(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: Fluid mechanics	**2. Course code**
3. Validity of course description: 2015/2016	
4. Level of studies: 1st cycle of higher education	
5. Mode of studies: intramural studies	
6. Field of study: Industrial and Engineering Chemistry	RCH
7. Profile of studies: -	
8. Programme: general	
9. Semester: 4	
10. Faculty unit teaching the course: Department of Chemical Engineering and Process Design	
11. Course instructor: prof. Andrzej Gierczycki, PhD, DSc	
12. Course classification: field	
13. Course status: compulsory	
14. Language of instruction: English	
15. Pre-requisite qualifications: basic knowledge of Mathematics and Physics	
16. Course objectives: An objective of the course is to acquaint students with the fundamental principles governing gas and liquid behaviour.	
17. Description of learning outcomes: underneath	

No.	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	student knows principles and laws of fluid statics and their practical applications	credit test	lecture	K1A_W01 ++ K1A_W14 +
2.	student possesses basic knowledge of pressure and fluid flow measurement methods	credit test	lecture	K1A_W01 ++ K1A_W14 +
3.	student knows laws of fluid dynamics, in particular those regarding liquid flow in conduits	credit test	lecture	K1A_W01 ++ K1A_W14 +
4.	student is able to carry out calculations concerning pressure drop in pipes and power of fluid transportation devices	credit test	class	K1A_U08 ++ K1A_U24 +
5.	student is able to calculate tank discharging time and design a required pipe diameter	credit test	class	K1A_U08 ++ K1A_U24 +
6.	student understands the necessity of further professional training and the development of his/her engineering and personal competence	observation and discussion	lecture, class, consultation	K1A_K01 +

18. Teaching modes and hours

Lecture / BA /MA Seminar / Class / Project / Laboratory

Lecture sem. 4 - 30 hr / class – sem. 4 - 15 hr

19. Syllabus description:

The course is divided into two parts: fluid statics and fluid dynamics. The first one comprises properties of fluid such as density, viscosity, surface tension and capillarity. Then pressure measurements by the use of a barometer, piezometer, U-tube, differential micrometer and Burdon gauge are discussed. The equilibrium equation for fluids at rest is derived and its selected applications including Pascal's law are shown. Liquid action on immersed surfaces and bodies are presented under Archimedes' principle and hydrostatic thrust on a plain or curved surface. The second part deals with laminar and turbulent flow of liquid. The latter is described starting from the famous Reynolds experiment and then introducing concepts of deterministic chaos and the Kolmogorov microscale of turbulence. A beauty and precision of fluid dynamics is shown in the form of

continuity and momentum equations (Euler, Cauchy-Lagrange and Navier-Stokes). More practical aspects of liquid flow are given by pressure losses calculations in smooth and rough pipes and the Bernoulli equation. Also some typical local pressure losses in elbows, diffusers, confusors and valves are considered. Transportation of liquids by pumps is shortly discussed together with the flow and pump system characteristics for an impeller pump. General dependencies for steady-state and unsteady-state discharge of liquid from a tank are derived. At the end, main devices used in fluid flow rate measurements, such as the Prandtl tube, Venturi meter, orifice meter, anemometer and rotameter are presented.

20. Examination: no

21. Primary sources:

Çengel Y.A., Cimbala J.M., Fluid mechanics. Fundamentals and Applications, McGraw Hill Co., New York 2006.
Daugherty R.L., Franzini J.B., Fluid Mechanics with Engineering Applications, McGraw-Hill Book Company, Inc., New York 1977.
Gierczycki A.T, Kubica R., Basic Course on Technical and Fluid Mechanics, Wyd. Pol. Śl., Gliwice 2012.
Mott R.L., Applied Fluid Mechanics, Prentice Hall, Upper Saddle River 2000.

22. Secondary sources:

Bird R.B., Stewart W.E., Lightfoot E.N., Transport Phenomena, second edition, John Wiley & Sons, Inc., New York 2002.
Cheremisinoff N.P., Gupta R. (Eds.), Handbook of Fluids in Motion, Butterworths, Boston 1983.
Hinze J.O., Turbulence, McGraw–Hill Book Co., New York 1959.
Gil M., Szymczak I., Gierczycki A., Jarzębski A., Thullie J., Chemical Engineering English-Polish Glossary, Wyd. Pol. Śl., Gliwice 2005.
Hirata M., Kasagi N. (Eds.), Transport Phenomena in Turbulent Flows, Hemisphere Publishing Corporation, New York 1988.
Longwell P.A., Mechanics of Fluid Flow, McGraw-Hill Book Company, Inc., New York 1966.
Marghitu D.B., Mechanical Engineer's Handbook, Academic Press, San Diego 2001.
McCabe W.L., Smith J.C., Unit Operations of Chemical Engineering, third edition, McGraw–Hill Book Co., New York 1976.
Streeter V.L. (Ed.), Handbook of Fluid Dynamics, McGraw-Hill Book Company, Inc., New York 1961.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/-
2	Classes	15/15
3	Laboratory	-/-
4	Project	-/-
5	BA/ MA Seminar	-/-
6	Other	15/15
	Total number of hours	60/30

24. Total hours: 90

25. Number of ECTS credits: 3

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):-

26. Comments:-

Approved:

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(date, Instructor's signature) (*date , the Director of the Faculty Unit signature)*