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)

Aero-Elasticity ● Aero-Elasticity

1.2. Neptun code

BMEGEÁTNG22

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)

mid-term grade

1.6. ECTS

3

1.7. Subject coordinator

name:	Kalmár-Nagy Tamás (71567010352)
post:	associate professor
contact:	kalmarnagy@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/BMEGEATNG22

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory elective

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

Aero-elasticity is a multidisciplinary science dealing with the interaction of flow and structural oscillations. The aim of the course is to review aero-elastic phenomena occurring in nature and engineering. After a clear presentation of the relevant physical and mathematical background and the solution of examples, the student becomes able to solve simpler but practical related problems. The rapidly evolving FSI (fluid-structure interaction) simulation technique is presented. In addition to describing the theoretical background of FSI, modeling questions are also presented to facilitate the mastering of the advanced numerical procedure.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Understands aero-elastic phenomena occurring in nature and engineering.
- He is aware of the differences between linear and nonlinear systems.
- He understands the methods of solving the better known aerodynamic phenomena.
- He was informed about the relationships between the finite element method and modal analysis from the perspective of aeroelastic problems.
- Knows the active and passive options for reducing oscillations.
- It distinguishes simpler bifurcations of nonlinear systems.
- Knows the methods of calculating buoyancy coefficients.
- Defines equilibrium situations and their stability.
- He is aware of coupled flow structure simulation techniques.
- Knows the methods of statistical evaluation of the quantity measured during the tests.

B. Ability

- Determines the equilibrium positions of a given system.
- Identifies the eigenvalues and stability of equilibrium situations.
- Calculates the buoyancy coefficients for a given geometry.
- Identifies sub- and supercritical bifurcations of the nonlinear system.
- Designs the shock absorber for a given vibration characteristic.
- Flatter and other aerodynamic instabilities are investigated using linearized models.
- It selects the flow forces by modifying the structural shape.
- It certainly handles the equation of motion in a dimensionless form.
- Analyzes buoyancy on sectional and aeroelastic wind tunnel models.
- Apply dampers, attenuations into dynamic equations.

C. Attitude

- He constantly monitors his work, results and conclusions.
- He is always open to critical professional comment on his work.

- It develops your ability to provide accurate and error-free problem solving, engineering precision and accuracy.
- It publishes its opinions and views without offending others.
- He publishes his results in accordance with his professional rules.

D. Independence and responsibility

- She works with her instructor and fellow students to expand her knowledge.
- Accepts professional and other critical comments.
- He collaborates with his fellow students in solving group tasks.
- With his knowledge, he carries out his scientifically based work based on his analyzes.
- He criticizes scientifically unsubstantiated assumptions.

2.3. Teaching methodology

The teaching of the subject is based on lectures. The lectures introduce students to the information defined by the knowledge competence elements using the technique of frontal education. The knowledge is applied and acquired at the skill level through homework. Within the framework of the project task, an issued problem must be solved individually or in groups (the latter also develops teamwork skills). The project work must be presented at the end of the semester.

2.4. Support materials

a) Textbooks

Dewey H. Hodges, G. Alvin Pierce: Introduction to Structural Dynamics and Aeroelasticity, 2011, ISBN-052119590X

Tamás Lajos: Fundamentals of Fluid Mechanics, 2015, ISBN-9789631228854

József Györgyi: Dynamics of Structures, 2006, ISBN-9634208681

b) Lecture notes

Tamás Kalmár-Nagy: Nonlinear dynamics, 2020, lecture note

c) Online materials

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNG22/

2.5. Validity of the course description

Start of validity:	2020. March 3.
End of validity:	2024. August 31.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Learning outcomes are assessed on the basis of two mid-year written summary performance measurements and one partial performance measurement. Summative academic performance appraisal is a complex, written way of assessing the knowledge and ability type competence elements of the subject in the form of an in-house dissertation, which requires the necessary lexical knowledge during the performance appraisal, the available working time is 60 minutes. Partial performance assessment (homework): a complex way of evaluating the knowledge, ability, attitude, and independence and responsibility type competence elements of the subject, the form of which is the independently prepared homework and project work.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: summative assessment

count: 2

purpose, description: Summative assessments collectively examine and assess students 'learning outcomes defined by knowledge and ability type competencies. Accordingly, each summative assessment assesses the acquisition of the designated theoretical and practical knowledge, as well as the existence of knowledge and the application of skills acquired in practice. Each summative assessment focuses 65% on theoretical knowledge and 35% on application skills. They will be completed on the dates specified in the study performance assessment plan, expected to be in the 7th and 13th weeks of education. 50 points can be obtained in the summary performance evaluation. A minimum of 50% is achievable.

2. Mid-term assessment

type: formative assessment, simple

count: 1

purpose, description: The basic aim of the partial performance assessment is to examine the existence of attitudes and learning outcomes belonging to the autonomy and responsibility competence group. The way to do this is to create a project task and then present it to the group. Assignments and assignments for groups of up to 2 people must be finalized by the fourth week of education. The content and form requirements and evaluation principles of the prepared project dissertation are included in the terms of reference. It will be completed on the date specified in the academic performance assessment plan, expected to be in the last week of education. You can get a maximum of 15 points with this task.

3. Mid-term assessment

type: formative assessment, simple

count: 5

purpose, description: The basic goal of partial performance assessment is to examine the existence of learning outcomes belonging to the autonomy, ability and knowledge competence group. The way to do this is to do homework. The content and form requirements and evaluation principles of the homework are included in the job description. It will be completed at the dates specified in the study performance assessment plan. You can get up to 35 points with the tasks.

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	50 %
2 . Mid-term assessment	15 %
3 . Mid-term assessment	35 %

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 85%
very good(5) ● Very Good [B]	85% .. 85%
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).

Need mid-term assessment to individually complete?

yes

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

NO

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 not possible

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 cannot be improved or repeated, the final result is assessed in accordance with Code of Studied 122. § (6)

3.8 Study work required to complete the course

Activity	**hours / semester**
participation in contact classes	28
preparation for summary assessments	32
elaboration of a partial assessment task	24
additional time required to complete the subject	6
summary	**90**

3.9. Validity of subject requirements

Start of validity: 2020. March 3.

End of validity: 2024. August 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 metrology and measurement theory in the field of mechanical engineering.
- Student has the detailed knowledge of the rules for the preparation of technical documentation.

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 deal with problems creatively, to solve complex problems in a flexible way, and to engage in lifelong learning and commitment to diversity and value-based approaches.

c) attitude

- Student strives to meet and enforce quality standards.
- Student strives to plan and carry out tasks to a high professional standard, either independently or in a team.
- Student is open and receptive to learning, embracing and authentically communicating professional, technological development and innovation in engineering.

d) independence and responsibility

- Student has the ability to work independently on engineering tasks.
- Student takes initiative in solving technical problems.
- Student takes responsibility for the sub-processes under student's management.

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)	-