FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in Polish	Procesy Cieplne
Name of subject in English	Heat Transfer Processes
Main field of study (if applicable):	Chemical Engineering and Processing
Specialization (if applicable):..	
Profile:	academic
Level and form of studies:	1st level, full-time
Kind of subject:	obligatory
Subject code	ICC015009
Group of courses	NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)			30	30	
Number of hours of total student workload (CNPS)			60	60	
Form of crediting			crediting with grade	crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points			2	2	
including number of ECTS points for practical (P) classes			2	2	
including number of ECTS points for direct teacher-student contact (BK) classes			1	1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of mathematics
2. Knowledge of chemistry at the high school level
3. Knowledge of physics at the high school level

SUBJECT OBJECTIVES

C1. Acquirement of the basic knowledge about the steady and transient heat transfer by conduction, convection and radiation
C2. Acquirement of the basic knowledge about the design and selection of heat exchangers
C3. Learning how to perform basic calculations of heat transfer and heat exchangers
C4. Obtaining basic skills of measurement of heat transfer

SUBJECT LEARNING OUTCOMES

relating to skills:

The person who has passed this subject:
PEK_U01 - can perform calculations related to heat transfer by conduction, convection and radiation,
PEK_U02 - can perform calculations related to the heat transfer coefficients,
PEK_U03 - can design basic types of heat exchangers,
PEK_U04 - can design and conduct experiments necessary to calculate the heat transfer.

PROGRAMME CONTENT

	Laboratory	Number of hours
Lab 1	Introduction	3

Lab 2	Heat transfer in the air cooler	3
Lab 3	Heat transfer in the shell-and-tube heat exchanger	3
Lab 4	Unsteady heat transfer in solid 1	3
Lab 5	Heat transfer in the plate heat exchanger	3
Lab 6	Heating and cooling of liquids in conditions of natural convection	3
Lab 7	Heat transfer in the thin layer heat exchanger	3
Lab 8	Heat transfer in the double-pipe heat exchanger	3
Lab 9	Heat transfer during boiling	3
Lab 10	Unsteady heat transfer in solid 2	3
	Total hours	**30**
Project		Number of hours
Proj 1	Heat conduction in flat and annular walls	4
Proj 2	Thermal insulation	2
Proj 3	Heat transfer in conditions of natural convection	2
Proj 4	Heat transfer in conditions of forced convection	2
Proj 5	Heat transfer in conditions of boiling and condensation	2
Proj 6	Test	2
Proj 7	Heat transfer between two fluids separated by flat and annular walls	4
Proj 8	Heat transfer by radiation	2
Proj 9	Designing of the thermal insulation of pipelines	2
Proj10	Project of a heat exchanger	6
Proj 11	Test	2
	Total hours	**30**

TEACHING TOOLS USED

N1. Tasks solving
N2. Project making
N3. Carrying out experiments
N4. Report making

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Way of evaluating learning outcomes achievement
F2 (laboratory)	PEK_U02,PEK_U04	Test, report
F3 (laboratory)	PEK_U02, PEK_U04	Test, report
F4 (laboratory)	PEK_U01, PEK_U04	Test, report
F5 (laboratory)	PEK_U02, PEK_U04	Test, report
F6 (laboratory)	PEK_U02, PEK_U04	Test, report
F7 (laboratory)	PEK_U02, PEK_U04	Test, report
F8 (laboratory)	PEK_U02, PEK_U04	Test, report
F9 (laboratory)	PEK_U02, PEK_U04	Test, report
F10 (laboratory)	PEK_U01, PEK_U04	Test, report

S(laboratory)= (F2+F3+F4+F5+F6+F7+F8+F9+F10)/9

C (laboratory)= 3,0 if the student has obtained the S average in the range 3-3.3
3.5 if the student has obtained the S average in the range 3.4-3.7
4,0 if the student has obtained the S average in the range 3.8-4.3

4,5 if the student has obtained the S average in the range 4.4-4.7 5,0 if the student has obtained the S average in the range 4.8-5		
F1 (project)	PEK_U01, PEK_U02	Test 1
F2 (project)	PEK_U02, PEK_U03	Test 2

S(project) = (F1+F2)/2

C(project)= 3,0 if the student has obtained the S average in the range 3-3.3
3.5 if the student has obtained the S average in the range 3.4-3.7
4,0 if the student has obtained the S average in the range 3.8-4.3
4,5 if the student has obtained the S average in the range 4.4-4.7
5,0 if the student has obtained the S average in the range 4.8-5

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] A. Kmieć, Procesy cieplne i aparaty, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2005.
[2] A. Skoczylas, Przenoszenie ciepła, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 1999.
[3] A. Kawala, M. Pająk, J. Szust, Zbiór zadań z podstawowych procesów inżynierii chemicznej. Część 2. Przenoszenie ciepła, Wydawnictwo Politechniki Wrocławskiej, Wrocław, 1987.
[4] http://www.iic.pwr.wroc.pl/index.php/dydaktyka/43-kierunkowe/procesy-cieplne

SECONDARY LITERATURE:

[1] T. Hobler, Ruch ciepła i wymienniki, Wydawnictwo Naukowo Techniczne, Warszawa, 1979.
[2] R.H. Perry, Perry's Chemical Engineers' Handbook, McGraw-Hill, 1997.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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