BSc in Mechanical Engineering 2N-AG0/2NAAG0
Process Engineering specialization 2N-AG0-PE

Mechanical Engineering
compulsory subject

SUBJECT DATA SHEET AND REQUIREMENTS

last modified: October 2019

FLUID FLOW SYSTEMS

(Áramlástechnikai rendszerek)

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEVGAG07	**7**	**2+1+0**	**p**	**3**	**English**

2. Subject's responsible:

Name:	Position:	Affiliation (Department):
Ferenc Hegedűs, PhD	Associate professor	Dept. of Hydrodynamic Systems

3. Lecturer:

Name:	Position:	Affiliation (Department):
Ferenc Hegedűs, PhD	Associate professor	Dept. of Hydrodynamic Systems

4. Thematic background of the subject:

The course covers the basic knowledge of design, and computations of stationary hydraulic or pneumatic pipe network systems.

5. Compulsory / recommended prerequisites:

Compulsory: -
Suggested: Fluid Machinery
Fluid Mechanics

6. Main aims and objectives, learning outcomes of the subject:

The main aim of the subject is to familiarize the students with the computational concepts of large water/gas distribution systems containing simple pipes, valves, throttles, reservoirs and pumps. Upon finishing the course, the students will be able to select pumps for a given system, perform stationary computations and reservoir sizing tasks.

7. Method of education:

lecture: 2h/7w
seminar: 1h/7w
laboratory: -
homeworks: Submission of report of a compulsory and a mandatory homework.

8. Detailed thematic description of the subject (by topic, min. 800 character):

Lectures: 7*3h

1. Basic principles of the conservation laws (mass, momentum and energy). Pressure and head losses in different type of devices. Characteristic curves of pipelines and pumps. Parallel and series connections of pipelines and pumps.
2. General solution technique for large pipe network systems. Defining the unknown quantities and collecting the required number of equations. Newton's method for solving large scale algebraic systems.
3. Case study of pump selection for a given water distribution system with given daily consumption schedule. Reservoir sizing and characteristic curve of the system.
4. Generalization of solution concept for compressible flows.
5. Case study of a long natural gas pipeline.
6. Derivation of the first order ordinary differential equation describing the stationary open channel flows. Definition of the specific depths (normal, critical) and the wave celerity. Discussion of the solution properties as a function of the relative position of the normal and critical depths.
7. Numerical solution technique for first order ordinary differential equations. Simple explicit Euler method. Selection of proper initial conditions.

9. Requirements and grading

a) in term-period

Type	**Share of the grade**
Mid-term test	50 %
Homework	50 %
Sum	100%

b) in examination period

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

According to the Code of Studies (Rector's Order № 7 of 2017 (6 November 2017) with the amendments of Rector's Order № 3 of 2018 (30 August 2018), available: https://gpk.bme.hu/downloads/en/BME_Code_of_Studies.pdf

d) grade

The mid-term grade is based on performance scores as shown in the table below.

grade ● [ECTS]	**points**
jeles(5) ● Excellent [5]	above 85%
jó(4) ● Good [4]	72,5–85%
közepes(3) ● Satisfactory [3]	65–72,5%
elégséges(2) ● Pass [2]	50–65%
elégtelen(1) ● Fail [1]	under 50%

10. Retake and repeat

According to the Code of Studies

11. Consulting opportunities:

Consultation hours by email appointments

12. Reference literature (compulsory, recommended):

- Dixon: Fluid Mechanics and Thermodynamics of Turbomacinery, Butterworth, ISBN 0-7506-7059-2
- A. Nourbakhsh *et al.*: Turbopumps & Pumping Systems, Springer, ISBN 978-3-540-25129-3
- Downloadable materials: www.hds.bme.hu

13. Home study required to pass the subject:

Contact hours	21	h/semester
Home study for the courses	29	h/semester
Home study for the mid-semester checks	20	h/check
Preparation of mid-semester homework	20	h/homework
Home study of the allotted written notes	-	h/semester
Home study for the exam	-	h/semester
Totally:	**=30×3=90**	**h/semester**

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

Name:	Title:	Affiliation (Department):
Ferenc Hegedűs, PhD	Associate professor	Dept. of Hydrodynamic Systems