BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
FACULTY OF MECHANICAL ENGINEERING

SUBJECT DATASHEET

I. SUBJECT DESCRIPTION

1. GENERAL DATA

1.1. Subject name (in Hungarian, in English)

Technical Acoustics and Noise Control ● Technical Acoustics and Noise Control

1.2. Neptun code

BMEGEÁTBG05

1.3. Type

study unit with contact hours

1.4. Course types and number of hours (weekly / semester)

course type	number of hours (weekly)	nature (connected / stand-alone)
lecture (theory)	1	-
exercise	-	coupled
laboratory exercise	1	-

1.5. Type of assessments (quality evaluation)

mid-term grade

1.6. ECTS

3

1.7. Subject coordinator

name:	Dr. Suda Jenő Miklós
post:	adjunct
contact:	suda.jeno.miklos@gpk.bme.hu

1.8. Host organization

Department of Fluid Mechanics (http://www.ara.bme.hu)

1.9. Course homepage

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG05

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory elective

1.12. Direct prerequisites

Strong prerequisite:	-
Weak prerequisite:	-
Parallel prerequisite:	-
Milestone prerequisite:	-
Excluding condition:	BMEGEÁTBG15, BMEGEÁTMKK3

(the subject cannot be taken if you have previously completed any of the following subjects or groups of subjects)

2. AIMS AND ACHIEVEMENTS

2.1. Aim

The course aims to present a description of phonological phenomena. To prepare students to perform basic acoustic and noise protection design and measurement tasks in the mechanical engineering practice. The course aims to present a description of phonological phenomena. With the acquired knowledge, students will be able to recognize simple engineering technical acoustic and noise reduction problems, solve tasks, perform simple noise protection planning and measurement tasks, and be able to develop their acoustic knowledge to solve more complex tasks independently. The knowledge of the subject lays the foundation for the successful completion of the master's level acoustics subjects.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- The student knows the subject of acoustics, the division of fields, the concept of sound, its dual nature, and the phenomena and sound that indicate this in different mediums, as well as as a function of frequency and effective sound pressure.
- The student knows the linear relationship between the variables describing the sound field, the mathematical and physical consequences of linearity, the speed of sound, the homogeneous acoustic wave equation.
- The student knows the general plane wave solution of the wave equation in free space, the trigonometric and exponential forms of harmonic waves, the solution of the wave equation in finite space, organ pipe and room eigen-frequencies.
- The student recalls the similarity of sound fields, the determination of the Helmholtz number from the similarity numbers of fluid mechanics, the important composition of harmonic waves, the concept of standing wave and beat.
- The student recalls acoustic resonators and their fields of application, critical frequency of Helmholtz resonator, harmonic analysis, sound spectrum, octave and third band resolution, concepts of pitch, tone, consonance and dissonance.
- The student recalls the energetic conditions in acoustics, volumetric sound energy density, sound intensity, sound power, effective sound pressure quantities, description with levels, operations with levels.
- The student is informed about spherically symmetric sound field, monopole, dipole, longitudinal and lateral quadrupole sound sources, and acoustic source model laws.
- The student knows the description of sound propagation in free space, the far-field approximation of sound sources, the loss processes of sound waves in air, and the meteorological events influencing sound propagation.
- The student is informed with respect to the description of sound propagation across a medium boundary in the case of perpendicular and oblique incidence, transmission loss of single-layer walls, with parts controlled by stiffness, damping and mass, resonance and coincidence frequencies.
- The student is aware of the description of sound propagation processes in channels, higher modes, the acoustic effects of sudden channel cross-section change, sudden tube termination, exponential horn, expansion chamber,

side branch resonator.

- The student is familiar with the calculation of sound fields with an energetic acoustic approach, the concept of direct and reflected sound field, the equivalent absorption area, the concepts of room constant and reverberation time.
- The student is aware of the subject of noise protection, the effect of noise on the human body, the meaning of subjective acoustic metrics, the general methodological principles of noise protection, the way of reducing noise of mechanical / fluid mechanical / thermal origin.
- The student has knowledge of noise abatement methods for free and bounded spaces and individual noise protection devices.
- The student has knowledge of acoustic measuring instruments, microphones, analyzers, the use of calibrators, the characteristics of an un-echoic room and a reverberation chamber, the determination of on-site noise exposure, and the sound power of equipment.
- The student names the single value characteristics of sound propagation, the concepts of transmission loss, noise reduction, insertion loss and impedance.

B. Ability

- Able to solve simple engineering tasks in the field of technical acoustics.
- Able to carry out simple noise protection design and measurement tasks.
- Able to further develop their knowledge of acoustics to solve more complex tasks.
- The student interprets the similarity of sound fields, the determination of the Helmholtz number from the similarity numbers of fluid mechanics, the characteristic complex harmonic waves, the concept of standing waves and beating.
- The student identifies acoustic resonators, the critical frequency of Helmholtz resonators, areas of application, harmonic analysis, spectral analysis, octave and one-third octave band resolution, and the concepts of pitch, tone, consonance, and dissonance.
- The student evaluates the energetic conditions in acoustics, the volumetric sound energy density, sound intensity, sound power, effective sound pressure quantities, the use of levels in acoustics, operations with levels, the concept of sound propagation, inhibition, and noise reduction.
- The student interprets the characteristics of the spherically symmetric sound field, monopole, dipole, longitudinal and lateral quadrupole sound sources, and acoustic source model laws.
- The student interprets the description of sound propagation in the free field, the remote approximation of point and line-like sound sources, the loss processes of sound waves in various materials, and the meteorological events influencing outdoor sound propagation.
- The student defines the description of sound propagation across a fluid boundary in the case of perpendicular and oblique incidence, sound insulation of single-layer walls, resonance and coincidence frequencies with parts controlled by stiffness, damping, and mass.
- The student outlines the description of sound propagation processes in channels (higher modes, sudden channel cross-section change, sudden tube termination, exponential funnel, expansion drum, side branch resonator with acoustic effects).
- The student calculates sound fields using an energetic acoustic approach (knowing the concepts of direct and reflected sound field, equivalent absorption surface, room constant, and reverberation time).
- The student analyzes the subject of noise protection, the effect of noise on the human body, the meaning of subjective acoustic metrics, the general methodological principles of noise protection, the noise of mechanical/fluid mechanical/thermal origin, and the means to reduce them.

- The student identifies noise reduction methods for free and confined spaces, and individual noise protection devices, acoustic measuring devices, microphones, analyzers, and calibration equipment important in mechanical engineering.
- The student distinguishes between the characteristics of an anechoic chamber and a reverberation chamber, the tools required to determine the on-site acoustic loading, and the sound power of equipment.
- The student identifies the one-dimensional characteristics of sound propagation, the concepts of sound attenuation, noise reduction, insertion loss, and impedance.

C. Attitude

- Initiates collaboration with the instructor and fellow students to expand knowledge.
- The student expands their knowledge with the continuous acquisition of knowledge and an open-minded attitude.
- The student is open to the in-depth use of modern information technology tools.
- The student seeks to learn about and routinely use the tools needed to solve fluid mechanics problems.
- The student strives for independent, accurate, error-free, and responsible solutions.
- The student strives to apply the principles of reliable operation, productivity, cost and time efficiency, energy efficiency and environmental awareness in solving fluids engineering tasks.
- The student develops their ability to align ethical engineering attitudes and long-term win-win considerations with market competition.

D. Independence and responsibility

- Independently thinks through the tasks and problems defined in the subject and solves them based on given resources.
- Accepts well-founded critical remarks and criticisms.
- In some situations, as part of a team, the student works with fellow students to solve tasks.
- The student supports a systematic approach and complex thinking in their thinking.
- The student is critical of engineering commitments of inadequate quality.

2.3. Teaching methodology

Lectures, presentation of theoretical curriculum with computational examples, supplemented by laboratory exercises, written and oral communication, use of IT tools and techniques, optional independent and group work laboratory measurement tasks. Presentation of theory and numerical examples 14 times a semester, two hours a week. Performing simple acoustic measurements in the laboratory exercises, from which a measurement report is prepared.

2.4. Support materials

a) Textbooks

Gábor Koscsó: Technical Acoustics and Noise Reduction (electronic textbook), 2021, ISBN

Tamás Lajos: Fundamentals of Fluid Mechanics. 2015, ISBN 978 963 12 2885 4.

AP Dowling, JE Ffowcs Williams: Sound and Sources of Sound, Ellis Horwood Limited (1990), ISBN: 0-85312-400-0

b) Lecture notes

Gábor Koscsó: Technical Acoustics and Noise Reduction (electronic textbook), 2021, ISBN

Dr. Tibor Szentmártony Dr. Imre Kurutz: Basics of Technical Acoustics, manuscript, Textbook, Budapest, 2005, note number: J 4-970

c) Online materials

Example library, calculation excercise collection: http: //

www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG05

https://mersz.hu/ (Gábor Koscsó: Technical Acoustics and Noise Reduction (electronic textbook), 2021)

2.5. Validity of the course description

Start of validity:	2025. January 1.
End of validity:	2029. July 15.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Writing an end-of-semester exam, completing an oral evaluation, and completing a measurement task: 80 points can be obtained on the end-of-semester exam, the qualification of the oral evaluation is passed or failed, or a maximum of 15 points. The necessary condition for obtaining the mid-semester grade is attaining at least a sufficient level of the points on the end-of-semester exam, 40% (32 points), and the passing of the oral evaluation. It is possible to retake the end-of-semester exam and the oral evaluation once on the 15th week.

3.2 Assessment methods

A. Detailed description of mid-term assessments

Mid-term assessment

type: summative assessment

count: 1

purpose, description: Writing an end-of-semester exam, completing an oral evaluation, and completing a measurement task: Writing an end-of-semester exam: 80 points can be obtained on the end-of-semester exam. The necessary condition for obtaining the mid-semester grade is attaining at least a sufficient level of 40% (32 points) of the score on the end-of-semester exam. It is possible to retake the end of- semester exam once on the 15th week of the semester.

B. Detailed description of assessments performed during the examination period (if relevant)

Elements of the exam:

1. written partial exam
   -
2. oral partial exam
   -
3. practical partial exam
   -
4. inclusion of mid-term results
   -

3.3 The weight of mid-term assessments in signing or in final grading

identifier	weight
Mid-term assessment	100 %

3.4 The weight of partial exams in grade (if relevant)

type	weight
written partial exam	0 %
oral partial exam	0 %
practical partial exam	0 %
inclusion of mid-term results	0 %

3.5 Determination of the grade

grade ● [ECTS]	the grade expressed in percents
very good(5) ● Excellent [A]	above 90%
very good(5) ● Very Good [B]	85% .. 90%
good(4) ● Good [C]	70% .. 85%
satisfactory(3) ● Satisfactory [D]	55% .. 70%
sufficient(2) ● Pass [E]	40% .. 55%
insufficient(1) ● Fail [F]	below 40%

The lower limit specified for each grade already belongs to that grade.

3.6 Attendance and participation requirements

Must be present at at least **70%** (rounded down) of lectures.

At least **70% of** laboratory practices (rounded down) must be actively attended.

3.7 Special rules for improving, retaken and replacement

The special rules for improving, retaken and replacement shall be interpreted and applied in conjunction with the general rules of the CoS (TVSZ).

Need mid-term assessment to individually complete?

yes

The way of retaking or improving a summary assessment for the first time:

each summative assessment can be retaken or improved

Is the retaking-improving of a summary assessment allowed, and if so, than which form:

retake or grade-improving exam possible for each assesment separately

Taking into account the previous result in case of improvement, retaken-improvement:

out of multiple results, the best one is to be taken into account

3.8 Study work required to complete the course

Activity	hours / semester
participation in contact classes	28
mid-term preparation for practices	7
preparation for summary assessments	16
additional time required to complete the subject	39
summary	**90**

3.9. Validity of subject requirements

Start of validity: 2023. April 16.

End of validity: 2029. July 15.

4. ADDITIONAL INFORMATION

4.1 Primary course

The primary (main) course of the subject in which it is advertised and to which the competencies are related:

Environmental engineering

4.2 Link to the purpose and (special) compensations of the Regulation KKK

This course aims to improve the following competencies defined in the Regulation KKK>

a) knowledge

- Ismeri a környezetvédelmi szakterület műveléséhez szükséges általános és specifikus matematikai, természet- és társadalomtudományi elveket, szabályokat, összefüggéseket.
- Korszerű informatikai ismeretek birtokában használni tud szakmai adatbázisokat és specializációtól függően egyes tervező, modellező, szimulációs szoftvereket.
- Ismeri a környezetvédelmi szakterület tanulási, ismeretszerzési, adatgyűjtési módszereit, azok etikai korlátait és problémamegoldó technikáit.

b) ability

- Képes a környezeti elemek és rendszerek korszerű mérőeszközökkel történő mennyiségi és minőségi jellemzőinek alapfokú vizsgálatára, mérési tervek összeállítására, azok kivitelezésére és az adatok értékelésére.
- Képes környezeti hatásvizsgálatok végzésére és hatástanulmányok összeállításában történő részvételre.
- Képes a gyakorlatban is alkalmazni a szakterületéhez kapcsolódó munka- és tűzvédelmi, biztonságtechnikai területek előírásait, követelményeit.

c) attitude

- Vállalja és hitelesen képviseli a környezetvédelem társadalmi szerepét, alapvető viszonyát a világhoz.
- Együttműködik a környezetvédelemmel foglalkozó társadalmi szervezetekkel, de vitaképes az optimális megoldások kidolgozása érdekében.
- Nyitott a szakmájához kapcsolódó, de más területen tevékenykedő szakemberekkel való szakmai együttműködésre.

d) independence and responsibility

- Felelősséget vállal a társadalommal szemben a környezetvédelmi téren hozott döntéseiért.
- Váratlan döntési helyzetekben is önállóan végzi környezetvédelmi feladatait, irányítja a környezetvédelmi szakmai munkát.
- Szakmai feladatainak elvégzése során együttműködik más (elsődlegesen gazdasági és jogi) szakterület képzett szakembereivel is.

4.3 Prerequisites for completing the course

Knowledge type competencies

(a set of prior knowledge, the existence of which is not obligatory, but greatly facilitates the successful completion of the subject)	-

Ability type competencies

(a set of prior abilities and skills, the existence of which is not obligatory, but greatly contributes to the successful completion of the subject)	-