MODULE DESCRIPTION

Module code	full-time studies:	**Z-ZIP1-E-305**
	part-time studies:	**Z-ZIPN1-E-305**
Module name	**Fluid Mechanics and Heat Transfer**	
Module name in Polish	**Mechanika Płynów i Wymiana Ciepła**	
Valid from academic year	**2019/2020**	

MODULE PLACEMENT IN THE SYLLABUS

Field of study	**MANAGEMENT AND PRODUCTION ENGINEERING**
Level of education	**1st degree**
Studies profile	**General**
Form and method of conducting classes	**Full-time and Part-time**
Specialisation	**All**
Unit conducting the module	**Department of Production Engineering**
Module co-ordinator	**Artur Bartosik, PhD, DSc**
Approved by:	

MODULE OVERVIEW

Type of subject / group of subjects	**Major**
Module status	**Compulsory**
Language of conducting classes	**English**
Module placement in the syllabus - semester	**Semester III**
Initial requirements	**No requirements**
Examination (YES/NO)	**YES**
Number of ECTS credit points	**4**

Method of conducting classes		**Lecture**	**Classes**	**Laboratory**	**Project**	**Other**
Per semester	full-time studies:	**30**	**15**			
	part-time studies:	**18**	**9**			

TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	Knowledge on physical properties of Newtonian and non-Newtonian fluids, and its measurements Knowledge on practical meaning of buoyancy and thrust.	ZIP1_W02
	W02	Basic knowledge on fluid motion phenomena and governing equations in fluid mechanics. Facilitating pump-pipeline transportation. Basic knowledge on phenomena of heat transfer and their governing equations.	ZIP1_W08
Skills	U01	A student knows place and role of fluid mechanics in technics and has ability to use equilibrium equation of liquids and to calculate simple thrusts.	ZIP1_U01
	U02	A student has ability to use fluid mechanics equations in order to calculate flow rate and friction in any flow field. Students knows how to calculate pipeline characteristics and find best pipeline-machine efficiency.	ZIP1_U14
	U03	A student has ability to predict simple heat exchange processes.	ZIP1_U17
Social competences	K01	A student understand needs of lifelong learning in order to improve skills in fluid mechanics and heat transfer.	ZIP1_K01
	K02	A student has ability to work as a team member in order to solve engineering problems relevant to fluid mechanics and heat transfer.	ZIP1_K04

TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	Structure of fluid mechanics; physical properties. Newtonian hypothesis, Newtonian and non-Newtonian fluids. Types of pressure and instruments to its measurements. Pressure and temperature distribution in Earth atmosphere. Hydrostatics – equilibrium equation for liquids Hydrostatic thrust on flat plat and swimming of body Laminar and turbulent flow; Reynolds experiment Continuity equation; Bernoullie equation for ideal fluids Bernoullie equation for real fluid; Darcy-Weisbach equation, Friction factor - Nikuradse graph Pipeline characteristics; Flowing machine characteristics and matching point of both characteristics Heat transfer phenomena - conduction, convection and radiation Conduction – Fourier law; Heat transfer coefficient and its experimental set up. Conduction in rectangular and cylindrical geometry – one and several layers Convection – Newtonian equation; heat transfer coefficient and its set up; Convection and conduction through rectangular and cylindrical geometry; Methods of enhancing and depressing the heat transfer Radiation – radiation phenomena; emission and absorption coefficient; Stefana-Boltzmanna and Kirchhoffa law Heat exchangers; fuels; Methods of heat production

Classes	Physical properties of fluids. Application of equilibrium equation to measurements and calculations of pressure. Application of continuity and Bernoulliego equations in ideal flows. Application of continuity and Bernoulliego equations in real flows; Darcy-Weisbach equation - calculation of pipeline characteristics. Application of heat transfer equation in simple geometry. Application of conduction and convection in engineering. Application of conduction, convection and radiation in engineering.

METODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes *(select X)*					
	Oral exam	**Written exam**	**Test**	**Project**	**Statement**	**Other**
W01		X	X			
W02		X	X			
U01			X			
U02		X	X			
U03		X	X			
K01			X			
K02			X			

FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Exam	Obtaining a min. 50% correct answers based on the test with closed and open questions.
Classes	Credit with grade	Obtaining a min. 50% from accounting tasks.

STUDENT WORKLOAD

Balance of ECTS points												
No.	Type of student's activity	Student's workload										Unit
		full-time					part-time					
1.	Participation in the activities	Lc	C	Lb	P	O	Lc	C	Lb	P	O	h
		30	15				18	9				
2.	Other (consultation, exam)	4	2				4	2				h
3.	**Number of hours of a student's assisted work**	**51**					**33**					h
4.	**Number of ECTS credit points which are allocated for assisted work**	**2,0**					**1,3**					ECTS
5.	**Number of hours of a student's unassisted work**	**49**					**67**					h
6.	**Number of ECTS credit points which a student receives for unassisted work**	**2,0**					**2,7**					ECTS
7.	**Work input connected with practical classes**	**33**					**33**					h
8.	**Number of ECTS credit points which a student receives for practical classes**	**1,3**					**1,3**					ECTS
9.	**Total number of hours of a student's work**	**100**					**100**					h
10.	**Punkty ECTS za moduł** *1 ECTS=25 hours*	**4**										ECTS

LITERATURE

1. Wright T., Gerhart P.M. (2010), Fluid machinery, application, selection, and design, 2nd Edition, Tylor & Francis Gr., London.
2. Heinz Bloch (2020), Fluid Machinery. Life Extension of Pumps, Gas Compressors and Drivers, Editor: De Gruyter.