**Course SYLLABUS form**

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| **Basic data of the subject** |
| **Academic Unit:**  | **Faculty of Mathematics & Natural Sciences****Department of Chemistry** |
| **Course title:** | Analytical Chemistry II ([Engineering Chemistry](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&cad=rja&uact=8&ved=0ahUKEwjnvuXRv97JAhWF0h4KHeyiCGEQFgg4MAQ&url=http%3A%2F%2Fprospective.appsci.queensu.ca%2FEngineeringSciencePrograms%2FEngineering-Chemistry.html&usg=AFQjCNHNoh9B4CmcbuWP9mrsA0uQlY4yIw&sig2=GdCY8lzzmV6Fvffhpvxu7w)) |
| **Level:** | **Bachelor** |
| **Course status:** | **Obligatory** |
| **Study year:** | **Second Year/winter Semester (II/3)** |
| **Number of hours per week:** | **3+4** |
| **Credit value – ECTS:** | **7** |
| **Time / location:** | **Department of Chemistry** |
| **Lecturer:** | **Prof. Dr. Fatmir Faiku** |
| **Contact details:**  | **f\_faiku@hotmail.com****044 261 366** |
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| **Course description** | The course will address the basic concepts of volumetric analysis (methods of neutralization, precipitation, complexes and oxidation-reduction) and gravimetric. The course will consist of a series of lectures related to laboratory exercises. At the end of the course, the student should have sufficient knowledge of volumetric and gravimetric methods used in the study and also an experience in conducting analytical experiments. |
| **Course objectives:** | The aim of this course is to create relation between theoretical knowledge and laboratory operations which are necessary for independent analysis. During this course the student will gain the knowledge which helps to orient quickly and straight to the analytical proceses. The student will be able to organize the independent research in laboratory and to analyse the quality.  |
|  **Learning outcomes:** | * Relation between theoretical knowledge and laboratory operations.
* Recognize vollumetric methods:
* Neutralization,
* Precipitation,
* oxido reduction,
* Construction of the acid-base curves, precipitation and oksidoreduktion.
* To recognize gravimetric methods.
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| **Contribution on student load (must correspond with learning outcomes)** |
| **Activity**  | **Hours** | **week** | **Total /hours**  |
| Lectures | 3 | 15 | 45 |
| Exercise laboratory | 4 | 15 | 60 |
| Practice work |  |  |  |
| Contact with lecturer/consultations | 2 | 12 | 24 |
| Field exercises |  |  |  |
| Mid-terms, seminars | 3 | 2 | 6 |
| Homework |  |  |  |
| Individual time spent studying (at the library or home) | 2 | 8 | 16 |
| Final preparation for the exam | 10 | 2 | 20 |
| Time spent in evaluation (tests, final exam) | 1 | 4 | 4 |
| Projects, presentations, etc. |  |  |  |
| **Total** |  |  | **175** |
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| **Teaching methods**  | Lectures, numerical exercises, lab exercises, seminares. |
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| **Evaluation methods** | The first evaluation: 20%, The second evaluation: 20%, Homework: 5%, Regular attendance 5%, Final exam (written and oral): 50%, Total: 100%.The final grade will be calculated as follows:51%- 60% = 6 61% -70% = 771% - 80% = 8 81% - 90% = 991%-100% =10 |
| **Literature** |
| **Basic Literature:**  | [Daniel C. Harris](http://www.palgrave.com/authors/author-detail/Daniel-C.-Harris/55116), Quantitative Chemical Analysis, 2015. |
| **Additional Literature**  | Daut Vezi, Bazat teorike të kimisë analitike, Tiranë, 2007.Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Fundamentals of analytical chemistry, 2004. |

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| **Designed study plan:**  |
| **Week** | **Lectures which will be held** |
| ***First week:*** | Introduction, Classification of quantitative chemical analysis methods, Volumetric and gravimetric analysis, ways to develop quantitative analysis. |
| ***Second week:*** | Systematic approach to chemical analysis, Sample, sample of preparation, Evaluation of analytical data, Errors in quantitative analytical chemistry, Errors in chemical analyses. |
| ***Third week:*** | Systematic errors, Random errors in chemical analysis, The nature of random errors, Calibration and standardization, gravimetric methods of analysis, Particle size and purity of the precipitate. |
| ***Fourth week:*** | Reagents precipitation, Filtration and washing of the precipitates, Drying and calcinations of precipitates, Occurrences of precipitation, Colloidal solutions, Peptization, Occurrence of flocculation, Calculation of results from gravimetric data, Gravimetric determination. |
| ***Fifth week:*** | The basic principles of volumetric, Standard solutions, Primary and secondary solutions, Classification of volumetric methods, Titration, Types of titration, Volumetric calculations. |
| ***Sixth week:*** | Methods of neutralization, Indicators acid-base, Titration of strong acids with strong bases, Titration of strong bases with strong acids, Titration of weak acid with strong base.  |
| ***Seventh week:*** | Titration of weak base with strong acids, Titration for polyprotic acids, Titration of phosphoric acid, Titration of carbonic acid, Titration of boric acid, Errors of acid- base indicator, Calculations of errors. |
| ***Eighth week:*** | **The first assessment** |
| ***Ninth week:*** | Calculation error of hydrogen, Calculation error of hydroxide, Calculation error of acid, Calculation error of base, Precipitation reactions, Solubility product, Formation and dissolution of the precipitates. |
| ***Tenth week:*** | Volumetric precipitation analysis, Argentometry, Determination of chloride by Mohr’s method, Determination of chloride by Volhard’s method, Indicators of adsorption, Curves titration in volumetric precipitation analysis, Titration of halides. |
| ***Eleventh week:*** | [Titration of a halide mixture](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKEwiEg76Wlt7JAhVFvA8KHSZSA10QFgg0MAM&url=http%3A%2F%2Farchives.evergreen.edu%2Fwebpages%2Fcurricular%2F2000-2001%2FMANDM2000%2FHandouts%2FLabs%2FChemistry%2Flab8w.htm&usg=AFQjCNF9Tfph7EZTdKGbMsbV_DBsv1-muA&sig2=-4XTb2xMggKJAk_ku9yxjQ), Other methods of volumetric precipitation analysis, Complexation reactions, Equilibrium constants, The formation of complexes, Types of complexes, Simple complexes. |
| ***Twelfth week:*** | Chelate complexes, [Complexometria](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwi-pZrltt7JAhWKHR4KHRFFDB0QFgggMAA&url=http%3A%2F%2Fwww.infoescola.com%2Fquimica%2Fcomplexometria%2F&usg=AFQjCNFoEyQrqnFaYpMr8Ea1SCIgnjxKaw&sig2=TikhxUlhkoK4sV-FxnK2Jg), Titration of cyanide with AgNO3, Species present in a solution of EDTA, Influence of pH on the stability of the M-EDTA |
| ***Thirteenth week:*** | The impact of other factors on the stability of the M-EDTA, Titration curves when a complexing agent is present, Metal indicators, Oxidation-reduction reactions, Equilibrium constants. |
| ***Fourteenth week:*** | The influence of pH of redox reactions, [Permanganometry](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiC67Hjyt7JAhUC9h4KHQoHC7gQFggdMAA&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FPermanganometry&usg=AFQjCNEVFbgwBP0XAoBs50cnpwTgaHUzkw&sig2=0T6GS7ZtaM-hb-xot6Agqg)method, Bromatometry method, Jodometry method, Constructing redox titration curves, Oxidation-reduction indicators. |
| ***Fifteenth week:*** | **The second assessment** |
| **Designed study plan – Lab exercise:**  |
| **Lab exercises which will be held** |
| Preparation of standard solution of HCl |
| Standardization of solution HCl with Na2CO3 |
| Preparation of solution standard NaOH |
| Standardization of solution NaOH with HCl |
| Titration of H2SO4 |
| Titration of H3PO4 |
| Titration of H3BO3 |
| Preparation of standard solution of AgNO3 |
| Preparation of NaCl standard solution |
| Standardization of solution AgNO3 with NaCl |
| Determination of chloride by Mohr method |
| Determination of iodide by Fajans method |
| Preparation of standard solution of EDTA |
| Preparation of standard solution of Zn2+ |
| Standardization of solution EDTA with Zn2+ |
| Titration of Ni2+ |
| Titration of mixture Ca2++ Mg2+ |
| Preparation of standard solution of KBrO3 |
| Preparation of standard solution of Na2S2O3 |
| Standardization of solution Na2S2O3  with KBrO3 |
| Titration of Cu2+ |
| Determination of Fe3+ with gravimetric method |
| Determination of Ni2+ with gravimetric method |
| **Testing Analysis** |

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| **Academic policies and rules of conduct:** |
| Each student should comply with the policies outlined in the Statute of Uuniversity of Prishtina. The student is required to attend regular lectures, exercises and seminars. To behave in conformity with the code of conduct and to comply with the rules of work in research laboratories. |