SUBJECT DATA SHEET AND REQUIREMENTS

Last modified: 2013.08.29. Valid from: 2013-2014-I. semester

COMPUTATINAL FLUID DYNAMICS I.

ÁRAMLÁSOK NUMERIKUS MODELLEZÉSE I.

1.	Code	Semester Nr. or fall/spring	Contact hours / week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEÁTMW02	**fall**	**2+2+0**	**p**	**5**	**English**

2. Subject's responsible:

Name:	Title:	Affiliation (Department):
Dr. Kristóf Gergely	associate professor	Dept. Fluid Mechanics

3. Lecturer:

Name:	Title:	Affiliation (Department):	%
Dr. Kristóf Gergely	associate professor	Dept. Fluid Mechanics	80 %
Dr. Lohász Máté	-	GEA EGI Co.Ltd.	20 %

4. Thematic background of the subject:
fluid mechanics

5. Compulsory / suggested prerequisites:
Compulsory: Fluid mechanics (BSc level)
Suggested: Computatinal Fluid Dynamics (BSc level)

6. Main aims and objectives, learning outcomes of the subject:
To deliver basic concepts of finite volume method and turbulence modelling. To introduce multi-phase flow modelling methodologies. To give practical skills in meshing and model validation as well as in construction of complex physical models being coupled to a hydraulic model.

7. Method of education:
lecture 2 h/w, seminar 0 h/w, laboratory 2 h/w

8. Detailed thematic description of the subject (min. 800 character):
Lectures:

1. Numerical approximations of derivatives and integrals. Discretisation of divergence, gradient and Laplace operator by means of finite volume method.

2. Numerical modelling of incompressible flows, resolution of pressure-velocity coupling in terms of psi-omega method and pressure correction method.

3-5. Characteristics of turbulence and turbulence modelling.

6. 1st theoretical test.

8. Application of finite volume discretisation method in a one-dimensional case. Stability of the central differencing scheme, upwinding, and numerical diffusion.

9. Solution of algebraic systems which are obtained by the discretisation of the governing equations of fluid flows. Iterative methods, multigrid methods.

10. Compressible flow modelling. Method of characteristics, application of finite volume method.

11-12. Introduction to multiphase flow modelling.

13. Application of User Defined Functions (UDFs) in Ansys-Fluent simulation system.

14. 2nd theoretical test.

Laboratory practices:

1-5. Generation of block-structured meshes with ICEM CFD software.

6-8. Individual assignment. Convergence checking, mesh independency checking, comparison of results of various models with measured data.

9-11. Handing in the report of the individual assignment. Group assignment (in groups of 3). Convergence checking, mesh independency checking, comparison of results of various models with measured data.

12. Tutorial examples in multiphase flow modelling.

13. Handing in the report of group assignment. UDF examples.

14. Presentation of the results of group assignments.

Ratio (%) of the application-level and practical knowledge gained in course of the subject: 70 %

9. Requirements and grading:
The subject in concluded with a practical mark. The evaluation consists of two theoretical tests (of equal value), individual assignment and group assignment. Practical assignments have a 50% share in midterm points.
Condition for the midterm signature: achieving at least 40% of the maximum total points of two theoretical tests and achieving at least 40% in each and every practical assignment. One retake opportunity is given for the theoretical tests on the 14th education week.
25 points can be achieved with the individual assignment, the report of which need to be prepared in PowerPoint format before the beginning of the 9th week laboratory practice.
15 points can be achieved with the group assignment. Each member of the team is equally evaluated. The group report is to be handed in in PowerPoint format before the beginning of the laboratory of the 13th week.
In case of late delivery of the practical reports the results are multiplied by a factor being reduced by 5% every day (1, 0.95, 0.9…). More than 12 days after the deadline practical reports are not accepted.
10 points can be achieved by the presentation of the results of group assignments on the laboratory of the 14th week. Each member of the team receives equal number of points.
Midterm evaluation consist of

- individual assignment: max. 25p;
- group assignment: max 15p written report, max. 10p presentation;
- 1st theoretical test: max 25p;
- 2nd theoretical test: max 25p.

Evaluation of practical marks (1,2,3,4,5) is according to the usual lower limits (0,40,70,85).

10. Disciplinary Measures Against the Application of Unauthorized Means at Mid-Terms, Term-End Exams and Homework

Supplement to 1/2013. (I.30.) Dean's Order / Codicil /: The following students are subject to disciplinary measures.

(a) ¬*Those students who apply unauthorized means (book, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written mid-term exams taken, and/or
*invite/accept any assistance of fellow students, with the exception of borrowing authorized means,
will be disqualified from taking further mid-term exams in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission option. Final term-end results in courses with practical mark will automatically become Fail (1), the ones with exam requirements will be labelled Refused Admission to Exams.

(b) *Those students whose homework verifiably proves to be of foreign extraction, or alternatively, evident results or work of a third party, are referred to as their own, will be disqualified from taking further assessment sessions in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), ones with exam requirements will be labelled Refused Admission to Exams.

(c) *Those students who apply unauthorized means (books, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written term-end exams taken, and/or
*invite/accept any assistance of fellow students, with the exception of borrowing authorized means,
will immediately be disqualified from taking the term-end exam any further as a consequence of their action, and will be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period.

(d) *Those students who alter, or make an attempt to alter the already corrected, evaluated, and distributed test or exercise/problem,
i.) as a consequence of their action, will be disqualified from further assessments in the respective semester. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), the ones with exam requirements will be labelled Refused Admission to Exams;
ii.) and will immediately be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period.

11. Consulting opportunities:

- According to the consultation times indicated on the web page of the lecturer of the subject.
- On cases-by-case arrangement.
- One day before each exam (if relevant to the subject).

12. Reference literature (compulsory, recommended):

- Self-made lecture notes taken during the lectures are sufficient and the recommend source of information to the preparation for the midterm tests. Lecture notes in PowerPoint format can also be downloaded from the web page of the subject.
- The web page of the subject can be found on the web page of the Department of Fluid Mechanics or by entering the following URL: http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATMW02

13. Home study required to pass the subject:

Contact hours	56	h/semester
Home study for the courses	0	h/semester
Home study for the mid-semester checks	5	h/check
Preparation of mid-semester homework	4	h/homework
Home study of the allotted written notes	0	h/semester
Home study for the exam	14	h/semester
Altogether:	**88**	**h/semester**

14. The data sheet and the requirements are prepared by:

Name:	Title:	Affiliation (Department):
Dr. Kristóf Gergely	associate professor	Dept. Fluid Mechanics