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)

Fundamentals of Fluid Mechanics ● Fundamentals of Fluid Mechanics

1.2. Neptun code

BMEGEÁTAKM1

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. Suda Jenő Miklós (71958230447)
post:	adjunct
contact:	suda@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/BMEGEATAKM1

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite:	BMETE90AX17
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

Students will acquire knowledge related to the flow phenomena and description of liquid and gaseous fluid that is important for technical applications. With the help of problem-solving exercises, the theoretical course introduces students to solving introductory level problems of fluid flows. Particular emphasis will be placed on knowledge of measurement techniques related to the fluid mechanics measurements, flow processes in machines, equipment, and in pipelines. Students gain skills in recognizing and solving frequent problems in their engineering work during the mid-semester practical problem-solving problems and applied theoretical tasks, as well as in acquiring theoretical knowledge in laboratory measurements and their practical application. Based on the acquired knowledge, the student can undertake to solve more complex tasks through self-education.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- The student knows Newton's law of viscosity, the peculiarities of Newtonian fluids, and the rheological curves for various types of fluids, the basics of Lagrangian and Eulerian descriptions of flow motion.
- The student knows the characteristic ranges of gas, superheated / saturated steam, liquid medium on the pressure-specific volume diagram; the ideal gas law; the tension curve of water; the phenomenon and countermeasures of cavitation erosion.
- The student is aware of the basic equation of hydrostatics; conditions for its validity and simplification, the continuity equation; conditions for its validity and simplification.
- The student understands the Euler equation and the conditions for its application; interpretation of local and convective acceleration, the Bernoulli equation; conditions for its validity and simplification; the concepts of static, dynamic and total pressure, their relationships and their measurement.
- The student recalls the vortex theorem of Thomson (Lord Kelvin), Helmholtz (I. and II.), its physical interpetation and consequences, the impluse momentum theorem; conditions for simplification, Alievi's theory; the resulting pressure-rise relationship.
- The student knows the Reynolds-experiment, Reynolds-number and its meaning, the characteristics of laminar and turbulent flows, the concept and main features of the boundary layer, the conditions and countermeasures of the boundary layer separation.
- The student is informed about the friction coefficient of laminar channel flow; its derivation, the basics of dimensional analysis (Buckingham's theorem), the conditional system of flow similarity, for constant as well as variable density.
- The student is aware of the equation of motion of viscous fluid flow, the Navier-Stokes equation, the Bernoulli equation extended by the pressure loss term.
- The student is aware of the pressure drop formulas of the various hydraulic elements, the Nikuradze and Moody diagram; with the concept of hydraulically smooth and rough pipes.

- The student understands the components of the aerodynamic force acting on the body immersed in the flow; the concept of bluff and streamlined bodies; the aerodynamic force and its components and force coefficients.

B. Ability

- The student is able to identify simple fluid mechanical problems, to explore and formulate the theoretical background needed to solve them.
- The student makes a proposal for the identification of simple fluids engineering problems, for the exploration and formulation of the practical background necessary for their solution.
- The student applies the knowledge to estimate basic qualitative fluids engineering trends and to prepare measures.
- The student develops a simplified flow modeling capability for practical fluids engineering problems.
- The student is able to provide an estimate quantified by a practical fluids engineering problem model as a basis for engineering design and decision making.
- The student applies the knowledge to perform basic fluid mechanics measurements.
- The student proposes the evaluation of the results of basic fluid mechanics measurement from an engineering point of view.
- The student distinguishes between the characteristics, phenomena and descriptions of frictionless and viscous fluid flow.
- The student is able to calculate the hydraulic losses of a simple hydraulic system.
- The student identifies aerodynamic characteristics, forces, and force coefficients.

C. Attitude

- The student is open to expanding knowledge with the instructor and fellow students.
- the student seeks to learn about and routinely use the tools needed to solve fluid flow problems.
- The student seeks to use information technology tools.
- The student improves the ability to solve accurately and error-free tasks.
- The student seeks to align ethical engineering attitudes and long-term win-win considerations with market competition.

D. Independence and responsibility

- The student independently thinks through fluid flow-related tasks and problems and solves them based on specific resources.
- The student accepts well-founded critical remarks concerning engineering work.
- In some situations, as part of a team, the student works with your fellow students to solve tasks.
- The student is committed to engineering work with a system-based approach.
- The student performs his engineering work responsibly, to the best of his knowledge.

2.3. Teaching methodology

Students studying the subject will acquire the basics of fluid mechanics knowledge and skills important for an engineer working in the field of environmental protection, on the basis of which they will be able to solve flow-related problems, acquire additional knowledge and skills necessary to solve such problems. In addition, this subject contributes to the understanding of the master-level subjects. The course prepares students to apply the basic equations of fluid mechanics in solving simpler technical and environmental-related problems, to recognize and evaluate fluid flow phenomena in the environment and environmental protection equipment. The course prepares students for their MSc studies. In addition, the characteristics of the subject (curiosity, connection of mathematical, physical and practical technical aspects) make it possible to develop students' engineering habits and to strengthen

their commitment to demanding approaches. Lectures, oral presentation, written and oral communication, use of IT tools and techniques, blackboard-chalk type presentation with presentations (photo / video) illustrations. In the lectures (in the absence of practice and laboratory measurement courses), in addition to the theoretical curriculum, we also discuss practical examples of fluid mechanics and the basics of fluid mechanics measurements. During the semester, in order to facilitate the easier acquisition of the interdependent study, optional mid-terms are organized for the purpose of encouraging continuous preparation. The course ends with a written and oral exam, in which we assess both theoretical knowledge and practical problem-solving knowledge.

2.4. Support materials

a) Textbooks

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

b) Lecture notes

Jenő Miklós Suda: Fluid Mechanics Exercises I. (electronic), 2021

Jenő Miklós Suda: Fluid Mechanics Exercises II. (electronic), 2021

c) Online materials

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATAKM1

https://youtube.com/playlist?list=PLZMS6jtbk5ZQyI-FEn6siJHsUNRN436ba

2.5. Validity of the course description

Start of validity:	2021. June 2.
End of validity:	2024. December 31.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Learning outcomes are assessed by written and oral examinations. At least 70% attendance on the lectures is required to obtaining of signature. Attendance is checked on the basis of the signed attendance sheet each time. Suggested exam grade can be received based on the excellent-level optional mid-terms. The written exam consists of 5 small theoretical test questions and 4-5-6 practical problems, that cover the theoretical knowledge presented in the course of the lectures. In the oral exam, the student takes the exam on the basis of a pre-issued series of oral items. The prerequisite for the oral exam is a successful (min40% result) written exam. The condition for a successful oral exam is the result of at least 40%. The successful written exam's score is valid during the actual exam period. The written exam result is given 90% and the oral 10% weight when calculating the exam grade.

3.2 Assessment methods

A. Detailed description of mid-term assessments

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: Written exam: The exam, which can be assessed for max. 100 points, consists of two parts: written (max. 90 points, 120 minutes) and oral (max. 10 points). The written exam part may include practical calculation examples and theoretical test questions. A prerequisite for a successful written exam is a written exam result of at least 40% (min. 36 points). The written exam contains 5 test questions and 4-5-6 calculation examples to be solved. A successful written exam is also a condition for admission to the oral exam.

2. oral partial exam

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

   description: Oral exam: In the afternoon of the given examination day, the announcement of the results of the written partial exam is followed by an oral exam. Pre-issued oral exam questions are available. Preparation time prior the oral exam is up to 15 minutes. The condition for a successful oral exam is a result of at least 40% (min. 4 points) of the oral exam part. In case of a failed oral exam, we provide the student with the opportunity to take a repeated question, but, in this case, only max. 4 points can be obtained for the oral part.

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

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	90 %
oral partial exam	10 %
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.

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

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: 2021. June 2.

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

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

- Student is familiar with the general and specific mathematical, scientific and social principles, rules, contexts and procedures needed to operate in the field of engineering.
- Student has the comprehensive knowledge of global social and economic processes.
- Student has the knowledge of the theories and contexts of fundamental importance in the field of engineering and of the terminology which underpins them.

b) ability

- Student has the ability to apply the general and specific mathematical, scientific and social principles, rules, relationships and procedures acquired in solving problems in the field of engineering.
- Student has the ability to apply the theories and related terminology in an innovative way when solving problems in a given field of engineering.
- Student has the ability to approach and solve specific problems within student's field of specialisation in a multi-disciplinary and interdisciplinary manner.

c) attitude

- Student is open and receptive to learning, embracing and authentically communicating professional, technological development and innovation in engineering.
- Student embraces the professional and ethical values associated with the technical discipline.
- Student seeks to contribute to the development of new methods and tools in the field of engineering. A deepened sense of vocation.

d) independence and responsibility

- Student shares her acquired knowledge and experience through formal, non-formal and informal information transfer with those in her field.
- Student evaluates the work of student's subordinates and contributes to their professional development by sharing critical comments.
- Student has the ability to work independently on engineering tasks.

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)	-