Course code: ……. **Plan position:** ……

A. INFORMATION ABOUT THE COURSE

B. Basic information

Name of course	***Physical Chemistry***
Field of studies	Chemical Technology
Level of studies	First degree
Profile of studies	General academic
Form of studies	Stationary
Specialty	1.Chemical process technology 2. Bioengineering 3. Chemistry and technology of cosmetics
Unit responsible for the field of studies	Faculty of Chemical Technology and Engineering/ Division of Chemical Technology of Physicochemistry of Materials
Name and academic degree of teacher(s)	Beata Jędrzejewska, PhD, DSc
Introductory courses	General chemistry, mathematics, physics
Introductory requirements	Knowledge of the basics of calculations, knowledge of the physical and chemical properties of substances

C. Semester/week schedule of classes

Semester	Lectures (W)	Auditorium classes (Ć)	Laboratory classes (L)	Project classes (P)	Seminar (S)	Field classes (T)	Number of ECTS points
winter	45^{E}	30					7
summer	30^{E}		60				8

2. LEARNING OUTCOME

No.	Learning outcomes description	The reference to the learning outcomes of specific field of study	The reference to the learning outcomes for the area
KNOWLEDGE			
W1	Has a structured, theoretically underpinned general knowledge of chemistry.	K_W03	P6S_WG
W2	Has knowledge of techniques and methods for characterisation and identification of chemical products.	K_W11	P6S_WG
W3	Knows the basics of kinetics of chemical processes including biochemistry and thermodynamics.	K_W10	P6S_WG
SKILLS			
U1	Works individually and as part of a team.	K_U02	P6S_UO P6S_UK
U2	Performs chemical experiments, investigates chemical processes and interprets the results obtained.	K_U06	P6S_UW

U3	Determines the physical and chemical properties of materials.	K_U12	P6S_UW
U4	Respects health and safety rules related to the work to be performed.	K_U14	P6S_UW
SOCIAL COMPETENCES			
K1	Is aware of the responsibility for jointly carried out tasks related to teamwork.	K_K04	P6S_KK P6S_KO

3. TEACHING METHODS

A. Traditional methods used

Lectures, video presentations, classes exercises, laboratory work under teacher´s supervision.

4. METHODS OF EXAMINATION

Lecture – written exam/test (minimum 50% of correct answers) or written assignment on the subject of the lectures, classes – written assignment, laboratory – passing a test (at least 50% of correct answers), performing the exercises provided in the schedule and processing the obtained results in the form of reports.

5. SCOPE

Lectures	Basic concepts of thermodynamics, work, heat, temperature. The 1st, 2nd and 3rd laws of thermodynamics. Hess's law. Kirchoff's law. Conditions of spontaneous processes. Free energy and free enthalpy. Properties of gases, ideal gas, real gas; Adsorption - physisorption and chemisorption and their characteristics. Partition coefficient. Surface tension. Viscosity; Colligative properties of solution such as vapour pressure, freezing point, boiling point, and osmotic pressure. Raoult's law; Systems, phases, constituents and variance. One- and two-components phase diagram; Rate of a chemical reactions. Factors affecting the rate of reaction. Integrated rate laws of simple reactions. The kinetics of complex reactions; Electrochemistry - redox reactions, conductance in electrolytic solutions, electrochemical cells.
Classes	Classes will illustrate the lecture topics and will introduce students to physical chemistry calculations. Calculations of the heat of chemical reactions, enthalpy, entropy; Calculations of ideal gas properties, vapor pressure, boiling point elevation, freezing point depression, osmotic pressure; Chemical equilibrium calculations. Reaction rate constant. Concentration, pH and pK calculations.
Laboratories	The exercises are selected by the lecturer, the exercises concern the issues discussed during the lectures. Experiments: Partition coefficient of acetic acid; Refraction of solutions; Temperature influence on viscosity of glycerine; Surface tension of organic compounds; Identification of organic compound after determining its molecular weight; Adsorption of methylene blue on aluminum oxide in solution; Phase diagram of liquid-gas for two-component (binary) solution; Equilibrium constant of an indicator; Kinetics of saccharose inversion; Conductance of weak electrolytes; Conductometric titration; Potentiometric titration; Thermal analysis. Liquid-solid phase diagrams, simple eutectics.

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES

LEARNING OUTCOME	Form of assessment					
	Oral examination	Written exam	Colloquium	Project	Presentation	Report
W1		x	x			x
W2			x			x

W3		x	x			
U1						x
U2			x			x
U3			x			x
U4			x			
K1		x	x			x

7. LITERATURE

Basic literature	1. Atkins P.W., Paula J., 2006. Physical Chemistry. 8th ed. Freeman. New York. 2. Whittaker A.G., Mount A.R., Heal M.R., 2000. Physical chemistry. BIOS Scientific. 3. Mortimer R.G., 2005. Mathematics for Physical Chemistry (3rd ed.). Academic Press. 4. Levine I. N., 2008. Physical chemistry. 6thed. McGraw-Hill. 5. Garland C.W., Nibler J.W., Shoemaker D.P., 2009. Experiments in Physical Chemistry. 8th ed. Boston: McGraw-Hill Higher Education.
Supplementary literature	1. Halpern A.M., 2006. Experimental Physical Chemistry, 2nd ed. Macmillan. Sime R.J., 1990. Physical chemistry: methods, techniques, and experiments. Saunders College Pub. 2. Monk P.M.S., 2004. Physical chemistry: understanding our chemical world. John Wiley and Sons. 3. White J.M., 1975. Physical Chemistry Laboratory Experiments. Prentice Hall.

8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity		Student workload– number of hours
Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes	Participation in classes indicated in point 1B	165
	Supervision hours	50
Student's own work	Preparation for classes	60
	Reading assignments	50
	Other (preparation for exams, tests, carrying out a project etc)	50
Total student workload		375
	Number of ECTS points	**15**