



CURRICULUM 2014



BACHELOR OF SCIENCE IN CHEMISTRY UNIVERSITAS NEGERI YOGYAKARTA

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A. Vision

To become, by 2025, a study programme that provides Chemistry graduates with good academic capabilities, that are professional, innovative, creative and highly competitive in the field of chemistry at the Southeast Asian level based on the principle of devotion, independence, and wisdom.

B. Mission

The mission of the Bachelor of Science in Chemistry, FMIPA, UNY is to carry out the Tri Dharma of Higher Education and other relevant activities including:

1. Education and teaching that can provide graduates who are virtuous, who possess academic capabilities, professional, innovative, and creative in the fields of chemistry, excellent, independent, and competitive at the Southeast Asian level.
2. Research in chemistry that supports the development of chemistry and technology that is beneficial for increasing the quality of human life and national development.
3. Community service through attempts at disseminating and applying the results of research, and participating in creating a scientific, democratic, and independent society to support the national development.
4. Cooperation with institutions and organizations, both at home and abroad, to support the implementation of teaching, research, and development of chemistry as a discipline
5. Fostering academicians to become members of a religious, independent, and scholarly community, who love the nation, country, and homeland.

C. Qualification Profile

The qualification profile in the form of a Programme Learning Outcome (PLO) is derived from the target of the occupational profile of BSC. The occupational profile of the BSC produces a superior, creative, and innovative graduates in Chemistry based on piety, independence, and scholarship that is capable of being researchers or analysts, educators or trainers, as well as entrepreneurs or practitioners in the field of chemistry. Detailed descriptions of each occupational profile can be seen in Table 1.

Table1. Occupational Profile of BSC

No	Occupational Profile	Specifications
1	Assistant researcher or analyst in the field of chemistry	BSC graduates can be assistant researchers or analysts in the field of chemistry who work professionally in various industries or research institutions, for example as working as quality controllers, in the industrial laboratories, or as operators of chemical analysis tools.
2	Educator or trainer in the field of chemistry	BSC graduates can become educators in the field of chemistry, such as lecturers, professional tutors for chemistry learners, and also chemistry teachers. However, to become a chemistry teacher, the graduates of BSC must followed a teacher professional development programme for one-year period. In addition, graduates of this study programme can also become competent trainers in the field of chemistry.
3	Entrepreneur or practitioner in the field of	BSC graduates can become entrepreneurs or practitioners through the manufacture of products that involve processes and

No	Occupational Profile	Specifications
	chemistry	applications in chemistry which can then compete in the global market and create new jobs.

The PLO formulation refers to learning outcomes in BSC that have previously been agreed and established together with all chemistry departments in Indonesian universities that covers the domain of attitudes, knowledge, general skills, and special skills. The learning outcomes formula has been adjusted to the Indonesian President's Regulation (PPRI) No. 8/2012 concerning KKNI (Indonesian National Curriculum Framework), Permenristekdikti (Regulation of Minister of Research, Technology and Higher Education) No. 44 of 2015 concerning SNPT (National Standards for Higher Education). Therefore, BSC UNY aims to produce scholars in the field of chemistry with competencies in attitudes, knowledge, generic skills, and specific skills that are superior, creative, and innovative based on piety, independence, and scholarship. The PLO formulation is then used as the basis for determining the learning outcome of each course that plays a role in achieving the expected occupational profile. The PLO formulation of BSC UNY can be seen in Table 2.

Table 1. PLO Formulation

Domain	PLO Formulation
Attitude	1. Having a religious attitude and human values
Generic Skills	2. Having an independent attitude, being able to adapt and take responsibility in completing tasks
	3. Communicating ideas orally or in written text
Knowledge	4. Applying ICT effectively in the scientific field
	5. Using various chemical research strategies and techniques to solve chemical problems and researches
	6. Being able to follow the development of science and technology as a supporter of lifelong learning process
	7. Analysing the chemical concepts and mind-set oriented to life skills
Specific Skills	8. Applying chemical science to support productive and innovative behaviour to overcome problems in society
	9. Integrating mathematical and scientific concepts to solve problems in chemistry
	10. Having the ability to innovate in chemical research techniques

D. Course Characteristics

BSC is under the Faculty of Mathematics and Natural Sciences (FMIPA), Universitas Negeri Yogyakarta (UNY). The curriculum of this study programme is reviewed and developed in accordance with university regulations and the development of chemical content, graduate competencies, development of science and technology, and the needs of the working world (industries). Efforts to achieve the expected graduate qualification profile are done by designing courses for this study programme in line with the PLO. The process of achieving the expected qualification profile is carried out through the main programme lecture activities with a minimum number of 145 credits equivalent to 238 ECTS. The learning activities were carried out

Table 3. Curriculum structure mapping towards PLO attainment

Course name	Course code	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10
Islam Education	MKU 6301	√	√	√							
Catholic Education	MKU 6302										
Christian Education	MKU 6303										
Buddhist Education	MKU 6304										
Hinduism Education	MKU 6305										
Confucianism Education	MKU 6306										
Civic Education	MKU 6207	√	√	√							
General Chemistry	KIM 6401					√		√			√
Physics for Chemistry	KIM 6302		√					√		√	
Biology for Chemistry	KIM 6303		√					√		√	
Mathematics for Chemistry	KIM 6304					√		√		√	
Statistics	MKU 6210					√		√			√
Pancasila	MKU 6208	√	√	√							
Socio-cultural Education	MKU 6214					√		√			√
Chemical equilibrium	KIM 6405					√		√		√	
Fundamentals of Organic Chemistry	KIM 6407		√					√		√	
Non-metal Inorganic Chemistry	KIM 6409					√		√	√		
Introduction to Computer Sciences	KMA 6215	√			√			√		√	
Entrepreneurship	MKU 6212	√	√	√	√						√
English	MKU 6211		√	√			√				√
Molecular Dynamics	KIM 6406					√		√		√	
Reactivity and Mechanism of Organic Reaction	KIM 6408					√		√	√		
Metal Inorganic Chemistry	KIM 6310					√		√	√		
Fundamentals of Analytical Chemistry	KIM 6411					√		√	√		√
Environmental Chemistry	KIM 6215					√		√	√		√
Chemical Laboratory Management	KMA 6212				√			√			√
Mathematics and Natural Sciences Insights and Studies	AMF 6201	√	√			√				√	√
Chemical Separation Method	KIM 6412				√	√					√
Biochemistry	KIM 6413					√		√			√
Physical Organic Chemistry	KMA 6205					√		√	√		
Coordination Chemistry	KMA 6408					√		√	√		
Chemical Process Industry	KMA 6317	√		√	√		√		√		√

theoretically with the total of 133 credits (218 ECTS) and practically with the total of 12 credits (20 ECTS). The curriculum structure mapping towards PLO attainment seen in Table 3.

The curriculum that is used today is the result of a review and revision in 2014. The curriculum structure to reach the PLO is divided into the specifications based on the university's course, the faculty's courses, the faculty's compulsory courses (common ground) and the study programme's compulsory courses. The study programme also requires taking elective courses in accordance with the students' areas of interest. Elective courses are grouped into 3 study fields, such as functional material groups, environmentally friendly chemistry and biological chemistry. The selection of elective courses is based on the congruity with the research proposal, and covers 67% of the courses in the suitable study group and 33% from the other study groups. Learning activities can be completed within 8 semesters, but no more than 12 semesters. Distribution of courses in terms of obligations can be seen in Table 4.

Table 4. Course structure in terms of obligations

No	Types of Courses	Total (in Credits)	Total (in ECTS)
1	University's Courses (General Course/Mata Kuliah Umum/MKU)	20	33
2	Faculty's Courses (AMF)	2	3
3	Faculty's Compulsory Courses/Common Ground (KIM)	56	92
4	Study Programme's Compulsory Courses (KMA and PKL)	55	90
5	Elective Course (KIM and KMA)	12 out of 56 credits	20 out of 93
Total		145	238

E. Course Framework for Bachelor of Science in Chemistry

Bachelor of Science in Chemistry is administered in 8 semesters. The course distribution is hierarchically arranged, which illustrates that the courses of the semester above are a continuation of courses from the previous semester. The distribution is based on the relationship between concepts, levels of knowledge, and course mapping, that some of the upper semester courses have the preconditions in the previous semester. The course distribution of the BSC of compulsory and elective course seen in Table 5a and Table 5b. BSC guarantees a balance between courses offered by the study programme. The 8th-semester students no longer take theoretical courses but take Thesis for 6 months. For this reason, students are expected to complete their degree in the 8th-semester.

Table 5a. Compulsory Course Distribution

Semester	Course Code	Course Name	SKS	ECTS
I	MKU 6301	Islam Education	3	
	MKU 6302	Catholic Education		
	MKU 6303	Christian Education		
	MKU 6304	Buddhist Education		
	MKU 6305	Hinduism Education		

	MKU 6306	Confucianism Education		
	MKU 6207	Civic Education	2	
	KIM 6401	General Chemistry	4	
	KIM 6302	Physics for Chemistry	3	
	KIM 6303	Biology for Chemistry	3	
	KIM 6304	Mathematics for Chemistry	3	
	MKU 6210	Statistics	2	
Total Workload for the 1st Semester			20	33
II	MKU 6208	Pancasila	2	
	MKU 6214	Socio-cultural Education	2	
	KIM 6405	Chemical equilibrium	4	
	KIM 6407	Fundamentals of Organic Chemistry	4	
	KIM 6409	Inorganic Non-Metallic Chemistry	4	
	KMA 6215	Introduction to Computer Sciences	2	
	MKU 6212	Entrepreneurship	2	
Total Workload for the 2nd Semester			20	33
III	MKU 6211	English	2	
	KIM 6406	Molecular Dynamics	4	
	KIM 6408	Reactivity and Mechanism of Organic Reaction	4	
	KIM 6310	Inorganic Metal Chemistry	3	
	KIM 6411	Fundamentals of Analytical Chemistry	4	
	KIM 6215	Environmental Chemistry	2	
	KMA 6212	Chemical Laboratory Management	2	
Total Workload for the 3rd Semester			21	34
IV		Mathematics and Natural Sciences Insights and Studies	2	
	AMF 6201			
	KIM 6412	Chemical Separation Method	4	
	KIM 6413	Biochemistry	4	
	KMA 6205	Physical Organic Chemistry	2	
	KMA 6408	Coordination Chemistry	4	
	KMA 6317	Chemical Process Industry	3	
Total Workload for the 4th Semester			19	31
V	MKU 6209	Bahasa Indonesia	2	
	KIM 6204	Polymer Chemistry	2	
	KMA 6306	Structural Analysis of Organic Chemical Compounds	3	
	KMA 6201	Quantum Chemistry	2	
	KMA 6511	Instrumental Chemistry	5	
	KMA 6214	Physical Biochemistry	2	
	KIM 6216	Pharmaceutical chemistry	2	
	KMA 6218	Selected Topics on Chemical Research	2	
Total Workload for the 5th Semester			20	33
VI	KIM 6214	Nuclear Chemistry	2	
	KMA 6216	Computational Chemistry	2	
	KMA 6203	Surface Chemistry and Colloids	2	
	KMA 6210	Crystallochemistry	2	

	KMA 6213	Separation and Analysis of Chemical Compounds Method	2	
	KMA 6219	Industrial Management	2	
	KMA 6320	Research Methodology in Chemistry.	3	
		Elective course 1	2	
		Elective course 2	2	
		Elective course 3	2	
Total Workload for the 6th Semester			21	34
VII	KMA 6202	Atomic and Molecular Spectroscopy	2	
	KMA 6207	Natural Products Chemistry	2	
	KMA 6209	Chemical Application of Group Theory	2	
	PKL6302	Fieldwork practice	3	
		Elective course 4	2	
		Elective course 5	2	
		Elective course 6	2	
	MKU 6313	Community Service	3	
Total Workload for the 7th Semester			18	30
VII	KMA 6621	Thesis	6	
Total Workload for the 8th Semester			6	10
Total SKS			145	238

Table 5b. Distribution of Elective Course

Semester	Course Code	Course Nam	SKS	ECTS
Study fields: Renewable and Functional Material Groups				
VI	KMA 6224	Structure Analysis of Innorganic Compound	2	
	KMA 6225	Nanochemistry Technology	2	
	KMA 6226	Bioinnorganic	2	
	KMA 6229	Membrane Technology	2	
VII	KMA 6222	Synthesis of Innorganic Chemistry	2	
	KMA 6223	Solid State of Innorganic Chemistry	2	
	KMA 6227	Organometallic	2	
	KMA 6228	Material Chemistry	2	
	KMA 6230	Catalyst Chemistry	2	
Total			18	30
Study fields: Biological chemistry				
VI	KMA 6233	Reaction Mechanism of Organic Compound	2	
	KMA 6234	Medicine Chemistry	2	
	KMA 6237	Food Material Chemistry	2	
	KMA 6239	Molecular Biotechnology	2	
VII	KMA 6231	Organic Chemistry Synthesis	2	
	KMA 6232	Isolation and Identification of Natural Material Compounds	2	
	KMA 6235	Toxicology	2	
	KMA 6236	Enzymology	2	

Semester	Course Code	Course Nam	SKS	ECTS
	KMA 6238	Petroleum Chemistry and Energy	2	
	KMA 6240	Fundamentals of Microbiology	2	
Total			20	33
Study fields: Biological chemistry				
VI	KMA 6243	Analysis of Industrial Materials	2	
	KMA 6244	Radioanalysis	2	
	KMA 6245	Chemical Engineering Operations	2	
	KMA 6246	Hazardous Waste Management	2	
VII	KMA 6249	Geochemistry	2	
	KMA 6241	Electrochemical Analysis	2	
	KMA 6242	Corrosion and Electroplating Chemistry	2	
	KMA 6247	Surfactants and Additives Materials	2	
	KMA 6248	Physical Methods for Analysis of Chemical Compounds	2	
Total			18	30

F. Course Description

Descriptions of each course can be seen in Table 6.

Table 6. Course Description

No	Course	Description
1	Islam Education	This course trains the students to be good personalities (kaffah) using Islamic values as the foundation of thinking and interaction based on their background knowledge and professions. The concept of kaffah can only be achieved by practicing their beliefs and piety to God by building islamic knowledge, religion dispositions, islamic skills, islamic commitment, moslem confidence, and islamic competence
	Catholic Education	This course discusses the concept of human and his origin; his call, pluralism in religion; on how Jesus preaches about Allah's kingdom; on how Jesus finishes his salvation; Allah the trinity; the church comes from Jesus Christ and his delegacy; Maria in the history of salvation; and being religious in the context of national level, the development of IT, Catholic marriage, as well as social and moral problems.
	Christian Education	This course provides students with spiritual training and guidelines in order to be able to run daily activities as a spiritually responsible human being.
	Buddhism Education	This course discusses the basic concept of Buddhism including theology, human, laws, morality, culture and IT as the introduction for Buddhists.
	Hinduism Education	This course discusses the introduction, God the one and only, human, ethics, IT and science, harmony for religious people, arts, culture, politics, and leadership from the perspectives of Hinduism.
	Confucianism	This course discusses the urgency of holding a

No	Course	Description
	Education	belief/religion in everyday life. It includes a study of the source of Confucianism values, the history of Confucianism, and expects students to practice the Holy Way brought by the Great Teachings (Thai Rights), and the role of Confucianism in the development of science and technology.
2	Civics Education	This course discusses civil education, democracy, laws, and multicultural values for students in order to make them realize their rights and responsibilities, be skillful and be morally good to build the country.
3	General Chemistry	This course discusses atomic theory, periodic table elements, chemical bonds, stoichiometry, introduction to chemical thermodynamics, chemical kinetics, chemical equilibrium, acid base, colligative properties of solutions, and redox and electrochemical reactions. Lectures also study the application of basic chemical concepts in everyday life, as well as laboratory activities
4	Biology for Chemistry	This course discusses the basic concepts in biology, objects of living organization, and scientific methods, principles, laws, theories and basic skills to apply scientific process through lab practices
5	Physics for Chemistry	This course discusses the introduction to physics, vector analyses, kinematics, dynamics, constant and resilience, heat, coefficient of linear expansion, fluid mechanics, static and elastic equilibrium, the first law of thermodynamics, kinetic theory of gasses, and the second law of thermodynamics.
6	Mathematics for Chemistry	This course will also include the study about mathematical concepts and their applications in chemistry. The concept includes: coordinate systems, functions of one or more variables, differential-integrals, differential equations, determinants, operators and vectors and data processing.
7	Statistics	This course discusses the basic concept of statistics, data description, probability, probability distribution, hypothesis testing, and samples of interpretation
8	Pancasila	This course elaborates the basic concept, existence, and implementation of Pancasila as the foundation of the country in every aspect of the society. It especially includes course introduction, Indonesian history, Pancasila as the foundation of the country, Pancasila as the ideology of the country, symbols in Pancasila, Pancasila as the philosophical system, Pancasila as the ethic system, and the implementation of Pancasila (the analysis of Pancasila's nature).
9	Social Culture Education	This course elaborates not only the concepts of human diversity, equality and equity as individual beings or parts of society, but also aesthetics, courtesy, and cultural value as a guidance to live in harmony for civil society.
10	Chemical Equilibrium	Chemical Equilibrium subjects discuss the concept of gas

No	Course	Description
		and its properties, the first law of thermodynamics and its application, thermochemistry, the second and third laws of thermodynamics and their application, chemical balance, phase balance, physical properties of solutions, and electrochemical balance.
11	Fundamentals of Organic Chemistry	This lecture covers theory and practice which includes material 1). The basic concept of organic reactions is the structure of organic molecules, resonant and conjugations. 2). structure, nomenclature, nature, reaction and conformation of alkanes and cycloalkanes. 3). structure, nomenclature, properties and reactions of alkene and alkyne compounds. 4). structure, nomenclature, properties, and reactions of halo alkane compounds 5). structure, nomenclature, aromaticity and reaction of benzene compounds and their derivatives. 6). structure, nomenclature, nature and reaction of alkanol, alkoxy alkoxy, diol and thiol compounds. 7). structure, nomenclature, nature and reaction of alkanal and alkanon compounds. 8). structure, nomenclature, nature and reaction of alkanonic acid compounds. 9). structure, nomenclature, nature and reaction of alkanonic acid derivatives. 10). structure, nomenclature, properties and reaction of amine nitrogen compounds
12	Inorganic Non-metal Chemistry	This course covers theories and practices which include: hydrogen and polyatomic atomic structures, periodic trend elements, symmetry and group molecular theory, covalent bond models (valence bond theory and molecular orbital theory), acid-base and donor-acceptor chemistry, chemical reactions (oxidation-reduction), and group chemistry main non-metal
13	Computer Knowledge Introduction	This course aims to introduce various basic application programs, word processors and data processors for writing, analyzing, and presenting. Lecture material includes the use of Microsoft Word to support report writing or chemical articles, Microsoft PowerPoint for presentations, Microsoft Excel for research data analysis, and chemistry applications to support chemistry studies and research
14	Entrepreneurship	This course aims to equip students in building spirit / soul and character of entrepreneurship, understanding the concept of entrepreneurship, and practicing entrepreneurial skills. The scope of this subject matter includes: spirit / soul development and entrepreneurial character, achievement motivation, creative thinking, entrepreneurial nature, business ethics and social responsibility, seeking new ideas, production management, finance, marketing and HR, business opportunities, business plans.
15	English	This course trains students to be able to master four basic skills in English namely reading, writing, listening, and

No	Course	Description
		speaking so that they are able to write and communicate using English in the context related to chemistry
16	Molecular Dynamics	This course studies about the molecular dynamics, which include the theory of gas kinetics, moving molecules (including gases and solutions), the rate of chemical reactions (including: empirical chemical kinetics and explanation of the law of speed), and complicated reaction kinetics. This course also learn about the theory and practicum in the laboratory.
17	Reactivity and Mechanism of Organic Compound	The subject of organic compounds' structure and reactivity contains concept, structure, physical and chemical traits and reaction mechanism on carbonyl compound (aldehyde and ketone), amide, aromatic compound, aromatic heterocyclic, stereochemistry, compound with poly-functional groups, carbohydrate, lipids, amino acid, and protein.
18	Inorganic Metal Chemistry	This course consists of Chemical Qualitative and Quantitative Analysis. Qualitative analysis is the identification of sample components with specific reagents. Quantitative analysis is the determination of quantities (grams, percent) by volumetric techniques. Lecture emphasizes the mastery of lecture material logically and scientifically and the ability to use scientific methods to solve problems faced by students.
19	Fundamentals of Analytical Chemistry	The basics of analytical chemistry include Chemistry Qualitative and Quantitative Analysis. Qualitative analysis is the identification of sample components with specific reagents. Quantitative analysis is the determination of quantities (grams, percent) by volumetric techniques. Lecture emphasizes the mastery of lecture material logically and scientifically and the ability to use scientific methods to solve problems faced by students.
20	Environmental Chemistry	This course provides experience for students to analyze chemical concepts related to the interaction of chemicals with the biotic, abiotic, and social environments. Lecture material is focused on the sources, reactions, transportation, effects and fate of chemical species in the air, water and soil environment, and also the influence of human activities on these processes. Lectures are carried out with discussions, demonstrations, and assignments that provide students with experience in solving environmental problems.
21	Chemistry Laboratory Management	This course discusses the basic concepts of (1) the understanding, purpose and scope of laboratory management, (2) laboratory understanding and function, (3) laboratory design and layout, (4) tool management, (5) material management, (6) tool selection criteria, (7) work safety in a laboratory, (8) assessment of learning activities in the laboratory, (9) management of laboratory waste, (10) hazardous experimental techniques, (11) MSDS.

No	Course	Description
22	Insight and Analysis of Natural Science Materials	This lecture includes theories about how to integrate various scientific sciences for the benefit of the development of chemistry. The course consists of: 1) Photosynthesis and the Biological Chain, 2) Science Philosophy, 3) Scientific Method, 4) Statistics, 5) The Role of Chemistry as the Center for Other Natural Sciences, 6) Role of mathematics and sciences in Technology Research and Development
23	Chemical Separation Method	This course deals with various principles of analytic separation, several factors that influence, electrochemical separation and analysis methods and separation with membranes.
24	Biochemistry	This course studies the chemical structure, function, chemical processes in cells (the smallest part of living things) which consists of carbohydrates, fats, proteins, enzymes, minerals, vitamins and water in the chemical process (metabolism) of carbohydrates, lipids and proteins. Discussing about nucleic acids, genetic engineering, hormones, nutrition and food, as well as practice about the nature and chemical reactions of carbohydrates, lipids, proteins and enzymes.
25	Physical Organic Chemistry	This course in Physical Organic Chemistry includes theories that include stereochemical material, stereochemical reactions, types of organic chemical reactions (substitutions, additions, eliminations, molecular rearrangements, oxidation, reduction) and reactions to aromatic compounds.
26	Coordination Chemistry	Inorganic Chemistry Coordination explains the typical properties of transition elements with regard to electronic configuration, oxidation rates, formation of complex compounds, colors, catalytic roles, and magnetic properties, and understanding Russell-Saunders coupling with spectroscopic terms, boundaries of complex compounds, types of ligands, coordination numbers, formula writing, naming, the development of the theory of bond formulations in complex compounds according to the Blomstrand-Jorgensen chain model, and Werner's model, geometric shapes, and isomers of complex compounds, the concept of effective atomic numbers, and valence bond theory (VBT), field theory crystals (CFT), dia- / para-magnetic, high- / low-spin magnetic properties, magnitude of orbital divisions d by the strength of the CFT model crystal field, molecular orbital theory (MOT); the magnetic properties of dia- / para-magnetic, high- / lowspin, and the level of covalance of the MOT model, the concept of stability according to the thermodynamic and kinetics aspects, the SN1-SN2 sustaining reaction mechanism, the trans effect, outer / inner-ball redox, and acid reaction complex compound bases, superconducting formula structures, electronic configurations typical for the lantanoide (4f) and actinoide

No	Course	Description
		(5f) series, characteristics of stable oxidation states, magnetic properties, lanthanide contractions, 4f orbitals and 5f orbitals.
27	Chemical Industrial Process	Chemical industrial process courses consist of theories, containing material on: Chapter I: Introduction, Chapter II. The production process in the Chemical Industry includes Industry: Sugar Cane, Paper, Petroleum, Portland Cement, Ammonia, Urea Fertilizer, Textile and Milk Powder, Chapter. III. Sulfonation Process, Chapter IV: Stoichiometry in Industry
28	Bahasa Indonesia	This course discusses the development, position and function of Bahasa Indonesia; its kinds; standardized spelling in Bahasa Indonesia; words and dictions; effective sentences in Bahasa Indonesia; paragraph; texts; topics for scientific writing; text convention and editing; structure of scientific writing; quotation and reference.
29	Polymer Chemistry	Discuss the basic concepts of polymer science, polymerization reactions, polymerization characterization, polymeric properties and polymer development based on research that has been done. Development of basic concepts and global trends in polymer science
30	Structural Analysis of Chemical Organic Compound	Structure Analysis courses for organic chemical compounds include the basic concepts of spectroscopy, the basic principles of UV, IR, NMR and MS spectroscopy, as well as structure elucidation of organic compounds based on the spectroscopic data.
31	Quantum Chemistry	Quantum Chemistry courses include learning about basic concepts in quantum mechanics, hydrogen atoms, approximation methods, quantum chemical calculations, molecular orbitals and molecular structures and chemical reactions.
32	Instrumental Chemistry	This course discusses about colorimetric methods, UV-Vis Spectroscopy, FTIR Spectroscopy, MS, NMR Spectroscopy, AAS, and combined technique. Lecture emphasizes the mastery of lecture material logically and scientifically and the ability to use scientific methods to solve problems faced by students
33	Physical Biochemistry	Through this course students are expected to be able to master biochemical understanding and philosophy, life characteristics, living substance structure, energy transformation, and physical biochemical history, energy metabolism, high-energy phosphate compounds (ATP), and adenylate systems that control the body's metabolism, phosphorylation mechanism oxidative and the occurrence of a series of reactions in the body, structure of proteins, biomembranes and their properties, and various kinds of transport systems in the body of living things.
34	Pharmaceutical	Learn about the basic concepts of the development of drug

No	Course	Description
	Chemistry	history, methods of administration of drugs, pharmacokinetic principles, pharmacodynamic principles, drug biopharmaceutical aspects, main effects and side effects of drug use, chemical structure of drug molecules, drug-receptor structure interactions and activity the biology, the relationship of structure and drug activity.
35	Selected Chemistry Research Topics	Selected Chemistry Research Topics study various research topics that have been developed and the ethics of writing articles: definition of Ethics and Style of Article Writing in the field of science, chemical aspects, selection of themes from research articles in the fields of organic chemistry, inorganic chemistry, biochemistry, analytical chemistry, and physical chemistry from international and national journals. analysis of research articles on the fields of organic chemistry, inorganic chemistry, biochemistry, analytical chemistry and physical chemistry from international journals and national journals, writing the Report of Analysis Results
36	Nuclear Chemistry	This course discusses changes in nuclear structure due to the reaction in the nucleus (nuclear reaction). Nuclear reaction consists of 2 (two) types, namely nuclear decay (radioactivity) and nuclear firing reaction (Nuclear Bombardment Reaction). Lecture emphasizes the mastery of lecture material logically and scientifically and the ability to use scientific methods to solve problems faced by students
37	Computational Chemistry	Computational Chemistry courses cover learning about the basic concepts in molecular mechanics and quantum mechanics and their applications especially in studying the structure and dynamics of fluid systems (solvation), theoretical approaches such as HF (Hartree-Fock) theory, DFT (Density Functional Theory) and Force Field Methods (Molecular Mechanics); In this study, it will be studied / demonstrated the use of some computational chemistry software such as Gaussian, Turbomole, Hyperchem and Gromacs in solving chemical problems and interface programs such as Gaussview, Tmolex and VMD in processing data on simulation and modeling results.
38	Surface Chemistry and Colloid	Solid surface structure and its relation to the adsorption-desorption process and its mechanism and analysis techniques on the surface. Like the properties of colloids and interfaces, emulsions and foams and the factors that affect colloidal stability, and apply these concepts in some cases.
39	Crystallochemistry	Crystallochemistry courses are courses for students of Bachelor of Education in Chemistry with descriptions including: chemical structure description, symmetry and molecular groups, chemical bonds and lattice energy,

No	Course	Description
		molecular structures 1(compounds of the main group elements) and 2 (transition metal compounds), crystal gratings, symmetry and groups crystals, X-ray diffraction instruments and determination of simple crystal structures. This course aims to enable students to understand the structure and grid contained in molecular compounds 1 and 2.
40	Separation Method and Chemical Compound Analysis	This lecture examines various principles of analytic separation, several factors that influence, electrochemical separation and analysis methods and separation with membranes
41	Industrial Management	The Industrial Management course is a course consisting of theory and making papers in groups, then presented. In theory explained about: the role of graduates of chemical study programs in a chemical industry, what abilities must be possessed by graduates to enter the workforce. In the next chapter, it is explained about production management and operations. Chapter II explains the safety and prevention of accidents. Chapter IV discusses how the stages of designing a chemical industry, and in Chapter V describes how industry managers strive to create a chemical industry that is ready for competitiveness and environmentally friendly. In making papers in groups, students make the design of a chemical factory; which includes: Name of industry, background why the industry was founded, things to think about when establishing a chemical industry, the purpose of the establishment of industry, production processes, organizational structure, safety of work and accident prevention.
42	Chemistry Research Methodology	This course is about designing useful chemical research projects, conducting research, presenting research results and reporting them.
43	Atomic and Molecular Spectroscopy	The course discusses the basic concepts of spectroscopy, and structure of molecular compounds. Molecular Symmetry, Group theory and character tables, Rotation Spectroscopy, Vibration Spectroscopy, Electronic Transition Spectroscopy, Photoelectron and laser spectroscopy, Core magnetic resonance spectroscopy, Electron magnetic resonance spectroscopy, and Its application in chemical systems
44	Natural Material Chemistry	This course covers the classification, structure, nature, origin of biogenesis, biosynthesis, ways of isolation, and its identification which includes classes of terpenoid compounds, steroids, flavonoids, polyketides, polyphenols, alkaloids, as well as several examples of useful natural compounds, found in various families plant
45	Chemical Application of Group Theory	Chemistry Group Theory explains the elements and operations of symmetry, and their application in orbital

No	Course	Description
		objects and various chemical geometries, the basic requirements of a point group, and their application in determining the character of non-generic representations, matrices for degenerate representations to construct character tables, application of group theory in the theory of chemical bonds: hybridization models for various simple and complex molecules, application of group theory in chemical bond theory: hybridization models for various simple and complex molecules, application of group theory in molecular orbitals for various simple molecules.
46	Internship	This course helps students to portray how to work in industry, company or even in research institution
47	Community Service	This course helps students to apply and integrate their knowledge in formulating problem and finding the potential of certain area based on knowledge and IT through experiential learning and direct practices.
48	Undergraduate thesis	This course helps students to implement the basic concept of scientific research based on their expertise by designing, executing, reporting and defending their research in the under graduate thesis defense.
49	Structure Analysis of Inorganic Compounds	This course discusses elucidation of inorganic materials using UV-Vis Spectrometer, FT-IR, X-Ray Diffraction (XRD), and SEM instruments. The study focuses on the relation between the structure and properties of inorganic salts, coordination compound, aluminosilicate materials (zeolite, clay), and metal oxide.
50	Nano chemistry Technology	This course discusses Nano Technology, Nano Science and Nanotechnology in Indonesia. The lecture also discussed Nanotools, Nanofabrication, Characterization of Nano Structures, Nano Structure Materials, Nanoparticles and Nanocapsules. Through Nanochemical Technology courses, students are expected to understand the concepts in Nanotechnology and be able to apply these concepts in a study.
51	Bioinorganic Chemistry	This course discusses the function and mechanism metal elements transport in the physiologic system. The lecture improves advance knowledge to apply several basic concepts in coordination chemistry in predicting function and reactivity of biomolecule metal based on its structure.
52	Membrane Technology	The course discusses the basic concepts of membrane technology, contain: the understanding of membranes, making membranes, processes and how membranes work and their utilization.
53	Synthesis of Inorganic Compound	This course discusses basic principal and influent factors of chemical reaction to produce inorganic materials. The study

No	Course	Description
		also elaborates the method of synthesis and several approach that can be applied. Lecture emphasizes the student's knowledge logically and scientifically to improve the ability to use scientific methods to solve problems relating how to synthesis a specific inorganic material.
54	Solid State of Inorganic Chemistry	Courses of Solid Sate Inorganic Chemistry are courses for students of Bachelor of Education in Chemistry wit descriptions including: description of solid state chemistry, single crystal and polycrystalline, preparation of single crystal, synthesis and characterization of single crystals, physical characterization of solid material, solid solution, and crystal defect.
55	Organometallic Chemistry	This course studies organometallic compounds, chemical compounds containing at least one chemical bond between a carbon atom of an organic molecule and a metal, including alkaline, alkaline-earth, and transition metals.
56	Material Chemistry	This course discusses various aspect of chemistry in the design and discovery of new as an important role to synthesis future functional materials. It advance understanding how the history of a material influences its structure, properties, and performance. Lecture emphasizes the mastery of lecture material logically and scientifically and the ability to use scientific methods to solve problems faced by students
57	Catalyst Chemistry	Catalyst Chemistry Course discusses the concept of catalysts, types of catalysts, synthesis, properties and applications in life.
58	Mechanism Reaction of Organic Compounds	This course provides experience for students to study the factors that influence the mechanism of organic reactions, the mechanism of organic chemical reactions based on the structure and reactivity of functional groups, as well as the mechanism of radical reactions and their applications of organic compound reactivity.
59	Medicinal Chemistry	This course studies about the working relationship of drugs, the relationship between chemical structure and biological activity of biodynamics through physical properties and chemical reactivity of compounds.
60	Food Material Chemistry	This lecture is an activity that broadens students' understanding of the basic concepts of foodstuffs and chemical compounds related to foodstuffs including humidity, carbohydrates, proteins, fats, minerals, vitamins, additives and polluting elements, analysis of these chemical compounds in foodstuffs and current trends in food research. Lectures are carried out through inquiry and expository approaches through classical lectures, discussions, independent assignments and seminars using computer-aided media.
61	Molecular	This course discusses about the fundamental of

No	Course	Description
	Biotechnology	understanding of microbes and their applications in various ways the field of life, the understanding of the microbial world which includes aspects of morphology, physiology, genetics, microbial cultivation, the role of microbes in various fields of human life, such as medical microbiology, food microbiology, and the environment.
62	Synthesis of Organic Compound	This lecture contains a discussion of concepts about: the principles of the disconnection approach; basic principles of aromatic compound synthesis; sequence of steps in the synthesis of organic compounds; disconnection of one C-X group: derivative of RCO carbonyl compounds. X derivatives of carboxylic acids, alcoholic compounds, alkyl halides, sulfides, ethers; chemoselectivity; disconnection of two C-X groups: 1,1-difunctional compound, 1,2-difunctional compound, 1,3-difunctional compound; amine synthesis, protective group. Nucleophilic addition to the double bond.
63	Isolation and identification of the structure of compounds of natural product	This course discusses Learn various isolation techniques and identify the structure of organic compounds of natural materials, which include classes of compounds: terpenoids, steroids, flavonoids, polyketides, polyphenols, alkaloids, as well as some examples of useful natural compounds, found in plant families. Lecture emphasizes the mastery of lecture material logically and scientifically and the ability to use scientific methods to solve problems faced by students
64	Toxicology	This course studies about the direction of toxicology, general principles and toxicology mindset, acute dose - chronic dose and dose response relationship, type of subject situation, toxicity, absorption, distribution, excretion, reactions that occur by hydrolysis oxidation reduction conjugation in air contaminants air contaminants and drugs, various kinds of toxicology, the use of toxicology
65	Enzymology	This course studies about the structure and function of enzymes, the understanding of enzymes, enzyme classification and enzyme nomenclature, enzyme monomers and oligomers, the factors that influence enzyme work, the kinetic of enzyme reaction: the molecular mechanisms of enzymatic reactions, the mechanisms of enzymatic reaction without cofactors, enzyme involvement in enzymatic reactions, the kinetics of enzymatic reaction with one substrate, relationship of initial reaction rate with concentration, inhibition, allosteric enzymes. Enzyme application in industry, isolation and purification of enzymes and immobilization enzyme.
66	Petroleum Chemistry and Energy	Chemistry course Petroleum Chemistry explains to students the importance of petroleum mining and its results for life and human activity in general. In this course, the process of formation of the earth oil is explained, the process of processing it into a product that can be used. Besides that,

No	Course	Description
		he also explained about some petroleum products, including: how to manufacture, chemical and physical properties, as well as quality standards. In addition, this course also explains the stages in the design of the establishment of the petroleum refining industry.
67	Fundamental of Microbiology	This course discusses about the fundamental of understanding of microbes and their applications in various ways the field of life, the understanding of the microbial world which includes aspects of morphology, physiology, genetics, microbial cultivation, the role of microbes in various fields of human life, such as medical microbiology, food microbiology, and the environment.
68	Industrial Material Analysis	This course discusses about Introduction, Industry and Water, Steel Industry, trace element analysis in minerals, Cement Industry, Paint Industry, Glass Industry and Ceramic Industry. Lecture emphasizes the mastery of lecture material logically and scientifically and the ability to use scientific methods to solve problems faced by students
69	Radioanalysis	This course discusses the chemical properties of the radioactive nuclide, its measurement of radioactivity, and its use in the analytical field. The subject of radioanalysis covers the concepts of radioactivity, measurement of radioactivity, atom chemistry, application of radionuclides in the analytical field, applications of radionuclides in engineering and industry.
70	Chemical Engineering Operations	This course contains material about: Introduction, Concepts of Mass balance, Steam-Liquid Balance and Distillation, Evaporation Process, Liquid Pumping
71	B3 Waste Management	This course provides experience to students to analyze the physicochemical properties of B3 waste and its management related to environmental health. Lecture materials are focused on 1) Definition, nature and classification of B3 waste, 2) Regulations related to B3 Waste Management, 3) Identification, documents, symbols, labels, packaging, storage, collection, transportation, processing, utilization, stockpiling and final disposal of waste B3, 4) Emergency response system in the processing of B3 waste, 5) Hospital waste treatment, 6) Processing of chemical laboratory waste, 7) Processing of chemical industry waste, 8) Printing waste treatment. Lectures are conducted with discussions, demonstrations, and assignments that provide experience to students to solve the problem of B3 waste management.
72	Geochemistry	This course covers theories that include material; the principles and history of geochemical science, earth and its relationship to the universe, the structure and content of the earth, thermodynamics and chemistry of crystals,

No	Course	Description
		magmatism and igneous rock, sedimentation and sedimentary rocks, and isotope geochemistry.
73	Electrochemical Analysis	This course will also include the study about electrochemistry concepts and their applications in analytical chemistry. The concept includes: Chemical change and electric energy electrolysis (redox reactive that require energy to occurs), galvanic or voltaic cells (reaction that provide energy when the occurs) Coverage of the materials: Electrolysis cells and galvanic cells, Potentiometry Electrogravimetry, Polarography, Voltammetry
74	Corrosion and Electroplating	This course discusses about the concept of corrosion and its prevention, as well as electroplating and its uses. The concept of corrosion and its prevention include Concept of Corrosion, Basics of Corrosion, Electrochemical Corrosion, Thermodynamics of Corrosion, Corrosion Kinetics and Electrochemical Applications, Know Forms of Corrosion, Factors Affecting Corrosion, Corrosion due to Water, Atmospheric Corrosion, Corrosion in Soil and Effect of Microbiology, Selection Material, Test and Design, Corrosion Risk, Cathodic Protection, Coating, Corrosion at High Temperature.
75	Surfactants and Addictive Materials	Application of the structure of surfactants and their additives relationship with the mechanism process. Students also describe the properties of interface surfactants, as well as the factors that influence their work processes, and apply these concepts in some cases.
76	Physical Methods to Analyze Chemical Compounds	Discuss the basic concepts and various physical methods for the analysis of chemical compounds, as well as the development of physical methods in the analysis of chemical compounds based on research that has been done.