

Cryogenic systems and applied superconductivity

Faculty of	Mechanical and Power Engineering
Name in English	Applied Cryogenics in Power Engineering
Name in Polish	Zastosowania kriogeniki w energetyce
Main field of study	Power Engineering
Specialization	-
Level of studies	II level
Form of studies	full-time
Kind of subject	optional-specialization
Subject code	W09ENG-SM2361
Group of courses	NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	50				
Form of crediting	Zaliczenie				
For group of courses mark final course with (X)					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BU) classes	1,28				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.	Knowledge of issues concerning thermodynamics basis of cryogenics and low temperature physics
2.	Knowledge of the basics of heat transfer and fluid mechanics
3.	Knowledge of the basics of electricity and magnetism

SUBJECT OBJECTIVES

C1	providing information about the use of gas and cryogenic technologies in industry and energetics
C2	providing information about the technologies of liquefied hydrogen and liquefied natural gas
C3	providing information about the industrial technologies of gas mixture separations
C4	providing information about superconductivity phenomenon and its application in energetics
C5	providing information about conventional and cryogenic-based energy storage systems
C6	providing information about fusion reactors, possible fuels and the needs for the cryogenic technologies use

SUBJECT LEARNING OUTCOMES

relating to knowledge:	
PEU_W01	has knowledge on the use of gas and cryogenic technologies in industry and energetics
PEU_W02	has knowledge on the technologies of liquefied hydrogen and liquefied natural gas
PEU_W03	has knowledge on the industrial technologies of gas mixture separations
PEU_W04	has knowledge on superconductivity phenomenon and its application in energetics
PEU_W05	has knowledge on conventional and cryogenic-based energy storage systems,
PEU-W06	has knowledge on fusion reactors, possible fuels and the needs for the cryogenic technologies use

relating to social competences:	
PEU_K01	is able to active listening

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Wy1	Introduction, course content overview	2
Wy2	Introduction to LNG technology	2
Wy3	LNG fuel systems	2
Wy4	LNG big Infrastructure	2
Wy5	Liquid hydrogen technology	2
Wy6	Liquid hydrogen fuel systems	2
Wy7	Gas mixtures separation	2
Wy8	Oxy-fuel technology in power generation and metallurgy	2
Wy9	Cryogenic exergy recovery systems	2
Wy10	Superconducting power cables and power grid auxiliary equipment	2
Wy11	Superconducting motors and generators	2
Wy12	Conventional and cryogenic energy storage systems	2
Wy13	Cryogenics in fusion reactors	2
Wy14	He3 resources and recovery systems	2
Wy15	Test	2
Suma godzin		30

TEACHING TOOLS USED	
N1	Information lecture
N2	Multimedia presentation
N3	Self-work, self-studies and preparation for the final test
N4	Individual discussion with students and consultancies

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F- forming (during semester), C- concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
C	PEU_W01 -PEU_W06 PEU_K01	Final test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	S. Mokhatab at. al., <i>Handbook of Liquefied Natural Gas</i> , Elsevier Inc., 2014, ISBN 978-0-12-404585-9
2	W. Peschka, <i>Liquid Hydrogen - Fuel of the Future</i> , Springer-Verlag/Wien, 1992, ISBN978-3-7091-9128-6
3	Thomas M. Flynn, <i>Cryogenic Engineering</i> , Marcel Dekker, USA.2005
4	Chorowski M., <i>Kriogenika, podstawy i zastosowania</i> , IPPU MASTA, Gdańsk 2007
5	A.R. Jha, <i>Cryogenic Technology and Applications</i> , Elsevier, USA, 2008
6	P. J. Lee, <i>Engineering Superconductivity</i> , Wiley-IEEE Press; 1 edition, 2001
7	A. U. Schmiegel, <i>Energy Storage Systems</i> , Oxford University Press, 2023
Secondary literature	
1	R.C. Scurlock, <i>Low-Loss Storage and Handling of Cryogenic Liquids: The Application of Cryogenic Fluid Dynamics</i> , Kryos Publications, United Kingdom, 2006
2	G. Ventura, L. Risegari, <i>The Art of Cryogenics</i> , Elsevier, USA, 2008
3	<i>Advances in Cryogenic Engineering</i> , Transactions of the Cryogenic Engineering Conferences

4	W. Buckel, R. Kleiner, Superconductivity: Fundamentals and Applications, Wiley-VCH, 2004
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SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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