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)

Computational Fluid Dynamics • Computational Fluid Dynamics

1.2. Neptun code

BMEGEÁTBG03

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	2	coupled

1.5. Type of assessments (quality evaluation)

exam

1.6. ECTS

5

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/BMEGEATBG03

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite: 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 introduce you to numerical modeling of flows, including setting up a mathematical model, possible variations of boundary conditions, mesh generation, basics of turbulence modeling and a description of concentrated parameter or one-dimensional time-dependent systems. Overall, it develops technical thinking and attitudes. The aim of the education is also to enable the student to recognize, correctly judge and independently solve the mechanical problems related to the curriculum based on the knowledge learned.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Knows the theoretical foundations of the finite volume method and the process of CFD analysis.
- Knows the mathematical background and physical interpretation of boundary conditions, as well as possible methods for modeling flow engineering machines.
- Knows the role of source members and rupture conditions in flow modeling.
- It recalls the theoretical foundations of turbulence modeling and the main features of each model.
- It recalls aspects related to numerical mesh compression and quality, boundary layer networking, and other mesh generation methods.
- It recalls the modeling of thermal processes, the calculation of heat transfer.
- Identifies potential sources of errors and uncertainties in CFD analysis, convergence tests, and error estimation methods.
- Identifies the concept of AMESim simulation environment (multiport, dynamic simulation of a 1D system with concentrated parameters) and its mode of operation.
- Identifies numeric models in model libraries.
- He understands the method of designing and building complex simulation models.
- Understands the methods of parameter sensitivity tests and verification with measurement results.
- Understands the methods of functional development of the model.

B. Ability

- Able to judge the applicability of simulation analysis in technical problems.
- Able to create and apply three-dimensional flow models.
- Creates coupled thermal fluid models.
- Calculates the error estimate that determines the quality of the simulation analysis.
- Creates system models consisting of concentrated parameter components.
- It solves problems in engineering practice using system models.
- Selects the appropriate modeling approach for technical problems.
- Use three-dimensional flow models in your solutions.
- It improves the accuracy of modeling that is acceptable in engineering practice.

- Creates system models consisting of one-dimensional components.
- Selects the appropriate analytical approach to technical problems.
- Selects the appropriate simplification approach for technical problems.

C. Attitude

- Develops your ability to collaborate with the instructor and fellow students to expand your knowledge.
- It seeks to expand its knowledge through continuous acquisition of knowledge.
- Open to the use of information technology tools.
- It seeks to learn about and routinely use the tools needed to solve fluid flow problems.
- It strives for an accurate and error-free solution.
- It develops its analyzes to support it with a multidirectional approach.

D. Independence and responsibility

- Independently thinks through fluid tasks and problems and solves them based on specific resources.
- It is committed to the open reception of well-founded critical remarks.
- In some situations, as part of a team, you work with your fellow students to solve tasks.
- He supports the application of a systematic approach in his thinking.
- You take responsibility for the results of your work and your peers.

2.3. Teaching methodology

Lectures, laboratory computer classes, written and oral communication, use of IT tools and techniques, optional independent and group work tasks, work organization techniques. Lectures, laboratory computer classes, written and oral communication, use of IT tools and techniques, optional independent and group work tasks , work organization techniques.

2.4. Support materials

a) Textbooks

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

b) Lecture notes

1. Electronic note: Dr. Gergely Kristóf: Numerical modeling of flows, electronic textbook, ISBN 978-963-08-1212-2, distributor: CFD.HU Kft., 2014

c) Online materials

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2.5. Validity of the course description

Start of validity:	2021. April 26.
End of validity:	2024. April 26.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

A 2.2. The learning outcomes set out in point 1 are assessed on the basis of two (I. + II.) theoretical enclosures (summary academic performance assessment) and two (I. + II.) practical enclosures (summary study performance assessment). The score obtained with the practical enclosures (I. + II.) Is included in the final exam score with a weight of 50%. The condition for obtaining a signature at the end of the semester is a result of at least 40% from both theoretical enclosures, as well as the completion of each practical task with a score of at least 40%.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: summative assessment

count: 1

purpose, description: The mid-term examination consists of two (I. + II.) Theoretical enclosures and two (I. + II.) Practical enclosures. The score obtained with the practical enclosures (I. + II.) Is included in the final exam score with a weight of 50%. The mid-term examination consists of two (I. + II.) Theoretical enclosures and two (I. + II.) Practical enclosures. The score obtained with the practical enclosures (I. + II.) Is included in the final exam score with a weight of 50%.

2. Mid-term assessment

type: formative assessment, project-based, complex

count: 1

purpose, description: The mid-term examination consists of two (I. + II.) Theoretical enclosures and two (I. + II.) Practical enclosures. The score obtained with the practical enclosures (I. + II.) Is included in the final exam score with a weight of 50%. The mid-term examination consists of two (I. + II.) Theoretical enclosures and two (I. + II.) Practical enclosures. The score obtained with the practical enclosures (I. + II.) Is included in the final exam score with a weight of 50%.

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: Elements of the exam: The course ends with a written exam on the theoretical material. The examination score consists of the following sub-scores: 1. written performance evaluation: from the same part of the material as the semester (I. + II.) Theoretical closed places: max 50p. A minimum of 40% result in the written exam is required to pass the written exam. 2. Intermediate results crediting: I. practical confinement: max. 25p; II. practical indoor: max. 25p; The max. Based on 100 examination points, the examination marks 1, 2, 3, 4, 5 are determined on the basis of the usual lower point limits 0, 40, 55, 70, 85. The offered exam ticket is an excellent mid-term work, so the I. + II. theoretical closed and I. + II. can be obtained in case of at least 70% of the total results calculated on the basis of practical enclosure: in case of 70≤% <85 good (4) resp. For 85≤% <100, the recommended exam mark is significant (5).

2. oral partial exam

obligation: does not apply

description:

3. practical partial exam

obligation: does not apply

description:

4. inclusion of mid-term results

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

description: The mid-term examination consists of two (I. + II.) Theoretical enclosures and two (I. + II.) Practical enclosures. The score obtained with the practical enclosures (I. + II.) Is included in the final exam score with a weight of 50%. The mid-term examination consists of two (I. + II.) Theoretical enclosures and two (I. + II.) Practical enclosures. The score obtained with the practical enclosures (I. + II.) Is included in the final exam score with a weight of 50%.

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	50 %

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	0 %
practical partial exam	0 %
inclusion of mid-term results	50 %

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.

At least **70% 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

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

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	56
preparation for laboratory practices	14
preparation for summary assessments	16
elaboration of a partial assessment task	30
exam preparation	35
summary	**151**

3.9. Validity of subject requirements

Start of validity: 2021. April 26.

End of validity: 2024. April 26.

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.

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.

c) attitude

- Student is open and receptive to learning, embracing and authentically communicating professional, technological development and innovation in engineering.

d) independence and responsibility

- 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)	-