Module DDM 4204 - Vibration and Acoustics 1

1	Module Number	Study Programme	Semester	Offered in	Duration	Module Type	Workload (h)	ECTS Points
	4204	DDM	1	☒WS ☐SS	1 Semester	compulsory	120	4

2	Courses	Teaching and Learning Forms	Contact Time (SWS)	Contact Time (h)	Self-Study Time (h)	Language
	a) Vibration and Acoustics Measurement	Lecture	2	30	75	English
	b) Vibration and Acoustics Measurement	Laboratory	2	15		

3 **Learning Outcomes and Competences**

Once the module has been successfully completed, the students can...

Knowledge and Understanding

- Explain the basic procedure of vibrations and acoustic measurement techniques and understand the connections within theoretical basics and practical measurement.
- Describe basics of mechanical vibrations, optical, holographic and other vibrational measurement techniques.
- Basic knowledge in the mathematical, mechanical and optical fundamentals of vibrational measurement techniques.
- Recognize the significance of the subject to development process of mechanical and automotive systems.
- Understand and explain single degree of freedom (SDOF) vibrational models, digital signal processing (DSP) and fourier transform process (DFT and FFT), basics of laser light and holography.

Use, Application and Generation of Knowledge

Use and Transfer

- Apply principles of optical laws, DSP, DFT and FFT to Frequency Response Function (FRF) and Order Tracking measurements.
- Create lab reports and presentations.
- Analyse vibrational and acoustic behaviour of chosen automotive components.
- Recognize and classify connections.
- Analyse vibrational and acoustic problems and derive or develop solutions.
- Take different perspectives and points of view on a given situation, weigh them up against each other and make an assessment.
- Design components with wanted vibrational and/or acoustic properties.
- Calculate basic properties of SDOF models.
- Familiarize themselves with new ideas and topics based on their basic knowledge.

Scientific Innovation

- Develop concepts for the vibrational and acoustic optimization of mechanical and automotive components.

Communication and Cooperation

- Interpret the results of vibrational and acoustic measurements and draw admissible conclusions.
- Present FRF and operational deflection shapes and discuss them.
- Communicate and cooperate within the group in order to find adequate solutions for the task at hand.

Scientific Self-Conception/ Professionalism

- Justify the solution theoretically and methodically.
- Reflect and assess one's own abilities in a group comparison.

4 **Contents**

a) Vibration and Acoustics Measurement: Vibration measurement by mechanical means, optical and laser basics, vibration measurement by interferometric and holographic means, acoustic noise measurement, analysis of dynamic signals.

b) Laboratory Vibration and Acoustics Measurement: Introduction and handling of measurement equipment, FRF measurement on an automotive component, order tracking measurement on a car, Speckle interferometry, laser vibrometry.

5 **Participation Requirements**

Compulsory: Basic knowledge on fundamentals of optics and vibrations (Bachelor degree level)

Recommended: NA

6 **Examination Forms and Prerequisites for Awarding ECTS Points**

Written exam, 90 minutes, graded

Lab reports and tests, not graded

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7	**Further use of Module** 4210 Vibrations and Acoustics 2
8	**Module Manager and Full-Time Lecturer** Responsible: Prof. Dr.-Ing. Joachim Berkemer Lecturer: Prof. Dr.-Ing. Joachim Berkemer, Prof. Dr. rer. Nat. Hanno Käß, Thomas Vogt, Hans-Georg Leis
9	**Literature** Lecture documents, Ewins, D.J.: Modal Testing. Theory and Practice. New York: John Wiley and Sons. Eugene Hecht: Optics, Pearson New Internat. Edition, Pedrotti: Introduction to Optics Pearson
10	**Last Updated** 02.04.2019