

Compulsory modules: Analytical Chemistry

The following compulsory modules corresponding to 13 SKS / 19.5 ECTS-Credits must be passed:

2 nd semester	Compulsory Module: Analytical Chemistry A <i>Tentative module name: Fundamental analysis chemistry</i>	SKS	ECTS-Credits
a	Basic Analytical Chemistry (LO 6) Basic theory of analytical chemistry, dissociation theory, acid-base theory, solution chemistry, preparation of solution, buffer solution, hydrolysis, activity and activity coefficient, stages of analysis, source and kinds of analysis errors, identification and separations of anions, cations, gravimetry and volumetry analysis such acid-base titration, precipitation, complex formations, redox titration: permanganometric, bichromatometric, iodometric, and its application.	3	3.99
b	Experimental of Basic Analytical Chemistry (LO 3,5,6,8) Anion reaction, cation reaction, analysis of anion and cation in the solution, acidimetric and alkali metric, argentometric, permanganometric, bichromatometric, iodo/iodimetric, gravimetric.	1	1.33
Total		4	5.32
	Learning Outcomes: LO 3. Students master in theory and working as a researcher in the field of science and technology with the ability to solve community problems with an orientation to sustainable development and to disseminate research results in scientific meetings and scientific publications. LO 5. Student have expertise in practical work in the laboratory, handling general and special chemicals, and implementing work safety and security systems. LO 6. Students master the theoretical concepts of structure, properties, changes, kinetics, and energetics of molecules and chemical systems, identification, separation, characterization, transformation, synthesis of micro-and micro molecular compound and their application. LO 8. Students have experience, and able to operate common chemical instruments, as well as able to analyze data and information from these instruments.		
	Prerequisites: Basic Chemistry Practical course of Basic Chemistry 1		

3 rd , 4 th & 5 th semester	Compulsory Module: Analytical Chemistry B <i>Tentative module name: Analytical-instrument chemistry</i>	SKS	ECTS- Credits
a	Basic Analysis Spectroscopy (LO 6 & 8) Basic concept of spectroscopy, principle of instrumental spectroscopy, basic method of instrumental spectroscopy, application technique of analysis, analysis and interpretation of spectra, analysis of qualitative and quantitative using spectroscopy instruments (AAS, UV, IR, NMR, MS).	3	3.99
b	Separation Chemistry and Chromatography (LO 6 & 8) Separation using precipitation, Principle and Theory of Distillations technique (Simple and Stages Distillations), Principle and Theory of Extraction technique (Simple and Stage Extraction), Factors affected in the extractions, Coloum Chromatography, Efficiency and Resolution and Chromatography, Analysis using Gas Chromatography and Liquid Chromatography.	3	3.99
c	Electrometric and Spectroscopy of X-Ray (LO 6 & 8) Principle and Application of Electrometric Analysis Methods, Analysis Quantitative and Qualitative, Calculation of Analysis (Potentiometric, Voltammetry, Coulometry) and X Ray (XRD, XRF).	2	2.66
d	Experimental of Basic Spectroscopy Analysis (LO 3, 5, 6, 8) Practicing of spectroscopy analysis using (UV-Vis, AAS, IR, NMR and MS including sample preparation, standards solution preparation, instrument optimization, analysis technique (quantitative and qualitative), minimalizing of interference using those instrument techniques	1	1.33
e	Experimental of Basic Spectroscopy Analysis (LO 3, 5, 6, 8) Practicing Technique using coloumn chromatography, Distillations (simple and stage), Extraction (solution-solution), chromatography ion, thin layer chromatography, protein analysis, Ion Exchange Chromatography Technique, Instrumentation Technique of GC and HPLC.	1	1.33
Total		10	13.30
Learning Outcomes: LO 3. Students master in theory and working as a researcher in the field of science and technology with the ability to solve community problems with an			

	<p>orientation to sustainable development and to disseminate research results in scientific meetings and scientific publications.</p> <p>LO 5. Student have expertise in practical work in the laboratory, handling general and special chemicals, and implementing work safety and security systems.</p> <p>LO 6. Students master the theoretical concepts of structure, properties, changes, kinetics, and energetics of molecules and chemical systems, identification, separation, characterization, transformation, synthesis of micro-and micro molecular compound and their application.</p> <p>LO 8. Students have experience, and able to operate common chemical instruments, as well as able to analyze data and information from these instruments.</p>
	<p>Prerequisites: Basic Chemistry Fundamental of Analytical Chemistry</p>

4 th & 5 th semester	Compulsory Module: Analytical Chemistry C <i>Tentative name module: Environmental chemistry and statistical chemistry</i>	SKS	ECTS-Credits
a.	<p>Environmental Chemistry (LO 3 & 6) Environmental chemistry is more than just water, air, soil, and chemicals. This field use math, biology, genetics, hydrology, engineering, toxicology, and a lot more to help answer important questions about our environment, the chemicals therein, and what role people play in all of this or how it impacts us as a result.</p>	2	2.66
b.	<p>Statistic for Chemistry (LO 2 & 4) Definition, kind and benefit of statistic chemistry, kind of data and determination of statistic method for analysis of data from the result of the study, normality, homogeneity, and outlier from the result of the study, regression test and the correlation (parametric and non-parametric), significant test of parametric data (T-Test, ANAVA, and Duncan, Tukey), significant test of non-parametric data (Mann-Whitney Test, Wilcoxon, kruskal – Wallis, Friedmann).</p>	2	2.66
Total		4	5.32
	<p>Learning Outcomes: LO 2. Students have ability to apply scientific methods in chemistry and other fields. LO 3. Students master in theory and working as a researcher in the field of science and technology with the ability to solve community problems with an</p>		

	<p>orientation to sustainable development and to disseminate research results in scientific meetings and scientific publications.</p> <p>LO 4. Mastery of basic principles and ability to use the software in determining the structure and energy of micro molecules, analysis, and synthesis in general or more specific fields in chemistry (organic, biochemistry, or inorganic), and data processing (analytical chemistry).</p> <p>LO 6. Students master the theoretical concepts of structure, properties, changes, kinetics, and energetics of molecules and chemical systems, identification, separation, characterization, transformation, synthesis of micro-and micro molecular compound and their application.</p>
	<p>Prerequisites: Basic Chemistry 1 Fundamental Mathematics</p>