WROCŁAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

FACULTY OF …….

SUBJECT CARD

Course name in Polish	Interdyscyplinarne zastosowania fizyki statystycznej
Course name in English	Interdisciplinary applications of Statistical Physics
Course language	**polish**
University-wide general course type: 1)basic course (mathematics, physics, chemistry, other) Departmental course developing professional skills: 1) specialized course 2) interdisciplinary course	
Type of course (obligatory, optional): optional	
Educational effects according to ZW 26/2017: P8U_W, P8S_WG, P8U_U, P8S_UW, P8S_UK	
Subject code**:** FZP009076	

*delete as applicable

	Lecture	Laboratory	Seminar
Number of hours of organized classes in University (ZZU)	30		
Number of hours of total student workload (CNPS)	90		
Form of crediting	Exam **	Exam / crediting with grade*	Oral presentation
Number of ECTS points			
including number of ECTS points for practical (P) classes			
including number of ECTS points for direct teacher-student contact (BK) classes	2		

*delete as applicable **In case of didactic courses also inspections and evaluation classes

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Mathematical analysis and algebra - first degree level.
2. General physics - first degree level.
3. Basic skills in programming.

SUBJECT OBJECTIVES	
C1	Learning the principles of the classical description of a system that consists of many components in the framework of statistical physics. Learning the principles of creating models to describe phenomena and processes on the basis of classical statistical physics. Understanding the limitations of simplified models used to describe real systems.
C2	Learning to determine (analytically in exact and an approximate way, as well as numerically) parameters describing the macroscopic state of systems consisting of many interacting components.

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C3	Acquiring the ability of qualitative and quantitative analysis of quantum phenomena occurring in systems of fermions or bosons.
C4	

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

PEK_W01 – Knowledge of basic concepts and principles of statistical physics that allow to explain phenomena and to create their models.

Relating to skills:

PEK_U01 – Ability to use the mathematical tools to solve problems related to the area of statistical physics. Ability to create models of phenomena and processes in the area of statistical physics.

PROGRAM CONTENTS		
Form of classes - lecture		Number of hours
Lec1	Thermodynamics, fundamentals. Conditions for equilibrium and stability.	2
Lec2-Lec4	Statistical methods and ensembles. Relationship with thermodynamics.	4
Lec5-Lec6	Applications of statistical physics to determine the macroscopic properties of classical systems - examples.	6
Lec7-9	Statistical physics in quantum systems. Applications of statistical physics to determine the macroscopic properties of quantum systems - examples.	6
Lec8-10	Elements of the modern theory of phase transitions.	6
Lec11	Monte Carlo simulations in statistical physics.	2
Lec12-13	Selected problems of modern statistical physics.	4
Lec14-15	Examples of interdisciplinary applications of statistical physics.	4
	Total hours	30

Form of classes – laboratory		Number of hours
Lab 1		
Lab 2		
Lab 3		
Lab 4		
…		
	Total hours	

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Form of classes – seminar		Number of hours
Sem 1		
Sem 2		
Sem 3		
Sem 4		
…		
	Total hours	

TEACHING TOOLS USED	
N1	lecture, multimedia presentation
N2	homework, consultation
N3	discussions

EVALUATION OF ACHIEVED SUBJECT EDUCATIONAL EFFECTS		
Evaluation: F – forming (partial) C – concluding	Educational effect number	Way of evaluating achievement of educational effects
F1	P8U_W, P8S_WG, P8U_U, P8S_UW, P8S_UK	Exam
F2		
…		
C=F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] H. B. Callen, Thermodynamics and an introduction to thermostatistics, 2nd Edition John Wiley & Sons 1985.
[2] F. Reif, Fundamentals of statistical and thermal physics, McGraw-Hill 1965
[3] M. Plischke, B. Bergersen, *Equilibrium Statistical Physics, 3rd Edition*, Prentice-Hall Inc. 2006
[4] H. Gould, J. Tobochnik, Statistical and Thermal Physics: With Computer Applications, Princeton University Press (2010); http://stp.clarku.edu/notes/
[5] D. Chandler, *Introduction to modern statistical mechanics*, Oxford University Press 1987.
[6] L.D. Landau, E.M. Lifszyc, *Fizyka Statystyczna tom 5*, PWN 2012.
[7] J. Honerkamp, *Statistical physics. An Advanced Approach with Applications*, Springer-Verlag 2012.
[8] S. R. A. Salinas, *Introduction to Statistical Physics*, Springer-Verlag 2001.

SECONDARY LITERATURE:

[1] T. Kawakatsu, Statistical Physics of Polymers, Springer 2004
[2] P.G.de Gennes, J. Prost, The Physics of Liquid Crystals, Oxford University Press

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1993.
[3] W.C. Schieve and L.P. Horwitz, Quantum statistical mechanics, Cambrigde University Press 2009.
[4] A.I. Anselm, Podstawy fizyki statystycznej i termodynamiki, PWN 1984.
[5] F. Reif, Fizyka statystyczna, PWN 1971.
[6] S.B. Cahn, G.D. Mahan, B.E. Nadgorny, A Guide to Physical Problems. Part 2, Kluwer 2004.
[7] D. P. Landau, K. Binder, A Guide to Monte Carlo simulations in Statistical Physics, 2nd Edition, Cambridge University Press 2005.
[8] K. Christensen, N. R. Moloney, Complexity and Criticality, Imperial College Press 2005.
[9] M. Henkel, H. Hinrichsen, S. Lubeck, Non-Equilibrium Phase Transitions, Springer 2008.

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