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 Machinery • Fluid Machinery

1.2. Neptun code

BMEGEVGBX01

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	1	coupled
laboratory exercise	1	coupled

1.5. Type of assessments (quality evaluation)

exam

1.6. ECTS

4

1.7. Subject coordinator

name:	Dr. Hős Csaba János
post:	university professor
contact:	cshos@hds.bme.hu

1.8. Host organization

Department of Hydrodynamic Systems (http://www.hds.bme.hu/)

1.9. Course homepage

http://www.hds.bme.hu/oktatas.php?sm=1&xml=BMEGEVGBX01

1.10. Course language

hungarian, english

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite:	BMEGEENBGTD, BMEGEÁTBG11
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 aim of the course is to give an overview of pumps, compressors, fans and turbines, both in terms of the underlying physical principles and the theoretical understanding of the engineering applications. The course focuses on the mathematical description of the operation of turbomachines (centrifugal pump, compressor, and fan) using the Euler turbine equation and provides insight into the application of the usual dimensionless quantities (flow number, pressure number, specific speed, specific diameter) and affinity laws. Cavitation, serial and parallel connection of pipes and pumps, and simple pipeline systems are also addressed. The noise level of the fans, the power curves of the axial, radial and mixed turbine motors and the basic types and uses of water and wind turbines are explained. Basics of positive displacement pumps and motors along with typical applications, description of multi-stage reciprocating compressors are also covered.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Thermodynamic processes (isothermal, isentropic, polytropic compression, specific work, efficiency) taking place in pumps, compressors and fans.
- Main types of fluid machines (turbomachines, positive displacement machines, axial- radial and mixed pumps).
- Velocity triangles of radial, mixed and axial turbomachines.
- Theoretical and real characteristic curves.
- Origins of losses in fluid machines and the methods of estimating them.
- Cavitation and suction capacity (NPSH).
- Pipeline characteristic curve and the methods of estimating it.
- Basic technical characteristics of ventilation systems and fans.
- Operation of positive displacement pumps and motors.
- Principles of wind and water turbines.
- Basic measurement methods and devices associated with flow machinery.
- Methods for hydraulic testing of hydraulic machines.

B. Ability

- Design, conduct and evaluate measurements related to basic flow engineering machines (e.g. QH characteristic curve, NPSH curve).
- Estimating hydraulic parameters based on main pump / fan dimensions.
- Estimating the pressure drop of a simple pipeline, including fittings.
- Use of NPSH to ensure cavitation-free operation of a pump.
- Forces acting on the impeller of the pump.
- Selects the right pump or fan for a pumping aim.
- Estimating the operating parameters of a positive displacement pump.

- Choosing the appropriate pump type for a particular pumping task.
- Estimating the basic hydraulic parameters of wind turbines.
- Calculating basic hydraulic and thermal parameters of compressors.
- Distinguishing between real and ideal characteristic curves.
- Distinguishing between different flow engineering machines.

C. Attitude

- The student constantly monitors his work, results and conclusions.
- The student seeks to learn about and routinely use the system of tools needed to solve flow engineering problems.
- The student is open to the use of information technology tools.
- The student seeks to enforce the principles of energy efficiency and environmental awareness.
- The student develops your ability to provide accurate and error-free problem solving, engineering precision and accuracy.
- The student publishes his/her results in accordance with the rules of the profession.
- The student shares his/her opinions and views without offending others.

D. Independence and responsibility

- The student collaborates with the instructor to expand knowledge.
- The student openly accepts well-founded professional and other critical remarks.
- In some situations, as part of a team, the student works with your fellow students to solve tasks.
- With his/her knowledge, the student makes a responsible, well-founded decision based on his/her analysis.
- The student independently thinks through tasks and problems and solves them based on the given resources.
- The student is committed to the principles and methods of systematic thinking and problem-solving.

2.3. Teaching methodology

The material of the lectures is primarily used to understand the curriculum. Measurements performed in group work in the departmental laboratory, and an independent report on the measurement are aided by both communication and work organization techniques; both the acquisition of independent engineering work. In the example-solving practice, students get to know the methods of problem-solving / scaling through numerical examples and are also prepared for the exam.

2.4. Support materials

a) Textbooks

Dr. Olivér Fűzy: Flow Engineering Machines and Systems, Textbook Publishing Company, 1991, Budapest, ISBN 963 18 2988 X

István Józsa: Vortex pumps in practice, Invest-Marketing, 2013, Budapest, ISBN 978-963-87401-2-0

László Kullmann: Flow Technology Machines, Akadémiai Kiadó, 2018, ISBN: 978 963 454 181 3, DOI: 10.1556 / 9789634541813

b) Lecture notes

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c) Online materials

http://www.hds.bme.hu/oktatas.php?sm=1&xml=BMEGEVGBX01

2.5. Validity of the course description

Start of validity:	2021. January 20.
End of validity:	2026. January 20.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

The mid-term evaluation of the formulated learning outcomes is performed as follows: six mid-year written performance measurements (six level assessment evaluations) precede the laboratory measurements. In addition, the semester assessment of the subject is evaluated on the basis of the presentation of the control diagrams made during the measurements at the end of the measurement, the submission of the home measurement report by the deadline and the active participation in the example-solving exercises. The subject ends with an exam.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: diagnostic assessment

count: 6

purpose, description: In order to successfully carry out the laboratory measurement within the subject), it is absolutely necessary to check the existence of knowledge-type competence elements in writing (a short check-in), which takes place in the laboratory of the subject; the test paper may consist of: short theoretical questions that assess lexical knowledge, the interpretation of each concept and the recognition of the connections between them; and computational tasks that examine problem-recognizing-solving ability. The part of the curriculum on which the level assessment is based is determined by the practice leaders of the subject; available working time from a minimum of 10 to a maximum of 20 minutes; the evaluation is based on a score.

2. Mid-term assessment

type: formative assessment, simple

count: 1

purpose, description: A complex way of evaluating the knowledge, ability, attitude, as well as independence and responsibility type competence elements of the subject, the form of which is the individually prepared measurement protocol; the content of which is determined by the supervisor, the requirements of which are determined by the lecturer in agreement with the supervisors. The evaluation can be classified as “pass” or “fail”, deadline for submission: 2 weeks from the measurement.

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: A complex, written way of evaluating the knowledge and ability-type competence elements of the subject in the form of an exam, which may consist of computational tasks that focus on problem-recognizing-solving ability, as it basically focuses on the application of the acquired knowledge; it may also consist of short theoretical questions measuring lexical knowledge; and essay questions that examine the ability to synthesize. The part of the curriculum on which the assessment is based is determined by the lecturer of the subject in agreement with the supervisors. The available working time is approx. 90 min.

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	20 %
2 . Mid-term assessment	80 %

The condition for signing is that the score obtained in the mid-year assessments is at least **50%**.

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

type	weight
written partial exam	100 %
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]	72% .. 85%
satisfactory(3) ● Satisfactory [D]	65% .. 72%
sufficient(2) ● Pass [E]	50% .. 65%
insufficient(1) ● Fail [F]	below 50%

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

3.6 Attendance and participation requirements

Must be present at at least **0%** (rounded down) of lectures.

At least **70%** the exercises (rounded down) must be actively attended.

At least **83% 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).

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

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	56
mid-term preparation for practices	7
preparation for laboratory practices	14
elaboration of a partial assessment task	4
exam preparation	28
additional time required to complete the subject	15
summary	**124**

3.9. Validity of subject requirements

Start of validity: 2021. January 20.

End of validity: 2026. January 20.

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 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.
- Student has the broad theoretical and practical knowledge, methodological and practical skills for the design, manufacture, modelling, operation and management of complex engineering systems and processes.

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 process, organise, analyse and draw conclusions from information gathered during the operation of engineering systems and processes.

- Student is skilled in quality assurance, metrology and process control of engineering systems, technologies and processes.

c) attitude

- Student seeks to contribute to the development of new methods and tools in the field of engineering. A deepened sense of vocation.
- Student strives to improve student's own knowledge and that of student's colleagues through continuous self- and peer-learning.
- Student is involved in research and development projects in mechanical engineering, mobilising student's theoretical and practical knowledge and skills to achieve this goal, in collaboration with members of the development team.

d) independence and responsibility

- Student takes responsibility for the sub-processes under student's management.
- Student acts independently and proactively in solving professional problems.
- Student shares her acquired knowledge and experience through formal, non-formal and informal information transfer with those in her field.

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)	-