structures*, 2008 (library.tuiasi.ro)

- Allyn Phillips.- *Mechanical vibrations I*, University of Cincinnati, 2006 (lecture notes)
- Bujoreanu C., *Achiziția și prelucrarea datelor experimentale*, Editura Tehnopress. 2006
- Drăgan, B.- *Controlul vibrațiilor și zgomotului*, Editura “Gh. Asachi” Iași, 2003.
- Drăgan, B. - *Achiziția și procesarea semnalului vibroacustic*, Editura Politehnică Iași, 2004.
- Cottet, F., Ciobanu, O. – *Bazele programării în LabVIEW*, Ed.Matrix – Rom., București, 1998.
- Gafițanu, M., Crețu, Sp., Drăgan, B. – *Diagnosticarea vibroacustică a mașinilor și utilajelor* – Ed.Tehnică, București, 1989.

\*\*\**LabVIEW- Data Acquisition/Course Manual/Users Guide*, vol.I-IV, april 2015 Edition

## Evaluation

Evaluation form	Evaluation Methods	Percentage of the final grade
Course - colloquium	Written test	50%
Practical works	continuu evaluation+presence	50%

## Contact

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