SUBJECT DATASHEET

I. SUBJECT SPECIFICATION

1 BASIC DATA

1.1 Title

HYDRAULICS 1

1.2 Code

BMEEOVVAT42

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	**Hours**
lectures	2/week
seminars/exercise classes	1/week

1.5 Evaluation

examination

1.6 Credits

3

1.7 Coordinator

Dr. János Józsa, full professor (jozsa.janos@epito.bme.hu)

1.8 Department

Department of Hydraulic and Water Resources Engineering (www.vit.bme.hu)

1.9 Website

www.oktatas.bme.hu/BMEEOVVAT42

1.10 Language of instruction

Hungarian and English

1.11 Curriculum requirements

Obligatory in Civil Engineering (BSc)

1.12 Prerequisites

Recommended subjects:

Mathematics A1a — Calculus (BMETE90AX00).

Exclusive subjects (one shall not register if any of the subjects listed below has been completed):

Hydraulics 1 (BMEEOVVAT26).

1.13 Effective date

September 1, 2017.

2 OBJECTIVES AND LEARNING OUTCOMES

2.1 Objectives

The purpose of the subject is the students' acquiring knowledge upon the basic elements of hydrostatics, pipe hydraulics, channel hydraulics, hydraulic structures, seepage hydraulics and the application of the principles of mass, momentum and energy balance for these processes.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge
   1. Becomes familiar with the generally accepted terminology of hydraulics.
   2. Knows Euler's basic equations of hydrostatics and hydrodynamics and the relations derived from thereof.
   3. Understands the concepts of continuity and the possibilities of its applications.
   4. Understands Bernoulli's equation and the hydraulic relations derived from thereof.
   5. Becomes familiar with the momentum principle and is able to apply it to simple hydraulic phenomena.
   6. Becomes experienced in the application of Chézy's formula.
   7. Understands the basic phenomena occurring in the subsurface environment.
   8. Knows the most important types of hydraulic machines and their usual application.

B. Skills
   1. Able to establish simplified description of real hydraulic systems.
   2. Able to formulate the fundamental processes of hydraulic systems using mass, momentum and energy balances.
   3. Able to identify simple hydraulic problems, to explore their practical backgrounds and, eventually, solve them.
   4. Expresses his or her ideas in an organized way both verbally and in writing.

C. Attitudes
   1. Attempts to perceive and routinely apply the methodology of hydraulic problem solving.
   2. Makes efforts to solve the problems without errors and with appropriate precision.
   3. Aims energy efficiency and environmental awareness in hydraulic design.

D. Autonomy and responsibility
   1. Performs the analysis and solution of basic hydraulic problems solely.
   2. Open to accept critical arguments.
   3. Applies systematic approach in his or her thinking.

2.3 Methods

Lectures, exercise classes, written and oral communications, application of IT tools and techniques, assignments solved individually.

2.4 Course outline

Week	Topics of lectures and/or exercise classes
1	The subject of hydraulics. Physical properties of water and other fluids. Hydrostatics Part 1: pressure, Euler's fundamental equation of hydrostatics.
2	Hydrostatics Part 2: pressure distribution, pressure diagrams; buoyancy, absolute and relative equilibrium.
3	Fluid flow: basic concepts, Euler's fundamental equation of hydrodynamics.
4	Flow of ideal fluid under gravity. Bernoulli's equation for ideal and real fluids, its extension to the whole cross section of the flow.

Week	Topics of lectures and/or exercise classes
5	Efflux from openings of hydraulically small and large sizes. Submerged entry.
6	The operating principle and types of weirs; free and submerged entry.
7	The dynamical equilibrium in pipe flow, shear stress profile, wall shear stress. Velocity profiles in laminar and turbulent flow. Moody's diagram..
8	Uniform flow in open channels. Chézy's formula. Hydraulic design of channels.
9	Surface elevation of gradually varying flows. Sharp variation of flow. Sub- and super-critical flow.
10	The momentum principle of hydraulics and its application. The hydraulic jump.
11	Design of stilling basins with constant width.
12	Seepage in porous media. Darcy's law and its application.
13	Streamlines in two dimensional seepage. The characterization of seepage below structures. Hydraulic machines.
14	Rotary pumps.

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5 Study materials

a) Textbook:
   Mott: Applied Fluid Mechanics (3rd edition)
b) Online materials
   As listed on the course website (www.oktatas.bme.hu/BMEEOVVAT42).

2.6 Other information

None

2.7 Consultation

The instructors are available for consultation during their office hours, as advertised on the department website at the beginning of the semester.

II. SUBJECT REQUIREMENTS

3 ASSESSEMENT AND EVALUATION OF THE LEARNING OUTCOMES

3.1 General rules

The assessment of the learning outcomes specified in Clause 2.2 above and the evaluation of student performance occurs via two midterm tests and written or oral examination.

3.2 Assesement methods

Evaluation	**Abbreviation**	**Assessed learning outcomes**
1st midterm test	ZH1	A1-4, B1-4, C1-2, D1, D3
2nd midterm test	ZH2	A1, A4-6, B1-4, C1-2, D1, D3
Written or oral examination	V	A1-8, B1-2, B4, C1, C3, D2-3

The dates of midterm tests can be found in the detailed course schedule on the subject's website.

3.3 Evaluation system

Abbreviation	**Score**
ZH1	25%
ZH2	25%
Total achievable during the semester	**50%**
V	50%
Sum	**100%**

3.4 Requirements and validity of signature

Criterion of obtaining the signature is at least 70% attendance rate to lectures and seminars/exercise classes and reaching at least 40% of the obtainable points of both midterm tests.

Whenever someone enrols with an already valid signature to the normal course instead of the examination course, then his/her midterm results overrule any previous midterm results, including the validity of signature.

3.5 Grading system

A midterm test or a written examination is considered unsuccessful if a score of less than 40% of the maximum achievable points is reached: this results a `failed' final grade. Otherwise the final grade is calculated as the weighted average of the midterm tests and the examination as specified in Clause 3.3.

grade	**points (P)**
excellent (5)	85%<=P
good (4)	70%<=P<85%
satisfactory (3)	55%<=P<70%
passed (2)	40%<=P<55%
failed (1)	otherwise

3.6 Retake and repeat

1) Both midterm tests can be made up or retaken once free of charge on the dates specified in the detailed course schedule. In case of retake, the previous score shall be substituted by the new result.

2) A second retake test, which is subject to a fee, will be given on the dates specified in the detailed course schedule if less than 2/3 of the enrolled students succeed. The second retake of both midterm tests can be organized as a combined test.

3.7 Estimated workload

activity	**hours/semester**
contact hours	14×3=42
preparation for the courses	7×1=7
preparation for the tests	2×8=16
home studying of the written material	5
preparation for the examination	20
in total	**90**

3.8 Effective date

September 1, 2017.