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 ● Fluid Mechanics

1.2. Neptun code

BMEGEÁTBG11

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	2	individual
laboratory exercise	1	individual

1.5. Type of assessments (quality evaluation)

mid-term grade

1.6. ECTS

6

1.7. Subject coordinator

name:	Vad János Gábor (71958341366)
post:	university professor
contact:	vad@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/BMEGEATBG11

1.10. Course language

hungarian, english, german

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite:	BMEGEMMBXM2, BMETE93BG03
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, knowledge and description of liquid / gaseous media that is important for technical application. Building on these, it introduces students to solving technical tasks related to the flow of media through laboratory and classroom exercises. Particular emphasis will be placed on measurement techniques related to flow measurement, flow processes in machines, equipment and pipelines. Students report on the acquisition of theoretical knowledge and their skills in its practical application in the mid-term practical problem-solving and applied theoretical dissertations, as well as in laboratory measurements. The course prepares students to recognize and solve flow problems in their engineering work, and enables them to take on more complex tasks based on the acquired knowledge through self-study.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Knows Newton's law of viscosity; the peculiarities of Newtonian fluids and the rheological curve of characteristic non-Newtonian fluids, the basics of the Lagrange and Euler methods of description, basic fluidological concepts.
- Oriented the characteristic ranges of gas, superheated / saturated steam, liquid medium on the pressure-species volume diagram; the ideal gas law; the tension curve of water; the phenomenon and countermeasures of cavitation erosion.
- He is aware of the basic equation of hydrostatics; conditions for its validity and simplification, the continuity equation; conditions for its validity and simplification.
- 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.
- He recalls Thomson (Lord Kelvin), Helmholtz I. and II. vortex theorem, its consequences, the momentum theorem; conditions for simplification, Alievi's theory; the resulting pressure rise relationship.
- He knows the Reynolds experiment, the Reynolds number and its illustrative 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 detachment.
- Informed the tube friction coefficient of laminar tube flow; its derivation, the basics of dimensional analysis, the conditional system of flow similarity, for constant as well as variable density.
- He is aware of the equation of motion of friction media, Navier-Stokes equation, Bernoulli equation extended with lossy term, hydraulic characterization of elements, Nikuradze and Moody diagram; the concept of hydraulically smooth and rough pipes.
- Understands the energy equation; validity and simplification conditions, sound propagation rate, Mach number definition, critical temperature, density, and pressure ratio, simple tank orifice outflow, Laval nozzle

characteristics.

- Understands the components of the force acting on the body placed in the flow; the concept of blunt and streamlined bodies; the aerodynamic force and force factor components.

B. Ability

- Able to identify simple flow problems, to explore and formulate the theoretical background needed to solve them.
- He makes a proposal for the identification of simple flow engineering problems, for the exploration and formulation of the practical background necessary for their solution.
- It is used to estimate basic qualitative flow engineering trends, thereby preparing measures.
- Develops a simplified flow model for practical flow engineering problems.
- It is able to provide an estimate quantified by a practical flow engineering problem model as a basis for engineering design and decision making.
- Apply your knowledge to perform basic flow measurements.
- It proposes the evaluation of the results of basic flow measurement from an engineering point of view.
- Develop your knowledge in the direction of advanced flow measurement technology.
- Develop your skills to expand your knowledge in the direction of advanced numerical fluid science.
- He suggests that he express his thoughts in an orderly form, orally and in writing.

C. Attitude

- Initiates collaboration with the instructor and fellow students to expand knowledge.
- He expands his knowledge with continuous acquisition of knowledge and a wide-ranging attitude.
- It is open to the in-depth use of modern information technology tools.
- It seeks to learn about and routinely use the tools needed to solve fluid flow problems.
- It strives for independent, accurate, error-free and responsible solution.
- It strives to apply the principles of reliable operation, productivity, cost and time efficiency, energy efficiency and environmental awareness in solving flow engineering tasks.
- It develops its 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, you work with your fellow students to solve tasks.
- It supports a systematic approach and complex thinking in its thinking.
- He is critical of engineering commitments of inadequate quality.

2.3. Teaching methodology

In addition to classroom lectures (theoretical background), classroom exercises (flow example), measurements in laboratory exercises, which provide practical experience in addition to the theoretical and practical knowledge gained in lectures and exercises. Communication is both oral and written; They use IT tools and technology; optional individual and group tasks; and information technology is also used.

2.4. Support materials

a) Textbooks

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

b) Lecture notes

Tamás Lajos, Fluid Mechanics (coursne notes in English in PDF), Tamás Lajos, 2005, Budapest.

c) Online materials

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG11/

Example: http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG11

Task collection: http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG11

2.5. Validity of the course description

Start of validity:	2020. February 1.
End of validity:	2024. December 31.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Participation in lectures, exercises and laboratory classes, writing in-house dissertations (ZH) is mandatory. The verification is performed on the basis of the signed ZH worksheets, the laboratory measurement and the attendance sheet at the lectures. It is not possible to replace laboratory sessions that have not been attended to without confirmation. In other matters related to presence, the current TVSz is authoritative. A 2.2. The assessment of the learning outcomes set out in point 1 is based on three mid-year written performance measurements (one level assessment and two summative assessment of academic performance), homework, and active participation in the exercises (partial performance assessment).

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: diagnostic assessment

count: 1

purpose, description: Measurement thesis (MD). Before starting the laboratory measurements (weeks 5 and 6), 1 MD is written. One of the conditions for obtaining a half-year ticket is an MD with a "pass" (rated at at least 50%) rating, which is also a condition for starting measurements. Measurement thesis (MD). Before starting the laboratory measurements (weeks 5 and 6), 1 MD is written. One of the conditions for obtaining a half-year ticket is an MD with a "pass" (rated at at least 50%) rating, which is also a condition for starting measurements.

2. Mid-term assessment

type: summative assessment

count: 3

purpose, description: Application Papers (AD). During the classroom exercises, 3 ADs will be written in weeks 5, 9 and 13. Composition of AD: a) Applied theoretical theorems (AE), developed according to prescribed criteria. b) Practical problem solving (GYP): written tasks that test the acquisition of the practical application of the theory by example. A condition for an AD to qualify as "compliant" is to achieve at least 40% of both parts (a) and (b) separately within that AD. One of the conditions for obtaining a mid-term ticket is 3 AD-qualified ADs. The 3 ADs are added to the mid-term ticket based on the maximum available points, proportionally, max. It counts 80%. Within this, the proportion of part a) is 30%, the proportion of part b) is 50%.

3. Mid-term assessment

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

count: 1

purpose, description: Laboratory measurements (measurement protocol): The measurement groups of 4 students take part in the measurements held in the laboratory of the Department of Fluid Mechanics. Prior to this, students can take the 1st, 3rd, 5th and 5th weekly, In the 2nd, 4th, 6th weeks they take part in 3 measurement preparation laboratory sessions. After completing the measurement, a measurement report (max. 20 points) and a measurement presentation (max. 20 points) must be prepared, which can be evaluated with a total of max. 40 points. One of the conditions for obtaining a mid-term ticket is a measurement report evaluated separately for at least 40% (8 points) and a measurement presentation evaluated separately for at least 40% (8 points). Thus, a total of max. 40 points can be obtained from the measurement, which is included in the mid-term ticket in a 20% share. The method of conducting and evaluating the measurements is detailed in the "Fluid Science Subject Laboratory Practice Requirements System" attached to this "Subject Data Sheet and Subject Requirements".

4. Mid-term assessment

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

count: 1

purpose, description: Laboratory measurements (presentation): One of the conditions for obtaining a mid-term ticket is a measurement report evaluated separately for at least 40% (8 points) and a measurement presentation evaluated separately for at least 40% (8 points). Thus, a total of max. 40 points can be obtained from the measurement, which is included in the mid-term ticket in a 20% share. The method of conducting and evaluating the measurements is detailed in the "Fluid Science Subject Laboratory Practice Requirements System" attached to this "Subject Data Sheet and Subject Requirements".

5. Mid-term assessment

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

count: 1

purpose, description: (active participation): Reward Points (JP). The supervisor can evaluate the interactive activity of the class and the elaboration of diligent tasks with reward points, which are included in the mid-term ticket for max. They are calculated at a rate of 10%. (active participation): Reward Points (JP). The supervisor can evaluate the interactive activity of the class and the elaboration of diligent tasks with reward points, which are included in the mid-term ticket for max. They are calculated at a rate of 10%.

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

1 . Mid-term assessment	100 %
2 . Mid-term assessment	80 %
3 . Mid-term assessment	10 %
4 . Mid-term assessment	10 %
5 . Mid-term assessment	5 %

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 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.

At least **85%** the exercises (rounded down) must be actively attended.

At least **85% 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

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

Completion of unfinished laboratory exercises:

missed laboratory practices must be performed in the teaching term at pre-arranged appointment

Repetition of laboratory exercises that performed incorrectly (eg.: mistake in documentation):

incorrectly performed laboratory practice (e.g. Incomplete/incorrect report) can be corrected upon improved re-submission

3.8 Study work required to complete the course

Activity	**hours / semester**
participation in contact classes	70
mid-term preparation for practices	14
preparation for laboratory practices	14
preparation for summary assessments	48
additional time required to complete the subject	34
summary	**180**

3.9. Validity of subject requirements

Start of validity: 2020. February 1.

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 knowledge of the theories and contexts of fundamental importance in the field of engineering and of the terminology which underpins them.
- Student has the knowledge of metrology and measurement theory in the field of mechanical engineering.

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 carry out laboratory testing and analysis of materials used in the engineering field, and to evaluate and document test results.
- Student has the ability to use information and communication technologies and methods to solve technical problems.

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 has the ability to work independently on engineering tasks.
- Student evaluates the work of student's subordinates and contributes to their professional development by sharing critical comments.

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)	-