POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2021/2022

1. GENERAL COURSE INFORMATION				
1.1 Course name	**Fluid mechanics**			
1.2 Study program/s	Undergraduate professional study Sustainable Development			
1.3 Course status (O,E)	Obligation	**1.6 Mode of instruction (number of hours)**	**Lectures**	30
1.4 Course code			**Exercises**	45
1.5 Course abbreviation	MF		**Seminars**	
1.6 Semester	IV		**E-learning**	
1.7 ECTS	5	**1.7 Place and time of instruction**	Premises of the Polytechnic of Međimurje in Čakovec, according to the schedule published on the website	
2. TEACHING STAFF				
2.1 Course leader/s-title	prof. Sarajko Baksa, Ph.D.	**contact**	sbaksa@mev.hr	
	- - -	**contact**	- - -	
2.2 Assistant/s- title	- - -	**contact**	- - -	
	- - -	**contact**	- - -	
2.3 Instruction held by- title	- - -	**contact**	- - -	

3. COURSE DESCRIPTION	
3.1 Course goals	The aim of the course is to enable students to independently create and understand the basic laws of fluid behavior at rest and in motion, as well as training students to solve simpler examples in the field of fluid mechanics, which can be found in engineering practice.
3.2 Prerequisites	They are not defined. For unhindered monitoring of teaching in the course, it is necessary that students have an active knowledge of high school mathematics, higher mathematics, parts of physics and mechanics. In particular, it is expected that the student can easily solve equations with one or more unknowns, know trigonometric and other basic mathematical functions, can actively apply the basic rules of derivation and integration of functions, know SI systems of units, know how to solve static problems of mechanics (forces and moments of forces in equilibrium).
3.3 Course outcomes	After successfully passing the course, the student will be able to: 1. Distinguish and calculate manometer and absolute pressure, and apply the manometer equation on the pressure calculation. 2. Calculate the forces by which a fluid at relative rest acts on planes and curved surfaces. 3. Describe and distinguish the most important concepts of fluid kinematics as well as regimes fluid flow. 4. Explain and use Bernoulli's equation. 5. Calculate fluid forces on solid walls using the impulse equation. 6. Construct and calculate a simpler pipeline with flow calculation in open channel and overflow.

3.4 Course content

The course presents contents related to the concept, possibilities and role of the basic laws of fluid behavior at rest and in motion, as well as training students to solve simpler examples in the field of fluid mechanics, which can be found in engineering practice.

3.5 Types of coursework

x	Lectures	x	Exercises	x	Blended e-learning	x	Individual activities		Laboratory
x	Seminars and workshops	x	Distant learning	x	Field classes	x	Multimedia and network	x	Mentorship
	Other								

3.6 Language of instruction

Croatian / English

3.7 Monitoring students' work (enter the number of ECTS credits for each activity so that the total number of ECTS credits is equal to the total ECTS value of the course, 1 ECTS = 30 hours)

2,5	Class attendance	0,2	Seminars		Essay
0,2	Class activity	0,2	Project		Report/paper
	Midterm exams	0,2	Practical task	0,2	Continuous knowledge check
1,0	Written exam		Experimental work		
0,5	Oral exam		Research		

3.8 Assessment and evaluation of students' work during classes and at the final exam

Activity specification	Percent %	Points
Assessment during instruction		
Attendance	5%	5
Class activity	5%	5
Project / Practical work	20%	20
Seminar / Colloquium I	20%	20
Seminar / Colloquium II	20%	20
Oral exam	30%	30
Exam assessment for the students who failed to fullfil all the obligatory requirements during the semester		
Written exam	*60%*	*60*
Total:	**100%**	**100**

3.9 Assessment criteria – analysis per learning outcomes

Ways of evaluating learning outcomes							
	Atten-dance	**Activity**	**Project**	**Mid-term exam 1**	**Mid-term exam 2**	**Practic work**	**Total**
Outcome 1			3	6		5	14
Outcome 2			3	6		5	14
Outcome 3			3	8		5	16
Outcome 4			3		6	5	14
Outcome 5			4		6	5	15
Outcome 6			4		8	5	17
Outcome not-related	5	5					10
Total	**5**	**5**	**20**	**20**	**20**	**30**	**100**

The course has defined 10 learning outcomes, a system of scoring outcomes, in order to pass the exam the student must achieve at least 50% points for each learning outcome.

	The grade is calculated as follows: • 87.51-100.00 points: rating Excellent (5) • 75.01- 87.5 points: rating Very good (4) • 62.51 -75.00 points: rating Good (3) • 50.01- 62.5 points: rating Pass (2) • 00.00- 50.00 points: rating Fail (1)	
3.10 Specific features related with taking the course	If the student collects 50% of the points of each outcome, he / she directly takes the exam, provided that he / she has done practical work (seminars / project). During the exam, it is possible to orally check the knowledge from practical work (seminars / project). Once earned points for each learning outcome are no longer deleted unless the student, with the express approval of the course leader, decides to correct the result for each learning outcome, whereby the points won are deleted and newly earned points for that learning outcome are entered. The final grade is obtained on the exam period and is the sum of points earned during classes. Students who did not take the colloquium access the written part of the exam where all learning outcomes are checked, and are required to have completed practical work (seminars / project) before taking the exam.	
3.11 Students obligations	Full-time students are required to attend at least 70% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. Part-time students are required to attend at least 30% of the total number of hours of lectures and exercises in order to exercise the right to take the exam. If the student has not fulfilled all the obligations set by the course, he is obliged to attend the lectures again and meet the conditions for taking the exam. Attendance can be offset by online tuition, organised webinars and added assignments given by teachers. One lesson lasts 45 minutes, and several hours form a teaching unit. Absence from one teaching unit is counted as one absence. Delays and apologies are recorded separately. In that case, if the student missed more than 50% of classes, and has a justifiable reason/apology, the request should be submitted to the Department Council, which then decides on the justification of student absences with the obligatory opinion of the course leader.	
3.12 Written assignments	Seminars / Projects	
3.13 Required reading	1.	M. Pečornik: Tehnička mehanika fluida. Školska knjiga, Zagreb, 1989.
	2.	M. Šavar, Z. Virag, I. Džijan: Mehanika fluida. Skripta – vježbe, FSB Zagreb, 2014.
	3.	F. M. White: Fluid Mechanics, 8th ed., McGraw-Hill, 2016.
3.14 Additional reading	1.	Z. Virag: Mehanika fluida - odabrana poglavlja, primjeri i zadaci, FSB Zagreb, 2002.
	2.	M. Šavar, Z. Virag, I. Džijan: Mehanika fluida. Skripta – predavanja, FSB Zagreb, 2014.
	3.	M. Potter, D. Wiggert: Schaum's outline of Fluid Mechanics. McGraw-Hill, 2008.
	4.	Ž. Andreić: Temelji mehanike fluida, Rudarsko-geološko-naftni fakultet Zagreb, 2014.

4 ADDITIONAL COURSE INFORMATION	
4.1 Quality control	The quality of the program, teaching process, teaching skills and level of mastery of the material will be established by conducting a written evaluation based on questionnaires, and in other standardised ways and in accordance with the by-laws of the Polytechnic of Međimurje in Čakovec.
4.2 Contact the teacher	Students can contact the teacher during the office hours and during classes, while for short questions and explanations they can contact him/her any day during working hours by coming in person or by landline. It is possible to ask questions and e-mail which will be answered as soon as possible.
4.3 Information about the course	It is the obligation of each student to be regularly informed about the course. All relevant information and notices related to classes and exams, maintenance or any year, will be reported in a timely manner on the bulletin board and on the website of the Polytechnic of Međimurje in Čakovec.
4.4 Course contribution to the study program	Course contribution to the study program in generic learning outcomes; I1 - Interpret information, ideas, problems and solutions to professional and General public, I2 - Use new technologies and techniques as part of a lifelong process Learning, I5 - Critically evaluate arguments, assumptions and data in order to create opinions and contributing to the solution of the problem. The contribution of the course to the study program in specific learning outcomes; I6 - Solve engineering problems of sustainable development by applying mathematics, physics, chemistry and biology, I7 - Analyze collected data in the field of sustainable development, I8 - Interdisciplinary to solve engineering problems of sustainable development, I11 - Apply basics of thermoenergetics, thermodynamics and hydromechanics in spatial design of thermodynamic systems, I12 - Develop a technical plan in the field of design of Mechanical Thermotechnical System, I13 - Analyze the basic elements and networks in electrical engineering and justify use of non-renewable and renewable energy sources, applicable code thermotechnical systems, I14 - Apply and monitor conventional heating, cooling, and ventilation systems and devices, I15 - Maintain thermotechnical systems and thermal distribution networks I16 - Propose technical changes and upgrades to conventional ones thermotechnical systems in the direction of sustainable development.

5. ANALYSIS OF COURSE TOPICS (the number of hours is equal to the number of lectures and exercises of the course)				
LECTURES				
Hours	**Topic and description**	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	**Learning outcomes**	**Course outcome**
1.	Fluid properties, physical quantities used in Fluid Mechanics and their units.	Lecture, Discovery learning, Presentation	Use standardization and normative series of quantities used in Fluid Mechanics	I1
2.	Fluid statics - manometer equation.	Lecture, Discovery learning, Presentation	Distinguish fluid statics - manometer equation	I1
3.	Fluid statics - the action of fluid on flat and curved surfaces.	Lecture, Discovery learning, Presentation	Distinguish models of the action of fluids on flat and curved surfaces	I2
4.	Fluid statics - buoyancy.	Lecture, Discovery learning, Presentation	Use various forms of buoyancy of fluid	I2
5.	Fluid statics - relative fluid rest.	Lecture, Discovery learning, Presentation	Distinguish the relative rest of fluid	I2
6.	Fluid motion. Speed and acceleration, currents and trajectories. Viscous and non-viscous flow, turbulence, boundary layer. Turbulent and laminar flow. Compressive and incompressible flow.	Lecture, Discovery learning, Presentation	Use knowledge of turbulent and laminar flow, compressible and non-compressible fluid flow	I3
7.	Law of conservation of mass and energy (Bernoulli equation).	Lecture, Discovery learning, Presentation	Apply the Law on Conservation of Fluid Mass and Energy	I4
8.	Application of the Bernoulli equation. Dynamic, static and stop pressure. Prandt-Pitot tube.	Lecture, Discovery learning, Presentation	Apply Bernoulli equations, dynamic, static and stop pressure of fluid	I4
9.	Application of the Bernoulli equation. Leakage through openings and nozzles.	Lecture, Discovery learning, Presentation	Use knowledge of the application of the Bernoulli equation, flow through openings and nozzles	I4
10.	Viscous fluid flow in pipelines - laminar and turbulent flow.	Lecture, Discovery learning, Presentation	Apply the basic syntax of viscous fluid flow in pipelines	I5
11.	Viscous fluid flow in pipelines - local losses.	Lecture, Discovery learning, Presentation	Apply the concept of local viscous fluid flow losses in pipelines	I5
12.	Calculation of simple pipelines.	Lecture, Discovery learning, Presentation	Apply the calculation of simple pipelines	I5

13.	Law on conservation of momentum and momentum.	Lecture, Discovery learning, Presentation	Explain the Law on Preservation of the Quantity of Motion and the Moment of the Quantity of Motion	I6
14.	Flow in open channels and overflows.	Lecture, Discovery learning, Presentation	Explain the flow in open channels and overflows	I6
15.	Fundamentals of computer fluid mechanics. Demonstration of flow simulation in engineering CAD packages.	Lecture, Discovery learning, Presentation	Apply computer creation of fluid mechanics flow simulation	I6
EXERCISES/ SEMINARS				
Hours	**Topic and description**	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	**Learning outcomes**	**Course outcome**
1.	The concept of fluid pressure and velocity. Barometric, manometer and absolute pressure.	Lecture, Discovery learning, Presentation	Application of norms and standardization within the field of fluid mechanics	I1
2.	Solving problems in the field of manometer equation.	Lecture, Discovery learning, Presentation	Explain the models of technical problems in the field of manometer equation	I1
3.	Solving problems in the field of hydrostatics.	Lecture, Discovery learning, Presentation	Apply models for solving problems in the field of hydrostatics	I2
4.	Solving problems in the field of hydrostatics.	Lecture, Discovery learning, Presentation	Apply solving problems in the field of hydrostatics	I2
5.	Solving problems in the field of hydrostatics.	Lecture, Discovery learning, Presentation	Explain various technical tasks in the field of hydrostatics	I2
6.	Solving problems in the field of hydrostatics. Determining the flow regime.	Lecture, Discovery learning, Presentation	Determine and design fluid flow regimes	I3
7.	Problems with the application of the Bernoulli and continuity equations.	Lecture, Discovery learning, Presentation	Apply problems with the application of Bernoulli and continuity equation	I4
8.	Problems with the application of the Bernoulli equation. Dynamic, static and stop pressure. Prandt-Pitot tube.	Lecture, Discovery learning, Presentation	Apply solving problems from the field of Bernoulli equation	I4

9.	Problems with the application of the Bernoulli and continuity equations.	Lecture, Discovery learning, Presentation	Apply solving problems from the field of Bernoulli's equation. and continuity equations	I4
10.	Modeling of friction losses in a pipeline.	Lecture, Discovery learning, Presentation	Make Modeling of friction losses in pipeline	I5
11.	Calculation of friction losses and local losses in pipelines.	Lecture, Discovery learning, Presentation	Build a calculation of friction losses and local losses in pipelines	I5
12.	Tasks from the budget of simple pipelines.	Lecture, Discovery learning, Presentation	Apply the calculation of simple pipelines	I5
13.	Calculation of fluid forces on solid walls due to changes in pressure and velocity using the impulse equation.	Lecture, Discovery learning, Presentation	Explain the calculation of fluid forces on solid walls due to changes in pressure and velocity using the impulse equation	I6
14.	Open channel capacity calculation and overflow calculation.	Lecture, Discovery learning, Presentation	Make an open channel capacity calculation and an overflow calculation	I6
15.	Computer 3D CAD demonstration of fluid flow simulation.	Lecture, Discovery learning, Presentation	Create a 3D computer CAD demonstration of fluid flow simulation	I6