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)

Fluid Mechanics II. (PhD) ● Fluid Mechanics II. (PhD)

1.2. Neptun code

BMEGEÁT4A09

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:	Kristóf Gergely János (71957915589)
post:	associate professor
contact:	kristof@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/BMEGEAT4A09/

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

An overview of the basic equations of fluid science. Vortex transport equation, Helmholtz analogy. Potential flows. Flow in porous materials, percolation, leakage flow. Elemental flows, Zhukovsky transformation, formation of buoyancy on wings. Boundary layers, the boundary layer equation, similarity solutions for a laminar boundary layer. Formation of turbulence. Turbulent boundary layers, numerical solution methods. Boundary layer control. Introduction to gas dynamics. Wave phenomena: calculation of isentropic waves, perpendicular shock waves, oblique shock waves and expansion waves. Hydraulics of pipelines. Wave propagation in a weakly compressible fluid, analysis of pipeline transients. Modeling and optimization of flow engineering machines. Atmospheric flows: mesoscopic atmospheric effects and their modeling.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Knows the chapters of fluid science that are related to the individual research topic.
- Understands the physical theory and modeling of the investigation process.
- Informed in the computer implementation of the solution methods.
- He is aware of well-known modeling methods related to his research topic.
- It distinguishes between known modeling methods.
- Knows the solution methods used in your chosen topic.
- Knows model uncertainties and error estimation methods.
- He has a comprehensive knowledge of the approximation of the employee and their limits of validity.
- Define similarity parameters related to the topic.
- Informed about the expected impact of similarity parameters.

B. Ability

- Analyzes the available domestic and international literature sources in fluid science.
- It interprets the characteristics of the flow characteristic of the topic area and the factors influencing them.
- Able to derive and calculate the quantities related to the subject and his / her research topic, specific to his / her field of fluid science.
- It identifies the parameters related to his / her research topic, characteristic of his / her field of fluid science, and the possibilities of their theoretical and practical modification.
- Apply the subject and research topics related to the subject of the research, which are important in the field of fluid dynamics physical modeling.
- Apply the numerical modeling knowledge of the subject and his / her research topic, which is important in the field of fluid dynamics.
- He / she is able to determine the key issues related to his / her research topic, related to important factors, parameters and physical characteristics in his / her field of fluid science.

- Selects the appropriate methods for the specific fluid dynamics problem.
- Able to fully evaluate model results.
- 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

- He constantly monitors his work, results and conclusions.
- It expands your knowledge of flow theory through continuous acquisition of knowledge.
- Open to the use of information technology tools.
- It seeks to learn about and routinely use the system of tools needed to solve fluid flow problems.
- It develops your ability to provide accurate and error-free problem solving, engineering precision and accuracy.
- It strives for demanding engineering work and makes a decision based on careful consideration.
- It monitors changes in the social, economic and political system.
- He publishes his results in accordance with his professional rules.
- It publishes its 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, you work with your fellow students to solve tasks.
- With his knowledge, he makes a responsible, informed decision based on his analyzes.
- He feels a responsibility for the sustainable use of the environment and for present and future generations.
- He is committed to the principles and methods of systematic thinking and problem solving.

2.3. Teaching methodology

In the pre-arranged weekly lectures of the subject, the parts of the curriculum related to the individual research topic of the students are presented in the framework of a consultation, which helps to acquire comprehensive flow knowledge and to independently acquire parts related to the research area. Students are given an individual assignment related to their research topic during the semester, which they must solve during the semester and report on the outcome. During the solution of individual tasks, within the framework of the lectures or beyond that, consultation is possible.

2.4. Support materials

a) Textbooks

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

Schlichting, H., & Gersten, K. (2016). Boundary-layer theory. Springer. ISBN 9783662529171

b) Lecture notes

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c) Online materials

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEAT4A09/

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 task closely related to his / her own doctoral research topic. During the semester, the theoretical lectures give each student the theoretical knowledge and methodology needed to solve the problem. 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 a documentation. At the end of the semester, the result of the oral exam consists of 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, project-based, complex

count: 1

purpose, description: To be developed during the semester, a project task related to PhD research, which helps to deepen the acquisition of the curriculum through theoretical and practical calculations and derivations. The aim of the partial achievement is to examine the existence of knowledge, ability, attitude, and learning outcomes belonging to the autonomy and responsibility competence group. Upon successful completion of the task, the student stabilizes the 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 syllabus given during the semester, which the students develop independently in writing over a given period of 120 minutes. No aids may be used during development. A sample set of questions and a collection of possible written exam questions compiled on the basis of the curriculum are available to the students. The questions asked of the students serve to check the appropriate level of mastery of the curriculum. The prerequisite for the oral exam is a successful written exam result, so the success of the written exam is a prerequisite for the oral exam.

2. oral partial exam

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

description: In the oral exam, the speaker asks three questions from the curriculum, to which the students answer in detail at the board after a few minutes of reflection time. No aids may be used during the preparation period. The questions asked of the students serve to check the appropriate level of mastery of the curriculum. A prerequisite for the oral exam is a successful written exam result. The oral exam must be particularly successful.

3. practical partial exam

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4. inclusion of mid-term results

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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	50 %
oral partial exam	50 %
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 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).

Can the submitted and accepted partial performance assessments be resubmitted until the end of the replacement period in order to achieve better results?

yes

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

elaboration of a partial assessment task	30
exam preparation	21
additional time required to complete the subject	11
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)	BSc and MSc level flow theory and flow engineering theory; knowledge of physical and numerical modeling of flows; comprehensive knowledge of the design, performance and evaluation of flow simulation tests

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