BSc in Mechanical Engineering
Process Engineering spec.
2NAAG0 training code
compulsory subject

SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 31th January 2014

NUMERICAL SIMULATION OF FLUID FLOWS

ÁRAMLÁSOK NUMERIKUS SZIMULÁCIÓJA

1 Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
BMEGEÁTAG26	6	2+0+1	p	3	English

*: in case of enrolment in fall

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
Gábor Závodszky	assistant lecturer	Dept. of Hydrodynamic Systems

4. Thematic background of the subject:
Fluid mechanics

5. Compulsory / suggested prerequisites:
Compulsory: Fluid Mechanics /BMEGEÁTAG01/ or Fluid Mechanics /BMEGEÁTAG11/

6. Main aims and objectives, learning outcomes of the subject:
To deliver knowledge of modelling approaches in various flow categories, theoretical basis and practical application of turbulence models, principles of numerical solution, errors and uncertainties rising from numerical simulation. 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 0h/w, laboratory 1h/w

8. Detailed thematic description of the subject:
Lectures (course-week, topics):
1-6. Numerical methods /by Gábor ZÁVODSZKY/
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) starting on the 8 course-week:

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. 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 one practical test. Condition for the midterm signature: achieving at least 40% of the maximum total points of both theoretical tests and achieving at least 40% in the practical test.

Midterm evaluation consist of

- 1st theoretical test: max. 33p;
- 2nd theoretical test: max 33p;
- Practical test: max. 34p;

which sums up maximum 100 points, from which, the evaluation of practical marks (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/BMEGEATAG26

13. Home study required to pass the subject:

Contact hours	42	h/semester
Home study for the courses	18	h/semester
Home study for the mid-semester checks	3x10	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:	90	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