Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

Faculty of Chemical Technology and Engineering

Field of study	Chemical Engineering		
Mode of study	stationary	*Level*	first cycle
Graduate's qualification	inżynier		
Area(s) of study	nauki techniczne		
Educational profile	general academic		
Module			
Course unit	**Fluid Mechanics**		
Code	ChEn_1A_S_C03		
Field of specialisation			
Administering faculty	Institute of Chemical Engineering and Environmental Protection Processes		
ECTS	6,0	*ECTS (forms)*	6,0
Form of course credit	examination	*Language*	english
Electives		*Elective group*	

Form of instruction	*Code*	*Semester*	*Hours*	*ECTS*	*Weight*	*Credit*
lecture	W	3	30	2,0	0,40	examination
lecturing course	A	3	30	2,0	0,30	credits
laboratory course	L	3	30	2,0	0,30	credits

Leading teacher	Rakoczy Rafał (Rafal.Rakoczy@zut.edu.pl)
Other teachers	Konopacki Maciej (Maciej.Konopacki@zut.edu.pl)

Prerequisites

W-1	Bacic knowledge in mathematics and engineering.

Module/course unit objectives

C-1	The course is aimed at giving an introduction to fluid mechanics. Student will be able to define fluid flow in chemical engineering by means of the mathematical relations; explain the physical properties of a fluid and the consequence of such properties on fluid flow; state the conservation principles of mass, momentum and energy for fluid flow; apply the basic applied-mathematical tools that support fluid mechanics; create mathematical descriptions of fluid flow with the application of the mathematical description.; determine the basic forces acting on fluid flow.

Course content divided into various forms of instruction		*Number of hours*
T-W-1	introduction to fluid mechanic; fundamentals; phenomenological rate and transport laws; differential equations of fluid mechanics dimensional analysis and similarity; scale-up; fluid properties; fluid statics; conservation principles; flow; internal flow applications; technical aspects of fluid mechanics; compressible flows; flow measurement and control; external flows; turbulent flow;	30
T-A-1	fluid properties; fluid static; fluid kinematics; laminar flow; turbulent flow; steady flow; unsteady flow; internal flow	30
T-L-1	Practical studies of fluid flow in chemical engineering systems.	30

Student workload - forms of activity		*Number of hours*
A-W-1	Participation in lectures	30
A-W-2	Individual literature study	25
A-W-3	Preparation for exam	5
A-A-1	Participation in classes	30
A-A-2	individual calculations of tasks	20
A-A-3	prepration to pass	10
A-L-1	Participation in labs	30
A-L-2	Preparation of reports	20
A-L-3	Preparation to pass	10

Teaching methods / tools

M-1	Information lecture with the use of a multimedia projector
M-2	Discussion
M-3	Classes
M-4	Laboratory

Evaluation methods (F - progressive, P - final)

Evaluation methods (F - progressive, P - final)		
S-1	P	Written test
S-2	P	Written pass
S-3	F	Reports
S-4	F	Active participation in auditory classes

Designed learning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to the learning outcomes defined for the particular areas of education	Reference to learning outcomes leading to the degree of "inżynier"	Course objectives	Course content	Teaching methods	Evaluation methods
Knowledge							
ChEn_1A_C03_W01 Student has knowledge in fluid mechanics, including mathematical calculation useful for solving tasks connected with the scope of chemical engineering.	ChEn_1A_W15 ChEn_1A_W20	P6S_WG_TA11	P6S_WG_IA11	C-1	T-A-1 T-W-1 T-L-1	M-1 M-2 M-3 M-4	S-1 S-2 S-3
Skills							
ChEn_1A_C03_U01 Student is able to plan and conduct process experiments, including measurements and operations, as well as to interpret the obtained results and draw the conclusions	ChEn_1A_U01 ChEn_1A_U03 ChEn_1A_U05 ChEn_1A_U07 ChEn_1A_U08 ChEn_1A_U16	P6S_UO P6S_UU P6S_UW_TA11 P6S_UW_TA14	P6S_UW_IA11 P6S_UW_IA14	C-1	T-A-1 T-W-1 T-L-1	M-2 M-3 M-4	S-1 S-2 S-3
Other social / personal competences							
ChEn_1A_C03_K01 Student is able to work in a group and perform as a group leader; he/she is able to estimate the time necessary to accomplish the assigned tasks.	ChEn_1A_K01 ChEn_1A_K03 ChEn_1A_K04 ChEn_1A_K05	P6S_KK P6S_KO P6S_KR		C-1	T-A-1 T-W-1 T-L-1	M-2 M-3 M-4	S-3 S-4

Required reading

1. Borghi, Roland; Anselmet, Fabien, Turbulent multiphase flows with heat and mass transfer, ISTE Ltd ; Hoboken : John Wiley & Sons, Inc.,, London, 2014

2. Andrzej T. Gierczycki, Robert Kubica, Basic course on technical and fluid mechanics, Wydawnictwo Politechniki Śląskiej, 2012., Gliwice, 2012

3. Clement Kleinstreuer, Modern fluid dynamics : basic theory and selected applications in macro- and micro-fluidics, New York : Springer, London, 2010

4. Yunus A. Çengel, John M. Cimbala., Fluid mechanics : fundamentals and applications, McGraw Hill, 2006., Boston, 2006

Supplementary reading

1. James O. Wilkes, Fluid Mechanics for Chemical Engineers, Pearson Education Inc., Upper Saddle River, NJ, 2006

2. Ron Darby, Chemical Engineering Fluid Mehanics, Marcel Dekker, Inc., Basel, Switzerland, 2001