**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)*

**Acoustics II. (PhD) ● Acoustics II. (PhD)**

*1.2. Neptun code*

**BMEGEÁT4A24**

*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) | 2 | - |
| exercise | - | - |
| laboratory exercise | - | - |

*1.5. Type of assessments (quality evaluation)*

exam

*1.6. ECTS*

3

*1.7. Subject coordinator*

| | |
|---|---|
| name: | Dr. Horváth Csaba (71949162105) |
| post: | adjunct |
| contact: | horvath@ara.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/BMEGEAT4A24/

*1.10. Course language*

hungarian

*1.11. Primary curriculum type*

komplex vizsga tárgycsoport PhD tárgy

*1.12. Direct prerequisites*

Strong prerequisite: -

Weak prerequisite: -

Parallel prerequisite: -

Milestone prerequisite: -

Excluding condition: -

(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 introduce the students to the areas of acoustics required for a Ph.D. level knowledge of the subject. Depending on the individual doctoral research topic and the student's interest, topics detailed in the competencies of the course will be covered, as agreed upon with the lecturer. The course aims to supplement the acoustic knowledge of doctoral students, emphasizing numerical acoustics and state-of-the-art acoustic measurement methods.

### *2.2. Learning outcomes*

Competences that can be acquired by completing the course:

A. Knowledge

- The student is familiar with free field acoustics in a stationary fluid: orders of magnitude, the wave equation and sound sources, Green's function and its integral form.
- Knows the topics related to inverse problems and sound source unambiguity.
- The student is familiar with the basic subject area of the wave equation.
- Knows the concepts of acoustic energy and impedance.
- Recalls the free field Green's function and its application.
- The student is aware of the multipole decomposition and examples for it, as well as its effect on the sound transmitted to the observer.
- The student is aware of the effect of the Doppler effect on the sound transmitted to the observer.
- The student has knowledge regarding advanced acoustic measurement methods and can apply them.
- Informed about aeroacoustic analogies: Lighthill analogy, Curle formulation, Ffowcs Williams-Hawkings formulation, choice of aeroacoustic variable.
- The student systematizes the hierarchy of numerical aeroacoustic simulations: Direct noise calculation, hybrid methods, broadband noise source models.

B. Ability

- Utilizes the concepts related to the subject and the research topic area.
- Analyzes the available domestic and international literature sources in the field.
- Interprets the characteristics of the flow space characteristic of the subject area and the factors influencing them.
- The student is able to derive and calculate the quantities related to the subject and their research topic, specific to their field of science.
- The student identifies the parameters related to the subject and their research topic, characteristic of the field of fluid mechanics, and the possibilities of their theoretical and practical modification.
- The student can apply fluid mechanics modeling related to the subject and related research topics.
- The student can apply the numerical modeling knowledge of the subject and their research topic, which is important in fluid mechanics.
- The student can identify key issues related to the subject and their research topic related to important factors, parameters, and physical characteristics in fluid mechanics.

- Selects the appropriate methods for the specific fluid mechanics problem.
- Outlines the current engineering solutions, key theoretical issues, and state-of-the-art practical solutions of the subject and the research topic area.

C. Attitude

- The student continuously monitors their work, results, and conclusions.
- The student expands their knowledge of acoustics by continuously acquiring knowledge.
- Open to the use of information technology tools.
- The student seeks to learn about and routinely use the tools needed to solve acoustic problems.
- The student develops their ability to provide accurate and error-free problem solving, engineering precision, and accuracy.
- The student strives to carry out engineering assignments with high quality and makes a decision based on careful consideration.
- The student monitors changes in the social, economic, and political system.
- The student publishes results in accordance with the rules of the profession.
- The student publishes opinions and views without offending others.

D. Independence and responsibility

- Collaborates with the instructor and fellow students to expand knowledge.
- Accepts well-founded professional and other critical remarks.
- In some situations, as part of a team, the student works with their fellow students to solve tasks.
- With the student's knowledge, makes responsible, informed decisions based on analyzes.
- The student feels responsible for the sustainable use of the environment, and for present and future generations.
- The student is committed to the principles and methods of systematic thinking and problem-solving.

*2.3. Teaching methodology*

The lectures of the subject are held weekly, at a given pre-arranged time. The portions of the course related to the individual research topics of the students are presented in the framework of a consultation, which helps the student independently acquire the information related to their area of research. Students are given an individual research topic related to their research topic during the semester, which they must solve during the semester and report on the outcomes. Consultation regarding the individual research topics is possible within the framework of the lectures or beyond that.

*2.4. Support materials*

a) Textbooks

Tamás Lajos: The basics of fluid dynamics. (Tamás Lajos, 2015.) ISBN 978 963 12 2885 4.

Stewart Glegg and William Devenport, Aeroacoustics of Low Mach Number Flows: Fundamentals, Analysis, and Measurement, Academic Press, 2017, London, ISBN 978-0-12-809651-2

Thomas J. Mueller, Aeroacoustic Measurements, Springer-Verlag, 2002, Berlin, ISBN 978-3-642-07514-8 ISBN 978-3-662-05058-3 (eBook).

b) Lecture notes

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c) Online materials

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEAT4A24/

*2.5. Validity of the course description*

Start of validity: 2020. February 15.

| | |
|---|---|
| End of validity: | 2024. December 31. |

# II. SUBJECT REQUIREMENT

## 3. ACHIEVEMENT CONTROL AND EVALUATION

*3.1 General rules*

During the semester, the student solves an independent research assignment closely related to their own doctoral research topic. During the semester, the theoretical lectures give each student the theoretical knowledge and methodologies needed to solve the problems. Students work independently on their own assignments, and the lecturer is regularly consulted as they progress. At the end of the semester, students present the results in front of each other and prepare documentation. At the end of the semester, the resulting grade of the oral exam is comprised of the grade for the completion of the semester assignment and the quality of the presentation.

*3.2 Assessment methods*

***A. Detailed description of mid-term assessments***

Mid-term assessment

type: formative assessment, point-in-time personal act

count: 1

purpose, description: An individual research assignment is to be carried out during the semester, which is related to the student's Ph.D. research and helps them deepen their acquisition of the curriculum through theoretical and practical calculations and derivations. The individual research assignment aims to examine the existence of knowledge, ability, attitude, and learning outcomes belonging to the autonomy and responsibility competence groups. Upon successful completion of the task, the student stabilizes their knowledge acquired in the lectures.

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

Elements of the exam:

1. written partial exam

obligation: mandatory (partial) exam unit, failing the unit results in fail (1) exam result

description: In the written exam, the lecturer gives three questions and/or calculation tasks from the curriculum, which the students develop over a given period of 120 minutes. While carrying out the written examination tasks, the students taking the written examination may not use any aids not permitted by the instructor. They may only write their answers on the official examination sheets issued by the department.

2. oral partial exam

obligation: mandatory (partial) exam unit, failing the unit results in fail (1) exam result

description: During the oral exam, the lecturer asks three questions from the syllabus, which the students answer in detail on the board after a few minutes of preparation time. In order to prepare the answer to the oral examination question, the students taking the oral examination may not use any aids not permitted by the instructor. Students can take the oral exam after a successful written exam.

3. practical partial exam

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4. inclusion of mid-term results

obligation: mandatory (partial) exam unit, failing the unit results in fail (1) exam result

description:The method for calculating the grades from the mid-semester assignment grades is as follows: The score obtained based on the mid-semester individual research assignment makes up 50% of the exam mark. The grade of the mid-semester individual research assignment is worth 50% of the exam mark. The score obtained on the midsemester individual research assignment is therefore included in the calculation of the exam grade with a weight of 50%. The elaboration of the mid-semester individual research assignment is a precondition for being eligible for the exam. It is therefore one of the preconditions for a successful exam. There are no other means to receive credit for the midsemester individual research assignment on the final exam mark.

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

| **identifier** | **weight** |
|---|---|
| Mid-term assessment | 100 % |

The condition for signing is that the score obtained in the mid-year assessments is at least **40%**.

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

| **type** | **weight** |
|---|---|
| written partial exam | 25 % |
| oral partial exam | 25 % |
| practical partial exam | 0 % |
| inclusion of mid-term results | 50 % |

*3.5 Determination of the grade*

| **grade ● [ECTS]** | **the grade expressed in percents** |
|---|---|
| very good(5) ● Excellent [A] | above 95% |
| very good(5) ● Very Good [B] | 85% .. 95% |
| 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.

*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).

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

*new result overrides previous result*

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

*partial assesment(s) in this group can be improved or repeated once up to the end of the repeat period*

*3.8 Study work required to complete the course*

| **Activity** | **hours / semester** |
|---|---|
| participation in contact classes | 28 |
| exam preparation | 21 |
| additional time required to complete the subject | 41 |
| **summary** | **90** |

*3.9. Validity of subject requirements*

Start of validity: 2020. February 15.

End of validity: 2024. December 31.

## 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:

mechanical_engineering_sciences_PhD_programme

*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

b) ability

c) attitude

d) independence and responsibility

*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) | B.Sc. and M.Sc. level fluid mechanics theory and fluids engineering theory; knowledge of the physical and numerical modeling of flows; comprehensive knowledge of the design, implementation, and evaluation of flow simulations. |

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) | Independent, creative engineering problem-solving ability, ability to recognize and analyze the essential connections between complex flow phenomena and flow engineering processes |