BSc in Mechatronics
Integrated Engineering spec.
2N-AM0-IE training code
compulsory subject

SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 31th January 2014

NUMERICAL MODELLING OF FLUID FLOWS

ÁRAMLÁSOK NUMERIKUS MODELLEZÉSE

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEÁTAM05	6	2+1+1	p	4	English

2. Subject's responsible:

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

3. Lecturer:

Name:	Title:	Affiliation (Department):
Dr. Gergely KRISTÓF	associate professor	Dept. of Fluid Mechanics
Dr. Viktor SZENTE	assistant professor	Dept. of Fluid Mechanics

4. Thematic background of the subject: Fluid mechanics

5. Compulsory / suggested prerequisites:
Compulsory: Fluid Mechanics (BSc level) BMEGEÁT-AM01, or -AM11, or -AM21, or AG01, or -AG11, or -AE01, or -AKM1, or -AT01, or -MF03

6. Main aims and objectives, learning outcomes of the subject: To deliver knowledge of Computational Fluid Dynamics including analysis lumped parameter and one-dimensional descriptions. To familiarize with boundary conditions, turbulence modelling, application of source-terms and modelling approaches used in various flow categories. To develop skills both in recognizing potential applications of Computational Fluid Dynamics, and in individual development of simulation models.

7. Method of education: lecture 2h/w, seminar 1h/w, laboratory 1h/w

8. Detailed thematic description of the subject:
Lectures (course-week, topics):
1-6. Description of complex systems using lumped parameter and 1D approaches /by Dr. Viktor SZENTE/
7. 1st theoretical test
8-13. CFD analysis methodology /by Dr. Gergely KRISTÓF/ Details:
8. Introduction to Computational Fluid Dynamics (CFD), the Finite Volume Method.
9. The mathematical interpretations and practical applications of various boundary conditions. Modelling approaches used in fluid machinery.
10. Application of volume sources and internal jumps. Porous media modelling. Major characteristics of turbulent flows, turbulence models, wall treatment and boundary conditions in commonly used turbulence models.
11. Numerical mesh; quality and size criteria; meshing methods. Compressible flow modelling.
12. Thermal process modelling: natural convection, heat conduction and radiation. Boundary conditions on solid walls. Calculation of heat transfer coefficient.

13. Quality and trust of CFD.
14. 2nd theoretical test.

Laboratory (course-week, topics):

1-6. Amesim laboratory practices
7. 1st laboratory test
8. Axisymmetric flow in an orifice.
9. Simulation of flow in a radial pump.
10. Simulation of an exhaust pipe including porous filter.
11. Flow around a transonic airfoil.
12. Air and heat extraction from an enclosure using a kitchen canopy.
13. Individual modelling exercise.
14. 2nd laboratory test.

9. Requirements and grading

a) in term-period:

The subject in concluded with a practical mark. The evaluation consists of two theoretical test, and two practical tests. Condition for the midterm signature: achieving at least 40% of the maximum total points of each individual test. Midterm evaluation consists of:

- 1st theoretical test: max. 25p;
- 1st practical test: max. 25p;
- 2nd theoretical test: max 25p;
- 2nd practical test: max 25p.

The above test results sum up maximum 100 points, from which, the evaluation of the practical mark (1,2,3,4,5) is according to the usual lower limits (0,40,70,85).

b) in examination period: -

c) The students are subject to disciplinary measures against the application of unauthorized means at mid-terms, term-end exams and homework and the application of the 1/2013. (I.30.) Dean's Order must be followed.

10. Retake and repeat:

One retake opportunity is given for the tests on the retake week (15th education week).
Any further movements are due to the Code of Studies and Exams of BME.

11. Consulting opportunities:

Consultation hours: by email appointments and as it is indicated on the department's website. Weekly consulting hours will be provided. The consultation time can be enquired at the department administration after the registration week of the active semester. Exam consultation is provided the day before the exam.

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/BMEGEATAM05

13. Home study required to pass the subject:

Contact hours	56	h/semester
Home study for the courses	40	h/semester
Home study for the mid-semester checks	4×6	h/check
Preparation of mid-semester homework	-	h/homework
Home study of the allotted written notes	-	h/semester
Home study for the exam	-	h/semester
Totally:	120	h/semester

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

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