

Erasmus + Project No598241-EPP-1-2018-1-RS-EPPKA2-CBHE-JP

**Strengthening Educational Capacities by Building Competences and  
Cooperation in the Field of Noise and Vibration Engineering**

**SENVIBE**

## **Quality Report for WP5**

**Activity 7.2**

**Date: 02/10/2022**

## 1. DESCRIPTION OF THE WORK PACKAGE (WP)

This WP was concerned with the development, accreditation and implementation of a completely new Master Programme in Vibro-Acoustic Engineering (MAS VAE) for 25 students at the University of Novi Sad. The structure of the programme had been expected to be developed based on similar programmes that exist at two SENViBE partnering European universities: the Institute of Sound and Vibration Research, Southampton, UK and at the KTH in Stockholm, Sweden, and then adjusted for national purposes. The input from the stakeholders engaged in the No & Vib (Noise & Vibration) Hub had been planned via student internships and a list of recommended MSc theses, so that students work on real and practical No&Vib issues.

## 2. ACTIVITIES AND THEIR REALIZATION

### 2.1. Assessment per task

SENViBE activities		State		
No.	Title	Fully Completed	Partially Completed	Not Completed
WP.5.1.	Development of the MSc curriculum in VAE	✓		
WP.5.2.	Development of e-learning and b-learning materials	✓		
WP.5.3.	Accreditation of the MSc VAE programme	✓		
WP.5.4.	Enrolment of the MSc students	✓		
WP.5.5.	Implementation of the MSc VAE studies	✓		
WP.5.6.	Creation of a list of recommended MSc theses using the input of the stakeholders involved in the No&Vib Hub	✓		

### 2.2. Description of the implemented activities

- The new title of Master of Vibro-Acoustic Engineering registered and included in the list of professional, academic and scientific titles in Republic of Serbia for the first time in Serbia
- Content of MAS VAE developed with 12 modules with nine compulsory ones and three optional ones, where a student chosen three modules out of eight offered
- Based on the choice of optional modules and the master thesis, a student can specialize in one of three fields: Vibration Engineering, Acoustic Engineering or Environmental Noise and Vibration
- MAS VAE was accredited as an interdisciplinary study programme by the Certificate of the National Body for Accreditation and Quality Assessment in Higher Education dated on 22 April 2021
- MAS VAE was promoted widely ([one video](#) created and posted on the SENViBE YouTube channel, [one webpage](#) was created, two leaflets (<https://senvibe.uns.ac.rs/brosura/>, <https://senvibe.uns.ac.rs/e-brosura/>) were published in electronic and paper form)
- MAS VAE has been implemented with 25 students enrolled, all of which received appropriate promo-material, including the [SENViBE Glossary](#)

- During the implementation, the teaching staff from the University of Nis participated (2 persons). Besides them, the staff from Institute of Occupational Health participated in teaching as well (2 persons).
- 43 stakeholders engaged in the No&Vib Hub were approached to provide student Internships as well as the list of recommended MSc theses.

### 2.2.1. Involvement of people with fewer opportunities

NA

### 2.2.2. Refugees

NA

### 2.2.3. Innovation

- E-SENVIBE platform was adjusted for learning purposes, and it has been continuously enhanced with teaching & learning material. In the winter semester, separate pages were created for all 7 modules in the platform, while in the summer semester, this was done for 8 of them, where the last one covers three parts of the master thesis, which implies that all modules are represented in the platform.
- E-SENVIBE was also merged with Microsoft Teams for teaching purposes.
- New original digital multimedia materials (pptx files, mp4 files, codes, e-Pub, etc.) were created and uploaded to e-SENVIBE for 10 modules.
- Two new labs were established (Vibration Lab and A-lab with a mini-anechoic chamber) and used during classes and for students' projects.

## 2.3. Impact

**Short term impact:** Improved competences of the Serbian teachers (8 trained, 22 direct beneficiaries); Serbia gets first Masters of Vibro-Acoustic Engineering; Equipment purchased, and 2 new labs established; New teaching & learning materials available for 10 modules, including e- and b-lectures; One policy and procedure for practical training schemes for students created (Student Internships); 43 members of the No&Vib Hub invited to provide subjects for an MSc thesis in VAE; Guidelines and procedure for defending an MSc thesis in VAE created and published in e-SENVIBE.

**Long term impact:** Internationalisation of the MSc programme in VAE; Possibility for developing and implementing a PhD programme in No&Vib/Sound & Vib; High employability rate of Masters of Vibro-Acoustic Engineering (all stay in Serbia, no brain drains).

### 2.3.1. Unexpected outcomes/ spin-off effects

NA

## 3. STATISTICS AND INDICATORS

### For Training/Mobility Activities

Number of partner country "HEIs' students" trained

25

Number of partner country "HEIs' academic staff" trained

8

Number of partner country "HEIs' administrative staff" trained

1

Number of partner country "non-HEI individuals" trained (priv. sector, NGOs, civil servants, etc.)

1

## Impact at individual level

Extent of attention given to vulnerable groups

NA

Number of direct beneficiaries in the Partner country(ies) per year: academic staff from HEIs

22

Number of direct beneficiaries in the PCs (/year): administrative staff from HEIs

5

Number of direct beneficiaries in the PCs (/year): HE students

25

Number of direct beneficiaries in the PCs (/year): non HE individuals

45

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## 4. QUALITY ASSURANCE MEASURES

### 4.1. Reviews conducted in a descriptive form

Reviewed activity	Internal/External review	Reviewer	Description
W.P. 5.1. Development of the MSc curriculum in VAE	External	Matthew Phillip Cartmell	This document provides the review of the MSc programme in Vibro-Acoustic Engineering (VAE) developed at the University of Novi Sad (UNS)
W.P. 5.1. Development of the MSc curriculum in VAE	Internal	Branko Radicevic UniKg	The review was done on the basis of the author's manuscript "Noise and Vibration - Manual for Laboratory Exercises". by the authors Momir Prašćević and Darko Mihajlov
W.P. 5.1. Development of the MSc curriculum in VAE	Internal	Ivana Kovacic UNS	The review was done on the basis of the author's manuscript "Noise and Vibration - Manual for Laboratory Exercises". by the authors Momir Prašćević and Darko Mihajlov
W.P. 5.1. Development of the MSc curriculum in VAE	External	Dragana Sumarac Pavlovic	The review was written based on materials available on the website of the courses: Fundamentals of Technical Acoustics and Electroacoustics. The review refers to the available presentations, the literature offered and the structure of the exam requirements.
W.P. 5.2. Development of e-learning and b-learning materials	External	Zvonko Rakarić	The review was written based on Practicum in Mechanical Vibrations in both digital and printed forms, as well as on the basis of two videos.
W.P. 5.2. Development of e-learning and b-learning materials	External	Nataša Trišović	The review was written based on 1. Practicum in Mechanical Vibrations by Ivana Kovačić, Miodrag Zuković and Drago Radomirović 2. VideoLab1 3. VideoLab2
W.P. 5.2. Development of e-learning and b-learning materials	External	Ivan Luković	This document provides the review of the ICT Platform (e-SENvIBE Moodle). The review was written based on: - the Project Web presentation, URL: <a href="https://senvibe.uns.ac.rs/project/#">https://senvibe.uns.ac.rs/project/#</a> - insight into the e-SENvIBE Moodle learning platform,

			URL: <a href="https://www.e-senvibe.senvibe.uns.ac.rs/">https://www.e-senvibe.senvibe.uns.ac.rs/</a>
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WP5 had the task of developing a master curriculum of vibro-acoustic engineering. MSc VAE was developed, accredited and implemented with 25 students enrolled. Within this work package, e-learning and b-learning materials were developed. Stakeholders engaged in the No&Vib Hub were approached to provide student internships as well as the list of recommended MSc theses.

**The tasks in this WP are fully completed.**

#### **4.2. Rebuttal/answer to reviews with the actions taken to improve the state**

Not applicable

#### **4.3. Other measures**

None

**Prepared by Ivana Kovacic,  
Novi Sad, 02/10/2022**

**Enhanced by the Quality Assurance Group Leader, Natasa Stojic  
Sremska Kamenica, 01/11/2022**

**Approved by Project Coordinator  
Novi Sad, 02/11/2022**

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## **ANNEX 1**

### **Evaluation reports**



**Evaluation report template**

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**Strengthening educational capacities by building competences and cooperation  
in the field of Noise and Vibration Engineering**

**SENVIBE**

Author:	Matthew Phillip Cartmell, University of Strathclyde, Glasgow, G1 1XJ, Scotland, UK.
Executive summary	This document provides the review of the MSc programme in Vibro-Acoustic Engineering (VAE) developed at the University of Novi Sad (UNS)
External /Internal Evaluation Methodology	What has been done and how?  The review of the MSc was written based on... (short explanation of the documents available/used)
<b>Work Packages</b>	
Deliverable/ Activity Ref. No	5.1. Development of the MSc VAE studies  7.2. Internal and external reviews processes and outcomes.
<b>Review of MSc Programme in Vibro-Acoustic Engineering</b>	
Please write here your opinion in descriptive form:	

The programme is broad, as befits an M.Sc. that has been set up to generate professional engineering capability within the Voivodina region, but is also scientifically rigorous and very well supported indeed by laboratory and professionally provided exercises, tutorials, practicals, and the creation of internships. The course also aims to educate and train people for subsequent Ph.D. level research, so it fulfils two functions: the development of competence for the region in terms of business and entrepreneurship, and also the education and training of researchers. The overall course structure concept is conventional for an M.Sc., providing 60 ECTS credits over one calendar year, with a 240 ECTS credit entry requirement and the passing of an entrance exam. The latter point is, in my opinion, a very good thing - provided the quality that this ensures is sustainable in terms of student numbers. I note that 25 students are targeted for the intake, which is excellent and a practical and manageable figure for the number of staff involved. The electives are discussed initially as though there are only 3 elective courses when in fact there are 8 listed in the documentation, but then it's stated that there are 3 elective areas, so my assumption from this is that the 8 courses are spread across 3 areas. The 14 course summaries are very interesting and well explained on the whole. I note that 6 of them are compulsory and 8 are electives. The material offered within the compulsory courses is very much as one would hope to see, comprising professional aspects of research, innovation and engineering (1), mechanical vibrations (2), fundamentals of engineering acoustics (3), environmental and occupational noise and vibration (4), student entrepreneurship (6), and numerical methods in vibro-acoustics (7). These have clear and appropriate syllabuses, they are well supported by tutorial and practical classes, and the source material is well internationalised and entirely appropriate. So, the compulsory courses offer a suitable, sufficient, and appropriate basis for specialisation into one of the 3 elective areas. The elective courses cover all that one could imagine for an M.Sc. with the remit of the SENVIBE programme. They comprise human response to vibration (1.1), psychoacoustics and sound perception (1.2), vibration control (2.1), electroacoustics (2.2), monitoring and management in urban environments (2.3), structural dynamics (3.1), audio signal processing (3.2), and acoustic and vibro-acoustic materials (3.3). It is perfectly clear, on thinking about it, that the 3 elective areas that are offered (environmental engineering, acoustics, and vibration) can map into these 8 courses, although relatively little is said about that in the report. In my opinion this is fine, and offers the versatility that such an M.Sc. should be capable of demonstrating.

There is a very good overall mix of theoretical, practical, experiential, and organisational involvement for the students across the M.Sc. and I particularly like the connections established with local radio and TV studios, medical experts, and local businesses. This is really very good indeed. It is also very good that each

student gets a mentor, and that s/he can help the students obtain a foothold in local business for their internship. The hub, whilst not discussed in detail, is a nice initiative too, providing support for the internship aspects. There is plenty of mention of the use of software, and I assume that this is a mixture of commercial packages that are frequently used in vibro-acoustic engineering, including FEA (mentioned) and also some bespoke code-writing. It's very clear that this SENViBE M.Sc. has been properly thought out, well-resourced using local academic expertise and business and agency capability, and that it has been built up from a close reflection of extremely long-established activities at the University of Southampton. The course offers an excellent blend of activity spanning science, creative thinking, technology understanding and development, business practice and entrepreneurship, professional studies, and education. I am sure that it will benefit the population of the Voivodina region, and will once again place the University of Novi Sad at the heart of that region's growth and sustainability.

Suggestions for improvement:

I do not have suggestions for improvement other than to ask for a little more emphasis in future documentation of the presence of the science and technology behind digital sound, and also to show explicitly how the elective courses fit across the 3 elective areas. The course syllabuses and all entirely appropriate, they are contemporary, and they are scientifically and technologically deep and broad. So, as long as this is reflected in important course documentation then all is well.

### MSC PROGRAMMEE EVALUATION

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Does the structure of the study programme meet the standard and does it contain all the elements required by law?	X				
Is the purpose/learning goal clearly defined, in accordance with the tasks of the institution and does it ensure the acquisition of competencies?	X				
Are the learning outcome clearly formulated, in accordance with the tasks of the institution and whether they include the	X				

acquisition of competencies and skills?					
Are the learning goals of the VAE master study programme harmonized with the modern directions of the development of the appropriate scientific discipline in the world?	X				
By mastering the VAE programme, will students acquire the prescribed general and subject-specific abilities, especially appreciating whether the competencies are in accordance with the structure and content of the study programme and whether they are precisely described and harmonized with the outcomes?	X				
By mastering the study programme, will students become able to independently engage in scientific research or work?	X (with the right level of personal application subsequently - this is quite a challenging area academically)				
Does the curriculum structure include a schedule of courses by semesters and a detailed description of each course?	X				
Are the aims of each course clear, realistic, and achievable?	X				
Are the outcomes of each course clear and in accordance with the overall goal?	X				

<p>Are the syllabus of each course detailed enough?</p>	<p>X (maybe be a little more explicit about the digital aspects)</p>				
<p>Are the references/literature written for each course appropriate?</p>	<p>X (excellent)</p>				

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Prepared/Compiled by External evaluator  
Glasgow, 24/09/2020

Approved by the Quality Assurance Group Leader, Mira  
PucarevicSremska Kamenica, 24/09/2020

Approved by Project Coordinator  
Novi Sad, \_/\_/20

## СЕНАТУ УНИВЕРЗИТЕТА У НИШУ

**Предмет:** Рецензија рукописа „Бука и вибрације – приручник за лабораторијске вежбе“ аутора професора др Момира Прашћевића и професора др Дарка Михајлова

На седници Сената одржаној 28.02.2022. године према Одлуци о именовану рецензената СТУ број: 8/16-01-001/22-038, одређан сам за једног од двоје рецензената за рукопис „Бука и вибрације – приручник за лабораторијске вежбе“ аутора професора др Момира Прашћевића и професора др Дарка Михајлова. Након детаљне анализе поднетог рукописа подносим Сенату следећи

### ИЗВЕШТАЈ

Рукопис има укупно 166 страна. Илустрован је са 53 слике и 25 табела, од којих се 21 односи на извештаје о резултатима мерења и прорачуна. Поред тога у рукопису су дата 103 приказа екрана мерних инструмената приликом подешавања, мерења и обраде резултата мерења. Преглед актуелне и релевантне стручне и научне литературе (укупно 35 јединица) дат је после сваког поглавља што значајно олакшава праћење текста рукописа. У наведеној литератури налазе се референце које су коришћене у рукопису, али и оне које дају шири увид у материју која се разматра.

Рукопис је написан на српском језику и садржи 6 поглавља:

- Одређивање изолације од ваздушног звука у теренским условима
- Одређивање изолације од звука удара у теренским условима
- Мерење времена реверберације у слушаоницама
- Одређивање звучне снаге извора буке
- Мерење и оцена буке у радној средини
- Мерење и оцена вибрација шака-рука

Публикација БУКА И ВИБРАЦИЈЕ – приручник за лабораторијске вежбе је настала у оквиру пројекта „Јачање образовних капацитета кроз изградњу компетенција и сарадње у области инжењерства буке и вибрација“, чији је акроним SENVIbE. Пројекат SENVIbE припада групи Erasmus+ пројеката намењених јачању капацитета у високом образовању, финансира га Европска комисија, а координира Универзитет у Новом Саду.

Публикација БУКА И ВИБРАЦИЈЕ – приручник за лабораторијске вежбе представља резултат пројектне активности на пројекту SENVIbE. Потреба за оваквом публикацијом је проистекла након модификације предмета „Бука и вибрације“ који се реализује на Факултету заштите на раду у Нишу на студијском програму „Инжењерство заштите на раду“. Модификацијом предмета „Бука и вибрације“ су по први пут од његовог успостављања као облик наставе предвиђене лабораторијске вежбе и то применом лабораторијске опреме која је набављена у оквиру програмске активности пројекта SENVIbE.

Значајан допринос у креирању ове публикације су имале обуке аутора публикације на Институту за истраживање звука и вибрација у Саутемпτονу (ISVR – Institute of Sound and Vibration Research – University of Southampton) и на Краљевском технолошком институту у Стокхолму (KTH Royal Institute of Technology in Stockholm), реализоване у оквиру пројектне активности пројекта SENVIbE.

Полазећи од теоријских основа, аутори су у првом поглављу објаснили звучну изолацију и изолациону моћ и изражавање изолационе моћи једним бројем према стандарду SRPS ISO 717-1. Описан је поступак за одређивање изолације од ваздушног звука кроз положај извора звука, положај микрофона, дефинисање времена усредњавања и мерење времена реверберације. Приказан је мерни ланац, калибрација мерног система и начин повезивања мерне опреме за мерење изолационе моћи преградног зида. Приказана су детаљна подешавања мерача нивоа звука Brüel&Kjaer типа 2270, кроз слике мерних екрана инструмента. На крају поглавља су дати извештаји о резултатима мерења и прорачуна, који представљају водич за студенте у поступку реализације мерења и потребних прорачуна.

У другом поглављу аутори детаљно анализирају теоријске основе звука удара и одређивање изолације од звука удара, као и изражавање изолације од звука удара једним бројем према стандарду SRPS ISO 717-2. Представљен је поступак за одређивање звука удара кроз дефинисање положаја извора звука удара, положај микрофона, дефинисање времена усредњавања и мерење времена реверберације пријемне просторије применом класичних метода описаних у SRPS EN ISO 3382-2, или новом методом описаном у SRPS EN ISO 18233. На крају поглавља су дати извештаји о резултатима мерења нивоа звука у пријемној просторији, мерење нивоа позадинске буке и времена реверберације и резултати прорачуна стандардизованог нивоа звучног притиска удара.

У трећем поглављу аутори разматрају проблематику мерења времена реверберације у слушаоницама. Начин и брзина опадања енергије звука у просторији је један од основних критеријума за оцену акустичког квалитета просторије. Стандард SRPS EN ISO 3382-2 утврђује две методе мерења: методу искључења извора буке и методу интегрисаног импулсног одзива. Задатак за одређивање времена реверберације је приказан за случај амфитеатра са и без слушалаца.

Појам звучне снаге и начини њеног одређивања су приказани у оквиру четвртог поглавља. Не постоји инструмент који би омогућио директно мерење звучне снаге, већ се она одређује индиректно – на основу мерења звучног притиска или интензитета звука, као и других одговарајућих величина које дефинишу окружење у коме се одређује звучна снага: слободно звучно поље; дифузно или реверберационо поље; актуелно окружење у коме је смештен извор звука. Постоје две групе стандарда које утврђују методе за одређивање звучне снаге: серија стандарда SRPS EN ISO 3740, заснована на мерењу звучног притиска и серија стандарда ISO 9614 заснована на мерењу интензитета звука. На конкретном примеру приказан је поступак одређивања звучне снаге извора применом: инжењерске методе; информативне методе; методе реверберационе просторије. Звучна снага је веома важна карактеристика звучног извора и у много случајева је услов за добијање различитих сертификата о квалитету производа као што су CE знак и слично.

Мерење и оцена буке у радној средини, сагледана је кроз буку као професионалну штетност, што је приказано у оквиру петог поглавља. Граничне и акционе вредности нивоа дневне изложености буци и критеријуми за оцену су приказане према Правилнику о превентивним мерама за безбедан и здрав рад при излагању буци. Приказане су величине за оцену слабљења личне заштитне опреме за заштиту слуха, као и процена ефикасности коришћења личне заштитне опреме. Основни циљ мерења буке у радној средини је одређивање нивоа изложености радника буци на радном месту и оцену стања буке поређењем са дозвољеним граничним и акционим вредностима утврђених стандардом SRPS EN ISO 9612:2016. Извештаји са резултатима мерења и прорачуна су приказани



крз дневни ниво изложености буци за номинални радни дан са применом личне заштите опреме за заштиту слуха.

У шестом поглављу је приказано мерење и оцена вибрација шака-рука. Дате су теоријске основе врста вибрација које се преносе на човека и величине за оцену вибрација шака-рука. Граничне и акционе вредности вибрација шака-рука дефинисане су Правилником о превентивним методама за безбедан и здрав рад при излагању вибрацијама. Одређивање изложености вибрацијама шака-рука је описано поступно од монтирања акцелерометра, његове локације и оријентације и временског интервала мерења. Мерни ланац, повезивање система и његова калибрација, поступак мерења и читавања мерења детаљно су приказани и објашњени.

### ЗАКЉУЧАК

Публикација обухвата шест поглавља која су заснована на савременим научним и стручним достигнућима из области којој припада. Свако поглавље обухвата теоријске и практичне смернице за реализацију лабораторијских вежби. Свака лабораторијска вежба садржи: теоријске основетретираног проблема, кратак приказ стандардизованих мерних поступака, описе мерног ланца, повезивања и подешавања инструмената, преглед литературе, дефинисан задатак за студента, адекватну форму за бележење мерних резултата и обрасце за прорачун потребних величина.


Рукопис „Бука и вибрације – приручник за лабораторијске вежбе“ аутора професора др Момира Прашћевића и професора др Дарка Михајлова, написан је по свим стандардима уџбеничке и научно-стручне публицистике. Имајући у виду све напред наведено, са задовољством препоручујем Сенату Универзитета у Нишу да поменути рукопис прихвати за штампање као приручник за лабораторијске вежбе за предмет „Бука и вибрације“ који се реализује на Факултету заштите на радуу Нишу на студијском програму „Инжењерство заштите на раду“. Публикација се препоручује као додатна литература и студентима из осталих области инжењерских наука који изучавају проблеме буке и вибрација.

У Краљеву, 01.04.2022. године

**РЕЦЕНЗЕНТ**

Др Бранко Радичевић, ванредни професор  
Факултета за машинство и грађевинарство у  
Краљеву Универзитета у Крагујевцу (ужа научна  
област: Производно машинство)





prof. dr Ivana Kovačić  
Fakultet tehničkih nauka  
Novi Sad

**RECENZIJA PUBLIKACIJE BUKA I VIBRACIJE –  
PRIRUČNIK ZA LABORATORIJSKE VEŽBE  
AUTORA PROF. DR MOMIRA PRAŠČEVIĆA I PROF. DR DARKA MIHAJLOVA**

Publikacija Buke i vibracije – priručnik za laboratorijske vežbe, autora prof. dr Momira Praščevića i prof. dr Darka Mihajlova sa Univerziteta u Nišu je originalna i sadržajem bogata publikacija posvećena laboratorijskim vežbama iz oblasti Buke i vibracija.

Publikacija je napisana na 166 strane, a obuhvata šest poglavlja – svako posvećeno po jednoj od šest laboratorijskih vežbi: pet ih je usmereno na teme iz oblasti Buke, a jedna na oblast Vibracija. U oblasti Buke obrađene su teme: 1. Određivanje izolacije od vazdušnog zvuka u terenskim uslovima (sa 21 numerisanom slikom, šest numerisanih tabela i sedam navoda literature); 2. Određivanje izolacije od zvuka udara u terenskim uslovima (sa šest numerisanih slika, pet numerisanih tabela i sedam navoda literature); 3. Merenje vremena reverberacije u slušaonicama (sa četiri numerisane slike, tri numerisane tabele i četiri navoda literature); 4. Određivanje zvučne snage izvora buke (sa četiri numerisane slike, šest numerisanih tabela i sedam navoda literature) i 5. Merenje i ocena buke u radnoj sredini (sa četiri numerisane slike, pet numerisanih tabela i pet navoda literature), dok je iz oblasti Vibracija obrađena tema Merenje i ocena vibracija šaka-ruka (sa 14 numerisanih slika, dve numerisane tabele i pet navoda literature).

Vredan doprinos autora, koji proističe iz njihovog dugogodišnjeg nastavnog i praktičnog ekspertskeg iskustva, predstavlja unificiranost metodologije. Naime, svaka laboratorijska vežba je predstavljena i organizovana tako da sadrži: teorijske osnove tretiranog problema, kratak prikaz standardizovanih mernih postupaka, opise mernog lanca, povezivanja i podešavanja instrumenata, pregled literature, definisan zadatak za studenta, adekvatnu formu za beleženje mernih rezultata, a na samom kraju su dati i obrasci za proračun potrebnih veličina. Na ovaj način autori pomažu čitaocu da se detaljno upozna sa problematikom tretiranja i izvođenja merenja, obrade i analize podataka, ali i da stekne veštine vezane za ovaj proces, uopšteno posmatrano.

Publikaciju odlikuje bogat i vizuelno atraktivan ilustracijski sadržaj koji se odnosi na instrukcije za postavljanje, podešavanje i korišćenje merne opreme, kao i na podatke koji se sa njom dobijaju ili sa nje očitavaju. Publikacije nanašem jeziku koja na ovakav način pomaže čitaocu da stekne znanje u ovoj oblasti, do sada nije bilo. U ovom smislu autori daju vredan doprinos pomeranju stanja u oblasti na nacionalnom nivou. Navedeni kvalitet ide u prilog činjenici da je publikacija urađena u okviru Erasmus+ projekta „Jačanje obrazovnih kapaciteta kroz izgradnju kompetencija i saradnje u oblasti inženjerstva buke i vibracija“, čiji je akronim SENVIBE, finansira ga Evropska komisija, a koordinira Univerzitet u Novom Sadu. Vodeći se ciljem SENVIBE projekta da se poboljšajui izgrade nacionalni obrazovni kapaciteti i kompetencije u rešavanju inženjerskih pitanja vezanih za buku i vibracije u životnoj i radnoj sredini, autori ovom publikacijom daju značajan doprinos ostvarenju navedenog cilja.

Autori navode da je pisanje publikacije proisteklo nakon modifikacije predmeta Buka i vibracije koji se realizuje na Fakultetu zaštite na radu u Nišu na studijskom programu Inženjerstvo zaštite na radu, u okviru kog su po prvi put od njegovog uspostavljanja uvedene i laboratorijske vežbe i to sa laboratorijskom opremom nabavljenom u okviru projekta SENVIBE. Publikaciju, osim studenata ovog studijskog programa, mogu koristiti i studenti i nastavnici drugih fakulteta i studijskih programa koji žele da se upoznaju i steknu znanja iz navedenih oblasti.

Recenzent čestita autorima na ostvarenom kvalitetu publikacije u pogledu originalnosti njenog sadržaja, osmišljenoj i dosledno sledejoj metodologiji, kao i na kreativnosti ostvarene pri kreiranju vizuelnog sadržaja. Kako publikaciju odlikuje visok naučno-stručni kvalitet i ispunjenost svih standarda kvaliteta u pogledu sadržaja, obima, strukture i jezika, recenzent predlaže Senatu Univerziteta u Nišu da publikaciju odobri za štampu u kategoriji pomoćni udžbenik.

Novi Sad, 8. aprila 2022.

prof. dr Ivana Kovačić



**Evaluation report template**

Erasmus + Project No598241-EPP-1-2018-1-RS-EPPKA2-CBHE-JP

**Strengthening educational capacities by building competences and cooperation in the field of Noise and Vibration Engineering**

**SENVIBE**

Reviewer:	Zvonko Rakarić
Executive summary	This document provides the review of the <b>Learning and teaching materials for labs in Mechanical Vibration (module of the Master Programme in Vibro-Acoustic Engineering – MAS VAE)</b>
External /Internal Evaluation Methodology	What has been done and how?  <i>The review was written based on The Practicum for laboratory exercises on Mechanical vibration in both digital and printed forms, as well as on the basis of two videos.</i>
Work Packages	
Deliverable/ Activity Ref. No	5.2. Development of e-learning, and b-learning materials for MAS VAE  7.2. Internal and external reviews processes and outcomes.
<b>Review of Learning and teaching materials for labs in Mechanical Vibration (module of the Master Programme in Vibro-Acoustic Engineering – MAS VAE)</b>	
<i>The Practicum on Mechanical vibration was published in both digital and printed forms. There are also two videos as a part of The Practicum. The digital form contains 112 pages. It consists of two parts, so that each part, being printed separately, refers to one laboratory exercise. In addition, there is a video for both exercises. The duration of the first exercise video is 5 minutes and 20</i>	



seconds. It describes in detail the equipment for performing the first exercise regarding the vibrations of a two-story structure model. The second video shows a detailed description of the basic elements of the second laboratory exercise about transverse vibration of the console, and lasts for 4 minutes and 5 seconds. The videos were made very professionally, precisely and clearly. As such, videos are excellent preparation for students before entering the laboratory. A detailed description of the experiments is provided in both digital and printed forms. It includes an explanation of the experimental structure; sketches of the structure and the corresponding mechanical model; a schematic of the experimental; a picture of the experimental setup and a brief explanation of all important devices and key terms. These parts were written very clearly and carefully, pictures, sketches and schemes are presented very clearly and are visually appealing. Both exercises contain a part related to the experimental procedures and a part devoted to the analysis and discussion of the obtained results. These two parts of the practicum, together with all previous ones, completely ensure that students not only perform the exercise themselves, but also conduct appropriate analysis and draw appropriate conclusions. Also, at the end of both exercises there is an Appendix, which completely covers all necessary theoretical elements for performing the exercises. The Appendices were written very clearly and in detail. As a particular note there are the Mathematica Wolfram codes. Finally, at the end of both exercises, there are References. The References are up to date and admirable. The Practicum is modern and impressive. The authors' rich experience in subject teaching, as well as their high expertise, have undoubtedly contributed to the high quality of this publication. Their desire to bring the subject closer to students in a systematic and methodological way is admirable. I firmly believe that the authors managed to achieve this.

Suggestions for improvements: *I have no suggestions for any improvement.*

## EVALUATION

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	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The material is created and prepared in such a way so as to contribute to the achievement of the educational goals of the module	Yes				
The material is original	Yes				
The material covers the issues and topics under consideration at the level appropriate for MSc	Yes				
The content of the learning material is harmonized and connected with the enclosed material (videos)	Yes				
Each lab has a clear and well-developed structure	Yes				
The material is presented appropriately	Yes				
The material contains relevant instructions and explanations	Yes				
The material contains special sequences of knowledge integration	Yes				
The material has the same graphic identity consistently implemented	Yes				

Place, date:

Novi Sad, 14.03.2022

Name and signature:

Zvonko Rakarić

**Evaluation report template**

Erasmus + Project No598241-EPP-1-2018-1-RS-EPPKA2-CBHE-JP

**Strengthening educational capacities by building competences and cooperation in the field of Noise and Vibration Engineering**

**SENVIBE**

Reviewer:	Nataša Trišović
Executive summary	This document provides the review of the <b>Learning and teaching materials for labs in Mechanical Vibration (module of the Master Programme in Vibro-Acoustic Engineering – MAS VAE)</b>  <i>PLEASE DO NOT CHANGE</i>
External /Internal Evaluation Methodology	What has been done and how?  <i>The review was written based on</i>  <i>1. Practicum in Mechanical Vibrations by Ivana Kovačić, Miodrag Zuković and Drago Radomirović</i>  <i>2. VideoLab1</i>  <i>3. VideoLab2</i>
<b>Work Packages</b>	
Deliverable/ ActivityRef. No	5.2. Development of e-learning, and b-learning materials for MAS VAE  7.2. Internal and external reviews processes and outcomes.  <i>PLEASE DO NOT CHANGE</i>
<b>Review of Learning and teaching materials for labs in Mechanical Vibration (module of the Master Programme in Vibro-Acoustic Engineering – MAS VAE)</b>	

I had the pleasure to review Learning and teaching materials for labs in Mechanical Vibration (a module of the Master Program in Vibro-Acoustic Engineering - MAS VAE).

The material was provided to me:

1. Practicum in Mechanical Vibrations by Ivana Kovačić, Miodrag Zuković and Drago Radomirović
2. VideoLab1
3. VideoLab2

The content of the practicum predominantly makes a detailed description of two laboratory exercises:

1. Forced oscillations of a system with several degrees of freedom of movement.
2. Oscillations of systems with infinitely many degrees of freedom of movement.

VideoLab1 and VideoLab2 are video supplements to the first and second exercises.

The practicum is designed as a publication that students fill out during the preparation of laboratory exercises.

Each laboratory exercise is characterized by the content that students can clearly follow and implement. They are given:

- Objectives of the exercise
- Description of the experiment
- Procedure for performing the experiment
- Analysis, calculation, and discussion
- Contributions of importance for the appropriate laboratory exercise.

The first laboratory exercise is dedicated to forced oscillations with several degrees of freedom. The goals of the exercise are:

1. Establishing a connection between the behavior of the structure in the laboratory setting with discrete mechanical behavior and a mathematical model of a system with multiple degrees of freedom of movement;
2. Identifying the resonant behavior of the structure;

3. Graphical representation of the change in the forced response of the structure with engine speed;
4. Understanding the possibility of using additional weight and its position for reducing the amplitude of the structure response;
5. Identify the limitations of the simplified model.

In addition to the description of the experimental setup, model, and procedures that need to be carried out, this material also contains appendices and references that should help the user fill in the given tables, draw the required graphics, and answer the questions asked. There is also space for taking notes where the student can independently enter additional information or data of interest. The publication is accompanied by an audio-video recording that prepares the user for the exercises.

The Description of Laboratory Exercise 1 is supported by 27 figures and 8 tables.

The second laboratory exercise is dedicated to free and forced transverse oscillations of the console, as a system with infinitely many degrees of freedom. The goals of the exercise are:

1. Establishing a link between motivation and response;
2. Graphic representation of responses in different ways and their interpretation;
3. Identification of modal resonances and modal console shapes;
4. Conducting a qualitative and quantitative assessment of damping in the system;
5. Understanding the possibility of using additional weight and its position without affecting the response of the structure.

In addition to the description of the experimental setup and model, the devices used and procedures to be carried out, this material also contains appendices and references, which should help the user to fill in the given tables, draw the required graphics and answer the questions asked. There is free space for notes where the user can independently enter additional information or data of interest.

The publication is accompanied by an audio-video recording that the user prepares for performing exercises.



The Description of Laboratory Exercise 2 is supported by 19 figures and 6 tables.

The models analysed in the exercises were carefully selected so that the conclusion related to the corresponding task can be drawn intuitively and clearly.

Thus, in laboratory exercise 1, a simplified and reduced replica of a building model with an unbalanced washing machine on the upper level was chosen, while in another laboratory exercise, an elastic rod clamped at one end representing a console performing transverse oscillations is analysed. The exercises are well designed and insightful. This course will be a valuable resource for the Faculty of Mechanical Engineering.

Suggestions for improvements:

A particularly important fact that should be emphasized is the presence of laboratory exercises with adequate laboratory equipment. Although the course is superbly executed, there is always space for improvement of the program.

In frame of the two videos where the procedures of making laboratory exercises are extraordinarily explained, a part "questions for the audience" can also be included. It is possible that students would get more involved in the given experiment and suggest their own solutions. In accordance with the number of lessons and available equipment, it is possible to add another experiment in the future (longitudinal oscillations of a thin string, elastic rod, torsional oscillations of elastic bodies, etc.).

Certainly, this course is a great example of how an excellent result can be achieved with the cooperation of the university education establishments and with the support of the EU, from which students will have the opportunity to come out with tangible theoretical and practical knowledge.

## **EVALUATION**

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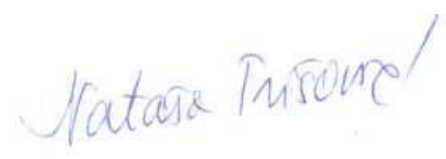
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The material is created and prepared in such a way so as to contribute to the achievement of the educational goals of the module	✓				
The material is original		✓			
The material covers the issues and topics under consideration at the level appropriate for MSc	✓				
The content of the learning material is harmonized and connected with the enclosed material (videos)	✓				
Each lab has a clear and well-developed structure	✓				
The material is presented appropriately	✓				
The material contains relevant instructions and explanations	✓				
The material contains special sequences of knowledge integration	✓				
The material has the same graphic identity consistently implemented	✓				

Place, date:

Belgrade, March 21<sup>st</sup> 2022

Name and signature:

Nataša Trišović



**Evaluation report template**

Erasmus + Project No598241-EPP-1-2018-1-RS-EPPKA2-CBHE-JP

**Strengthening educational capacities by building competences and cooperation in the field of Noise and Vibration Engineering**

**SENVIBE**

Reviewer:	Professor Ivan Luković
Executive summary	This document provides the review of the <b>ICT Platform (e-SENVIBE Moodle)</b>  <i>PLEASE DO NOT CHANGE</i>
External /Internal Evaluation Methodology	What has been done and how?  <i>The review was written based on:</i> <ul style="list-style-type: none"> <li>- <i>the Project Web presentation,</i> URL: <a href="https://senvibe.uns.ac.rs/project/#">https://senvibe.uns.ac.rs/project/#</a></li> <li>- <i>insight into the e-SENVIBE Moodle learning platform,</i> URL: <a href="https://www.e-senvibe.senvibe.uns.ac.rs/">https://www.e-senvibe.senvibe.uns.ac.rs/</a></li> </ul>
<b>Work Packages</b>	
Deliverable/ Activity Ref. No	<i>PLEASE DO NOT CHANGE</i>
<b>Review of ICT Platform (e-SENVIBE Moodle)</b>	
General opinion:  The e-SENVIBE platform (or e-SENVIBE for short) is well structured and developed in a way to support in a high quality way the additional project goal "to introduce new teaching methodologies, including the use of e-tools and b-learning approaches, aiming either at facilitating more intensive interaction between teachers and students/trainees or enabling them to fit the activities planned into,	

their everyday activities with a possibility for distance learning or repetitive insights into learning material, including experiments, via an ICT platform that will be created." By e-SENVIBE, an ICT platform for a support of the SPO1 - SPO4 project goals is provided in a satisfactory way.

Additional remarks:

Home page:

- A general description of the platform is not informative enough and not motivating for a new user. See my recommendations for possible improvements, given in the next section of the report.
- Under the title Course Categories, each topic contains disparate kind of information, while the title suggests that we will obtain a list of courses under each topic.
- E.g., in Undergraduate Courses the first we obtain some topics in categories "Courses on Noise and Vibration" and "Courses on Physical/Technical Physics", but not sole courses. In MSc programme in VAE and LLL Courses, we really obtain the list of concrete courses, while in No&Vib Hub it is some list of topics or lectures. By this, the title Course Categories is inappropriate and does not intuitively direct a visitor to a proper set of information.

Undergraduate Courses Category:

- It is not clear, if this category just offers selected topics in categories "Courses on Noise and Vibration" and "Courses on Physical/Technical Physics", or there are also complete courses included in the undergraduate level of studies.

LLL Courses Category:

- In this category, I can notice just one course listed. Is it planned by the project goals providing more than one course here? If so, it can be written in a textual description of this category, at the beginning.
- I can also see a subcategory Course 2, but it is empty. As such, please remove the empty Course 2.
- In the title of Course 1, the note "(PRISTUP SE ZATVARA PRE ZAVRŠNOG TESTA!)" is not a part of the title! My suggestion is to remove the note from the title and put it general information. Also, the rules and outcomes regarding this notion are to be clearly explained in the preamble of the course.

MSc programme in VAE Category:

- In all the courses of Semester II, as I approach the course content, I just obtain the message "that the course is not allowed to be independently selected". I cannot understand this message, and just I can notify that the course content is not available to me, as it is for the courses in Semester I. I cannot judge if it is a

defect in e-SENVIBE, or just a message is not informative enough for me. Anyway, a clear description how it is possible to approach the courses in Semester II is needed.

No&Vib Hub Category:

- It is extremely important here to approach the textual description of this category immediately upon approaching the category. What does it mean a list of lecturers at the first approach of this category?
- A textual description in the preamble of the category should clearly indicate and explain all subcategories included in this category.

In conclusion, I believe that e-SENVIBE is a very useful ICT platform for a satisfactory support of all planned e-learning / b-learning activities in the scope of the project goals. By customizing the Moodle e-learning platform to provide e-SENVIBE, the project outcome regarding the development of the appropriate ICT resources for a support of e-learning / b-learning is fully provided. Some improvements of e-SENVIBE are always possible and can further benefit to the project goals.

Suggestions for improvements:

Home page:

- A general description of the e-SENVIBE platform given in the home page can be improved. Apart from basic project info given here, which is nice, a new section of the description can be created to describe informally the whole structure of the e-SENVIBE platform.
- For example, here it should be textually explained the content of all three components of the platform. If I am an undergraduate student, I need some introductory, textual info what I will find in the Undergraduate Courses category and how it can be useful for me. The same holds for the other two categories: MSC Programme in VAE and LLL Courses.
- It should be described here, to whom exactly No&Vib Hub is aimed at, and what kind of information this section of the e-SENVIBE platform contains.
- If possible, it would be nice to embed here a diagram representation of the hierarchy of the whole e-SENVIBE structure.
- After opening each of the available categories, such as Undergraduate Courses, MsC programme in VAE, LLL Course, and No&Vib Hub, a more detail textual description of each category is to be given the first and then to provide the links to the subtopics of a category.
- I would prefer a better visual organization of the central part of the home page (font colors, font styles and sizes, titles, "nice" tabular and visual representations).

**General:**

- For each course in all of the categories, I could not have found any general information about the common course rules and ways of collecting points, finalgrades, and expected knowledge outcomes through the course execution.

From my point of view, it is a must and it should be inevitably added for all the courses included in e-SENVIBE.

- My recommendation is to engage English and Serbian professionals for a proofreading of the general textual descriptions in e-SENVIBE.
- I am not quite sure if mixing English and Serbian in the presentation of textual information is a good approach. If I generally select English, Serbian (Latin) or Serbian (Cyrillic) letters, nothing special is happened – everything is presented in Latin letters, mostly in Serbian, and some titles possibly in English. It should be fixed, and the textual information are to be consistently written in the same language and with the same letters.

**EVALUATION**

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The model is easily accessible	X				
The description and the aim of the Moodle at their entrance is clear			X		
The division of the model is clear			X		
The material presented the part for Undergraduate courses is well organized		X			
The content of the material presented in the part for Undergraduate courses is appropriate for end-users (undergraduate students)	X				
The material presented in the part for LLL courses is well organized	X				

The content of the material presented in the part for LLL courses is appropriate for end-users (LLL attendees)	X				
The material presented in the part for MSc in Vibro-Acoustic Engineering is well organized	X				
The content of the material presented in the part for MSc in Vibro-Acoustic Engineering is appropriate for end-users (MSc students)		X			
The material presented in the part for No&Vib Hub is well organized		X			
The content of the material presented in the part for No&Vib Hub is appropriate for end-users (No&Vib Hub members)	X				
The content of the Moodle as a whole is rich		X			
The Moodle as a whole is original	X				
The Moodle as a whole is functional	X				
The Moodle has the same graphical identity consistently implemented		X			

Place, date:

Name and signature:

Novi Sad, 3-MAR-2022  
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ИВАН ЛУКОВИЋ





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**Evaluation report template**

Erasmus + Project No598241-EPP-1-2018-1-RS-EPPKA2-CBHE-JP

**Strengthening educational capacities by building competences and cooperation  
in the field of Noise and Vibration Engineering**

**SENVIBE**

Reviewer:	D. Šumarac Pavlović
Executive summary	This document provides the review of the <b>Learning and teaching materials for MSc course in Vibro acoustic engineering</b>  <i>PLEASE DO NOT CHANGE</i>
External /Internal Evaluation Methodology	What has been done and how?  <i>The review was written based on materials available on the website of the courses: Fundamentals of Technical Acoustics and Electroacoustics. The review refers to the available presentations, the literature offered and the structure of the exam requirements.</i>
Work Packages	
Deliverable/ Activity Ref. No	Development of learning and teaching materials for MSC VAE - <b>Acoustics</b>  7.2. Internal and external reviews processes and outcomes.  <i>PLEASE DO NOT CHANGE</i>
<b>Learning and teaching materials for master courses in VAE</b>	
The course Fundamentals of Technical Acoustics covers a wide range of topics, starting with understanding the mechanism of the creation and propagation of sound, sound waves. All relevant phenomena that follow the propagation of sound waves through different media are covered.	
The time and frequency analysis of various audio signals (speech and music) as	

well as the basis for understanding the complex mechanism of human sound perception are covered in detail.

The acquired knowledge was applied in specific areas: room acoustics and building acoustics. The topic related to different disciplines in the field of ultrasound was specially addressed. This course covers the broad application of sound in various engineering disciplines.

The Electroacoustics course introduces students to the working principles of electroacoustic transducers, and the physical quantities used to characterize them. Microphones, speakers and headphones, which represent the basis of all complex audio systems, are covered. Within the course, various concepts of speaker and microphone systems are analysed in detail. Students are introduced to measurement techniques for measuring and characterizing audio devices and acoustic environments.

Both courses are covered by suggested literature that provides additional knowledge from all thematic areas covered by the mentioned courses

Suggestions for improvements in the proposed courses relate primarily to the introduction of more practical classes in which students would directly learn about different measurement techniques and thus gain a clearer insight into the nature of the physical phenomena discussed. Also, the courses could be improved by introducing specialized software tools that are used in engineering practice to design different systems, as well as software tools for measurement in different areas of acoustics.

## EVALUATION

MSC Course in VAE	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Will the L&T materials be valuable for the students/teachers?	x				
Is the content of the L&T materials appropriate for the level of the master study?		x			
Is the L&T materials enable the expansion of knowledge acquired in undergraduate studies?		x			
Is the content of the L&T materials relevant to the learning outcomes of the engineering	x				



departments?					
Is the content of the L&T materials detailed enough?		x			
Is the content of the L&T materials appropriate for the topic?		x			
Does the content of L&T materials have the appropriate scope and content?		x			
Is the content of the L&T materials up-to date?		x			
Does the content of the L&T materials have a logical structure	x				
Does the content of the L&T materials avoid repetition and includes introduction to the irrelevant the topics?	x				
Are L&T materials realized at the appropriate technical level?		x			

Place, date:

Name and signature:

Belgrade, 03.10.2022

D. Šumarac Pavlović

