Tantárgyi adatlap és követelményrendszer | Subject data sheet and requirements

2009.01.05.

Budapesti Műszaki és Gazdaságtudományi Egyetem
Gépészmérnöki Kar
Áramlástan Tanszék
Mechanical Engineering Modelling (MSc)
Fluid Mechanics major (MSc)

Budapest University of Technology and Economics
Faculty of Mechanical Engineering
Department of Fluid Mechanics
Mechanical Engineering Modelling (MSc)
Fluid Mechanics major (MSc)

Multiphase and Reactive Flow Modelling
(Többfázisú és reaktív áramlások modellezése)

1.	*Code (kód)*	*Semester (szemeszter)*	*Requirements (követelmények)*	*Credit (kredit)*	*Language (nyelv)*
	BMEGEÁTMW07	3.	lect./sem./lab. (**e**xam / **p**ract. / **s**ignat.) 1+1+0 (p)	3	English

2. Responsible person and Department (Tantárgyfelelős személy és Tanszék):

Name (név):	*Status (beosztás):*	*Department (tanszék):*
Dr. Gábor K. SZABÓ	research fellow	Dept. Fluid Mechanics

3. Lecturer (a tantárgy előadója):

Name (név):	*Status (beosztás):*	*Department (tanszék):*
Dr. Gábor K. SZABÓ	research fellow	Dept. Fluid Mechanics

4. Thematic background of the subject (A tantárgy az alábbi témakörök ismeretére épít):

Mathematics: practical knowledge of vector and tensor algebra and calculus, ordinary and partial differential equations.
Mechanics and thermodynamics: solid knowledge of principles.
Fluid mechanics: fluid mechanics of simple fluids, turbulence models, basic flow measurement techniques, basic CFD techniques.

5. Compulsory/suggested pre-requisites (kötelező/ajánlott előtanulmányi rend):

	Subject name (tárgynév)	*Code (tárgykód)*
Compulsory pre-requisites:	Advanced Fluid Mechanics	BMEGEÁTMW01
Suggested pre-requisites:	Computational Fluid Mechanics	BMEGEÁTMW02
	Flow Measurements	BMEGEÁTMW03

6. Main objectives of the subject (a tantárgy célkitűzései):

- Understanding the physical phenomena occurring in fluid systems with more than one chemical components or more than one phases.
- Familiarization with special measurement techniques used in such systems.
- Outlining the concepts of possible theoretical models and numerical modelling, understanding limitations due to restricted range of validity and computational resources.
- Detailed studying of models used in some typical engineering applications.

7. Detailed thematic description of the subject (a tantárgy részletes tematikája):

- Physical phenomena, major concepts, definitions and modelling strategies. Lagrangian vs. Eulerian description. Equilibrium vs. non-equilibrium models. Dimensionless numbers.
- Modelling free surface and fluid-fluid interfaces. Bubble growth and collapse. Gravity and capillary waves.
- Dispersed particle transport. Flow regimes and model options. Sedimentation and fall-out.
- Flow regimes in vertical, horizontal and inclined pipes. Closure relations.
- Advanced two-phase flow instrumentation.
- Phase change and heat transfer in single-component systems: boiling, cavitation, condensation. Related heat transport problems and industrial applications.

- Phase interactions: particle agglomeration and break-up.
- Modelling chemical reactions: flames, combustion models, atmospheric reactions.
- Computational Multi-Fluid Mechanics (CMFD): general methods and limitations, usage of general purpose computational fluid dynamics codes, design of specialized target software.
- Applications in power generation, hydrocarbon and chemical industry.

8. Mode of education of the subject (a tantárgy oktatásának módja):

Theoretical lectures with supplementary practical classes. Practical classes include laboratory demonstration experiments and measurements, problem solving exercises, CFD laboratory practices.

9. Requirements (követelmények):

Mid-term requirements:
- presence on practical classes,
- Test 1 (7^{th} week, 40 points),
- Test 2 (13^{th} week, 40 points),
- one running and realistic CFD model of an individually assigned simple model system (deadline depends on the actual assignment, 20 points).

Grading system.
In order to pass students must satisfy all four of the following conditions:
1. substantial activity in laboratory demonstrations,
2. at least 15 points on Test 1,
3. at least 15 points on Test 2,
4. at least 10 points on the assigned CFD problem before the individual deadline.

Those who will not have passed shall receive a final grade **1**.
Those who will have passed shall receive their final grades based upon the total of their points collected in the tests and the CFD problem as follows:

Total points	Final grade
at least 80	**5**
70 (incl.) … 80	**4**
60 (incl.) … 70	**3**
less than 60	**2**

10. Consulting opportunities (konzultációs lehetőségek):

Personal consultation with the lecturer and experts at the Department of Fluid Mechanics is possible.
If necessary, references to reliable on-line resources and information will be given.

11. Reference literature (jegyzet, tankönyv, felhasználható irodalom):

– Website of the subject: http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATMW07

1. Lecture notes downloadable from the Department's Internet site.
2. C. Crowe, M. Sommerfield, and Yutaka Tsuji. Multiphase Flows with Droplets and Particles. CRC Press, 1998.
3. D. Gidaspow. Multiphase Flow and Fluidization. Academic Press, Boston, 1994.

Further literature will be provided on the course website.

12. Home study required to pass the subject (a tantárgy elvégzéséhez szükséges tanulmányi munka):

Estimated time for home studies: 2 hours/week.

13. The data sheet and the requirements are prepared by (a tantárgy tematikáját kidolgozta):

Budapest, 5^{th} of January 2009

Name (név):	*Status (beosztás):*	*Department (tanszék):*
Dr. SZABÓ, K. Gábor	research fellow	Dept. Fluid Mechanics