Załącznik do zarządzenia nr 110 Rektora UMK
z dnia 17 lipca 2013 r.

Formularz opisu przedmiotu (formularz sylabusa) na studiach wyższych, doktoranckich, podyplomowych i kursach dokształcających

A. Ogólny opis przedmiotu

Nazwa pola	Komentarz
Name of the subject (in Polish and English)	***Analiza instrumentalna*** ***Instrumental Analysis***
Unit offering the subject	*Chair of Analytical Chemistry and Applied Spectroscopy* *Faculty of Chemistry* *Nicolaus Copernicus University in Toruń*
Unit for which the subject is offered	*Faculty of Chemistry* *Nicolaus Copernicus University in Toruń* *First stage studies S1 -Chemistry*
Subject code	*S1 – 0600-S1-O-AI*
ERASMUS code	
Number of ECTS credits	8 ECTS
Method of assessment	lecture- examination tutorial –graded credit laboratory- graded credit
Language of instruction	English
Designation whether a subject may be credited more than once	No
Allocation of the subject to subject groups	Obligatory subject
Total student workload	Contact hours with teacher - 120 contact hrs: - participation in lectures - 30 hrs - participation in tutorials - 15 hrs -participation in laboratory- 75 hrs Self-study hours: - writing reports/ papers/ projects- 35 hrs - reading literature- 15 hrs - preparation for test/ examination- 30 hrs Altogether: 200 hrs:25hrs /ECTS = 8 ECTS
Learning outcomes - knowledge	Student W1: knows basic rights and chemical nomenclature - K_W01. W2: Possesses knowledge and understanding on the basics of different analytical methods and their application in interpretation of analytical data - *K_W04* *W3*: Is familiar with theoretical and practical aspects of quantitative analysis procedure by classical and instrumental methods and is familiar with instrumentation performance *K_W06*

	W4: Knows regulations of hygene and safety rules of work with in analytical laboratory, knows basic terms of toxicology; legal act concerning chemical laboratory work and hazardous materials, their storage and labeling *K_W016* K_W02
Learning outcomes - skills	*U1:* Is able to perform measurements of the basic chemical data and prepare the report – K_U05 U2: Is able to do quantitative analyses using gravimetric, volumetrics titrations, and instrumental methods using analytical procedures and prepare the analytical report – K_U06 U3: Is able to react properly in the case of different hazardous situations e.g. fire, contact with chemical reagents -K_U16
Learning outcomes - social competencies	K1: Analitycal thinking: selfsufficiently and effectively works with large amount of informations and is able to find the correlations between the phenomennons and properly prepare the conclusions according to the rules of logic .–K_K01 It is conscientious, thorough and systematic - K_K01, K_K02. *K1: K2*: Professionalism and ethics: Knows and applies basics and standards of chemistry employee, among others ethical; understand the social importance of the profession; importance of the intellectual honesty, is caring about health and natural environment in his activities and in social groups. K_K08
Teaching methods	Lecture: expository Lecture using multimedia presentations and elements of discussions. Tutorial – practical Laboratory: laboratory.
Prerequisites	Basic knowledge of general and analytical chemistry
Brief description of the subject	The scope of the subject is acquire knowledge on contemporary methods of instrumental analysis. Lectures are given on the spectroscopic, electrochemical and chromatographic methods in applications for the analysis of pure substances and mixtures. The knowledge is provided on: theoretical basics, quantitative and qualitative methods of instrumental analysis as well as rules of instruments performance. Laboratory experiments and tutorials student acquire skills of sample preparation, rules of calibration the analytical equipment, analysis performances, methods of reporting using statistical analysis according to rules of good laboratory practice.
Complete description of the subject	**Lecture** Calibration methods in instrumental analysis. Quality assesment and validation of the analysis in different matrices. Electrochemical methods: introduction, potentiometry, ionselective electrodes, sensors based on filed effect transistor, conductometry, Spectroscopic methods: introduction, spectrophotometers singleband and dublebands, construction, spectrophotometry, IR spectroscopy, FTIR, Nuclear Magnetic Resonance in structural analysis, emission methods, fluorescence. Atomic spectroscopy: atomic absorption and emission, inductively coupled plasma method. Optodes and their application. Introduction to chromatographic methods, gas chromatography. **Tutorials:** Application of the statistical methods to elaboration of data and preparation of the report from quantitaitve and qualitative analysis. Drawing the calibration curves using least squares method, calculation of the parameters for analysis validation. **Laboratory:** student must performed the following analyses: Conductometric determination of the acetylosalicylic acid in aspiryne, potentiometric determination of bromides and iodides in water solutions using ionselective electrodes. Potentiometric determination of hydrochloric acid and acetic acid in the mixture. Spectrophotometric titration of Fe2+ by EDTA. Spectrophotometric determination of Fe2+ using complex with o-phenantroline or 2,2' – dipirydyl. Spectrophotometric determination of caffein

	in the instant coffee (UV - Vis). Introduction to IR spectroscopy, technique of service. Determination of sodium, potassium and calcium by flame photometry. Determination of heavy metals (Cd, Zn, Pb) by atomic absorption spectroscopy. Spectrographic identification of iron in aluminum alloys. Introduction to chromatographic methods, gas chromatography – examination of the retention times for alipahtic alcohols and determination of hydrocabons in a mixture by gas chromatography.
Literature	Literature: 1) W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 1996. 2) A. Cygański, Metody spektroskopowe w chemii analitycznej, WNT, Warszawa 1993. 3) E. Szłyk, P. Piszczek, Pracownia Analizy Instrumentalnej. Ćwiczenia laboratoryjne. Cz. I. Wydawnictwo UMK, Toruń 2004 4) D.C. Harris Quantitative Chemical Analysis, W.H. Freeman and Co. N.Y. 8th Ed. 2010. Additional literature: 1) D. A. Skoog, D. M. West, F.J. Holler, S. R. Crouch, Podstawy Chemii Analitycznej. Tom. 1 i 2. WN. PWN Warszawa 2007.
Assessment methods & criteria	Lecture - K_W01, K_W04, K_W06, Tutorial - K_W01, K_W04, K_W06, K_W16, ….– K_U06, K_U05, Laboratory: K_W01, K_W04, K_W06, K_W16,, ….– K_U06, K_U05, K_U16 **Lecture:** written exam 2,5 h, test open questions, sorted according to the level of difficulty. Mark threshold: satisfactory: min. 50 % points exam. Criteria: Student knows basic contents of the lecture. Mark threshold: Satisfactory plus : 61-65% pkt. Criteria: Student knows and understands theory of analytical method and basic instrument construction elements. Mark threshold:g ood: 66-75% Criteria: Knows and understand relations between quality of analysis and is able to solve analytical problems Mark threshold: good plus 76-80% Criteria: Knows and understand relations between different analytical methods applies knowledge to solve theoretical and practical problems of analysis. Mark threshold: very good above 80% Criteria: presents knowledge exceeding the area of the lecture and is able to solve advanced analytical problems **Tutoral**: graded credit- Criteria: solves the problem in written form and 2 midterm tests. Marks thresholds identical as for the lecture;: **Laboratory**: graded credit Criteria: written tests 15 min at the start of the laboratory

	Marks: 0-5 points for the each written test 0-5 points for preparation of the report from the latter laboratory analysis, 12 laboratory analyses is compulsory for each student Marks theresolds : satisfactory -50 %; satisfactory plus - 61 % -65%; good – 66-65 %; good plus 76-80 %; very good above 80% of the sum for the written test and the reports.
Work placement	not applicable

B) Opis przedmiotu cyklu

Nazwa pola	Komentarz
Didactic cycle	2014/2015 S (winter, spring)
Method of assessment of the subject in the cycle	***Lecture****- written examination* ***Tutorial****- graded credit* ***Laboratory****- gradet credit*
Type of classes, number of hours of classes and methods of assessment	**Lecture** - 30 hrs; examination **Tutorial** - 15 hrs; graded credit **Laboratory** 75 hrs graded credit
Subject coordinator	*Prof. Dr hab. Edward Szłyk*
Subject teachers	***Lecture****: Prof. Dr hab. Edward Szłyk* ***Tutorial*** *: dr hab. Iwona Szymanska* ***Laboratory****: dr hab.Piotr Piszczek,dr hab. I Łakomska, dr M. Barwiołek, dr R. Szczęsny, dr M. Kurzawa, dr T Muzioł, dr A. Radtke, dr A. Surdykowski*
Nature of the subject	Obligatory subject
	Lecture –1 group (limit - 120 persons) Tutorial – 3 groups (limit – 25 persons) Laboratory- 3 groups (limit 20 persons)
Time and place	Lecture –Tuesday 10-12 Auditorium I Tutorial – Mon. Tuesday. Wednesday; Time will be given when started nr room 244. Laboratory Ground floor rooms 27-35 Building A.
Learning outcomes	As in part A
Assessment methods & criteria	As in part A
List of topics	**Lecture:** 1. Calibration methods in instrumental analysis. 2. Quality assessment and validation of the analysis in different matrices.. 3. Electrochemical methods: introduction, potentiometry, 4. ionselective electrodes, 5. sensors based on filed effect transistor, conductometry, 6. Spectroscopic methods: introduction, spectrophotometers singleband and doublebands, construction, 7. Spectrophotometry, 8. IR spectroscopy, FTIR, 9. Nuclear Magnetic Resonance in structural analysis, 10. Emission methods,

	11. Fluorescence. Atomic spectroscopy: atomic absorption and emission, 12. inductively coupled plasma method. 13. Optodes and their application. 14. Introduction to chromatographic methods, 15. gas chromatography and applications. **Tutorial** Application of the statistical methods to elaboration of data and preparation of the report from quantitative and qualitative analysis. Drawing the calibration curves using least squares method, calculation of the parameters for analysis validation. Evaluation of the precision and accuracy of the results, application of the test t-student, calibration method by standard addition and internal standard addition **Laboratory**: 1. Conductometric determination of the acetylosalicylic acid in aspiryne, 2. potentiometric determination of bromides and iodides in water solutions using ionselective electrodes. 3. Potentiometric determination of hydrochloric acid and acetic acid in the mixture. 4. Spectrophotometric titration of Fe2+ by EDTA. 5. Spectrophotometric determination of Fe2+ using complex with o-phenantroline or 2,2' – dipirydyl. 6. Spectrophotometric determination of caffein in the instant coffee (UV - Vis). 7. Introduction to IR spectroscopy, technique of service. 8. Determination of sodium, potassium and calcium by flame photometry. 9. Determination of heavy metals (Cd, Zn, Pb) by atomic absorption spectroscopy. 10. Spectrographic identification of iron in aluminum alloys. 11. Introduction to chromatographic methods, gas chromatography – examination of the retention times for alipahtic alcohols 12. Determination of hydrocarbons in a mixture by gas chromatography.
Teaching methods	As in part A
Literature	As in part A