

Universitas
Negeri
Yogyakarta



TITLE



Curriculum 2014

Bachelor of Education in Chemistry
Department of Chemistry Education
Faculty of Mathematics and Natural Science

CURRICULUM 2014

BACHELOR OF EDUCATION IN CHEMISTRY

DEPARTMENT OF CHEMISTRY EDUCATION

FACULTY OF MATHEMATICS AND NATURAL SCIENCES

UNIVERSITAS NEGERI YOGYAKARTA

2014

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Vission and Mission

Vission

In 2025 the accomplishment of a Chemistry Education Study Program based on quality and excellence in the development of learning and research to produce Bachelor of Education in Chemistry that meets global pedagogical, professional, personal, social, and competitive competencies and has a pious, independent and intellectual character.

Mission

The Mission of Bachelor of Education in Chemistry are:

- a. Establishing education to produce Bachelor of Education in Chemistry that have pedagogical, professional, personal, social, and capable competencies in the global era.
- b. Developing chemical education through research and innovation based on character education in accordance with local wisdom, and disseminating research results nationally and internationally.
- c. Conducting community service by promoting the results of research and innovation in the field of chemical education on the part of users.
- d. Developing mutually beneficial cooperation with other parties both at home and abroad to support the pace of the development of chemistry and chemistry education.
- e. Fostering the academic community which is aimed at the realization of a campus community that is devout, independent, and scholarly and has a love for the nation, state and homeland.

Program Objectives

The objectives of Bachelor of Education in Chemistry (BEC) at the Faculty of Mathematics and Natural Sciences Universitas Negeri Yogyakarta (FMIPA UNY) are to produce graduates who work as chemistry educators, chemistry education researcher or entrepreneur in the field of chemistry education who are outstanding, creative, and innovative with the foundations of piety, independence, intelligence, and the ability to compete in the international level, which can be detailed as follows.

1. Graduates who represent the Indonesian humans that are pious to God Almighty with good personality and character, and can become good role models for students.
2. Graduates with pedagogical, professional, personality, and social competencies who serve as chemistry learning agents at school, follow the dynamics of chemistry education, apply them in the form of chemical learning innovation, as well as apply information and communication technology in an appropriate and creative way to increase the effectiveness of chemistry education implementation, in addition to analyze and develop chemistry education problem solving strategies in scientific manners.
3. Graduates who keep up with the development of chemistry science and master the field of applied chemistry in order to support creative behaviors in the community's productive efforts, master information and computer technology for the scientific development and play a role in the global era.
4. Graduates who are able to work together in a team and have the commitment to self potential development for the sake of character development.

Program Learning Outcome

The learning outcome development of the BEC has met the vision of UNY, namely making piety, independence, and intelligence as the foundational values that are developed in every learning process as seen in the learning outcome description presented on Table 1.1. In the table, the learning outcomes are grouped into the domains of attitude, knowledge, general skills, and specific skills. The attitude domain is a manifestation of piety, while knowledge is the realization of learning process that aims to generate intellectual humans. The general and specific skills, on the other hand, provide the alumni with the ability to become independent people. In conclusion, there are four types of learning outcomes, namely attitude, knowledge, specific skills, and general skills.

Table 1.1 Program Learning Outcomes

Domain	BEC Learning Outcomes
Attitude	I. The graduates of Bachelor of Education in Chemistry demonstrate religious spirit, moral, ethics, and characters of Indonesia in a community, society, and state life

	2. The graduates of Bachelor of Education in Chemistry demonstrate independence both individual and group work
Knowledge	3. The graduates of Bachelor of Education in Chemistry apply the concepts, principles, laws, and theories of mathematics, science, chemistry, education, and chemistry education that are continuously updated as a part of lifelong learning
Specific Skill	4. The graduates of Bachelor of Education in Chemistry adapt scientific work skills and chemical learning skills that are continuously updated as a part of lifelong learning to solve problems related to chemistry and chemistry education
Generic Skill	5. The graduates of Bachelor of Education in Chemistry adapt the ability for critical and creative thinking in dealing with problems in their careers or personal lives
	6. The graduates of Bachelor of Education in Chemistry implement cooperative skills in conducting their duties and solving problems

Curriculum Structure

In accordance with the UNY Rector Regulation Number 25 Year 2017, the curriculum structure of BEC consists of five (5) groups of course, namely university course (MKU), basic education course (MKDK), chemistry education course (MKBK), learning process skill course (MKKPP), and education development course (MKPP). The student workload for each course group is described in the student handbook and module handbook <http://pendidikankimia.fmipa.uny.ac.id/id/content/mata-kuliah> as presented in Table 1.3. below.

Table 1.3 The Curriculum Structure of Bachelor of Education in Chemistry

No	Type of Course	Code	Credits	PLO
1	University Course	MKU	18	1&2
2	Basic Education Course	MDK	8	1-3, 6
3	Faculty Course	AMF	2	3-6
4	Chemistry Education Course (including the integrated Internship 1 and Internship 2)	MPK	29	1-6
5	Chemistry Course	KIM	69	3-6
6	Education Internship Education Development Course (Internship 3) Thesis Final Assignment	PPL	3	4-6
		SPK	6	

No	Type of Course	Code	Credits	PLO
7	Elective Course	MPK, KIM, KIP, KMA	10	3-6

Courses and Courses Distribution

Courses Distribution in Every Semester

Sem.	Code	Course	SKS				ECTS	
			T	P	L	J		
1	MKU 6301	Islam Education*	3			3		
	MKU 6302	Catholic Education*	3			3		
	MKU 6303	Christian Education*	3			3		
	MKU 6304	Buddhism Education*	3			3		
	MKU 6305	Hindunism Educaation*	3			3		
	MKU 6306	Confucianism Education*	3			3		
	MKU 6207	Civic Educaation	2			2		
	MDK 6201	Science of Education	2			2		
	MKU 6214	Social and Cultural Education	2			2		
	KIM 6401	Basic Chemistry	3	1		4		
	KIM 6302	Physics for Chemistry	2	1		3		
	KIM 6303	Biology for Chemistry	2	1		3		
	Total			16	3		19	31.21
	2	MKU 6208	Pancasila	2			2	
MKU 6210		Statistics	2			2		
MDK 6203		Management of Education	2			2		
MDK 6211		English Language	2			2		
AMF 6201		Insight and Analysis of Natural Science	2			2		
KIM 6304		Mathematics for Chemistry	3			3		
KIM 6411		Basic of Analytical Chemistry	3	1		4		
KIM 6409		Nonmetal Inorganic Chemistry	3	1		4		
Total			19	2		21	34.50	
3	MDK 6202	Psychology of Education	2			2		
	MDK 6204	Sociology and Anthropology of Education	2			2		
	MPK 6201	Review of Chemical Curriruculum	2			2		
	MPK 6202	Chemistry learning media	2			2		

Sem.	Code	Course	SKS				ECTS
			T	P	L	J	
	KIM 6412	Chemical separation method	3	1		4	
	KIM 6405	Chemical equilibrium	3	1		4	
	KIM 6407	Basic of organic chemistry	3	1		4	
		Total	17	3		20	32.86
4	MPK 6303	Instructional strategies of chemistry	2		1	3	
	MPK 6204	ICT application for chemistry teaching and learning	2			2	
	MKU 6212	Entrepreneurship	2			2	
	KIP 6303	Instrument Analysis Chemistry	2	1		3	
	KIM 6406	Molecular dynamics	3	1		4	
	KIM 6310	Inorganic metal chemistry	2	1		3	
	KIM 6408	Reactivity and mechanism of organic reaction	3	1		4	
		Total	16	4	1	21	34.50
5	MPK 6305	Chemistry learning assessment	3			3	
	MPK 6306	Program development of chemistry learning	2		1	3	
	MKU 6209	Bahasa Indonesia	2			2	
	KIP 6205	Laboratory management	2			2	
	KIM 6215	Environmental chemistry	2			2	
	KIP 6201	Introduction to Quantum Chemistry	2			2	
	KIP 6402	Coordination chemistry and organometallic	3	1		4	
		<i>Elective Course 1</i>	2			2	
		Total	18	1	1	20	32.86
6	MPK 6307	High school chemistry	3			3	
	MPK 6208	Chemistry for vocational high school	2			2	
	MPK 6209	Micro-teaching		2		2	
	MPK 6310	Research methodology for chemistry education	3			3	
	KIP 6204	Analysis on organic compound structures	2			2	
	KIM 6413	Biochemistry	3	1		4	
		<i>Elective Course 2</i>	2			2	
		<i>Elective Course 3</i>	2			2	

Sem.	Code	Course	SKS				ECTS
			T	P	L	J	
Total			17	3		20	32.86
7	PPL 6301	Educational internship			3	3	
	MKU 6313	Community service program (KKN)			3	3	
	MPK 6211	Trend of chemistry research and learning	2			2	
	KIM 6214	Nuclear chemistry	2			2	
	KIP 6206	Industrial chemistry	2			2	
	KIP 6209	Chemistry research project		2		2	
		<i>Elective Course 4</i>	2			2	
		<i>Elective Course 5</i>	2			2	
Total			10	2	6	18	29.57
8	SPK 6601	Tugas Akhir Skripsi			6	6	
Total						6	9.85

Elective Courses

Elective Course									
No	Code	Course	SKS				Semester		ECTS
			T	P	L	Jml	Odd	Even	
1	MPK 6212	Chemistry history and perspective	2			2	√		(2SKS equal to 3.2 ECTS)
2	MPK 6213	Chemistry education research review	2			2		√	
3	MPK 6214	Chemistry learning workshop	2			2	√		
4	MPK 6215	Materials development on chemistry	2			2		√	
5	MPK 6216	Chemistry experiment at school	2			2	√		
6	MPK 6217	Products of chemical technology	2			2		√	
7	MPK 6218	Entrepreneurship in it-based learning	2			2	√		
8	KIM 6215	Pharmaceutical chemistry	2					√	
9	KIP 6207	Food chemistry	2				√		
10	KIP 6208	Chemistry macromolecule	2					√	
11	KMA 6207	Natural material chemistry	2			2	√		

12	KMA 6238	Petroleum chemistry	2	2	√
13	KMA 6242	Corrosion and electroplating	2	2	√
14	KMA 6246	B3 waste management	2	2	√
15	KMA 6249	Geochemistry	2	2	√

Courses Description

No.	Mata Kuliah	Deskripsi
1a	MKU 6301 Islam Education	This course trains the students to be good personalities (<i>kaffah</i>) using Islamic values as the foundation of thinking and interaction based on their background knowledge and professions. The concept of <i>kaffah</i> 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.
1b	MKU 6302 Catholic Education	This course discuss 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.
1c	MKU6303 Christian Education	This course provides students with spritual training and guidelines in order to be able to run daily activities as a spiritually responsible human being
1d	MKU 6304 Buddhism Education	This course discusses the basic concept of Buddhism including theology, human, laws, morality, culture and IT as the introduction for Buddhists.
1e	MKU6305 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.
1f	MKU6306 Confucianism	This course discusses the urgency of holding a 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

	Education	Rights), and the role of Confucianism in the development of science and technology.
2	MKU6207 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	MKU6208 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)
4	MKU6209 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
5	MKU 6210 Statistics	This course discusses the basic concepts of statistics, measurement scale and data collection, probability, random variable distribution, parameter estimation and hypothesis testing.
6	MKU6211 English Language	This course presents word types and their identification, basic structure and various sentence patterns, and sentence analysis. Emphasis is on recognizing sentence structure, subject, verb, noun, adjective, adverb, conjunction, and clause. Thus also build active or passive sentences; Special vocabulary is emphasized specifically in chemistry or science with various names of chemical compounds and various kinds of beaker equipment. Listening exercises are presented from various chemical videos, interesting text texts that are light-weight but up to date and contain criticism from journal publications. These topics are translated by each student, then discussed together by applying various sentence patterns that have been studied in the pattern of chemical texts that end in the preparation of paragraphs such as lab reports.

7	MKU6212 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.
8	MKU6303 Community Service Program (KKN)		This course is a course that is expected to be able to educate students to apply the knowledge they get in people's lives. Lecture material includes work program matrix, exploring local potential, ethics in people's lives, and compiling reports
9	MKU6214 Social and Culture Education		This subject is one of the groups of Community Life Courses in universities. This course provides basic knowledge of human concepts, cultural concepts, sociological concepts, and concepts of value, morality, law, concepts of science, technology, art, and the environment
10	MDK6201 Science Education	of	This course discusses the basic principles of education and the basic concepts of educational science as well as their application in educational praxis which includes: educational phenomena, historical viewpoints of education, the nature of education and science of education, education as a system, and issues (educational issues in the context of renewal (innovation) education.
11	MDK6202 Psychology Education	of	This course discusses the basic concepts of human symptoms in the field of education and their application, which includes the basic concepts of educational psychology, forms of psychological symptoms, individual differences, learning and learning, evaluation of learning outcomes and diagnostic learning difficulties.
12	MDK6203 Management Education	of	This course discusses the basic concepts, roles, and scope of education management, followed by an in-depth study of management of the field of education management, which includes: students, curriculum, education staff, educational facilities, education funding, and management of educational institutions and relationships educational institutions with the community, as well as educational leadership and educational

		supervision.
13	MDK6204 Sociology and Anthropology Education	This course perceives education as a socio-cultural process. In this course, concepts, socio-cultural methodologies in education, and various cases and problems in education will be discussed. This course also provides foundation knowledge about the importance of climate, approaches, and socio-cultural influences, both from school and from outside the school (family, peer group, community-nation, and mass media) in a multicultural society (pluralistic) and education that is most suitable for Indonesian (anthropos) people in realizing the goals of present and future Indonesian national education
14	MPK6201 Review of Chemical Curriulum	Through this course students are expected to be able to understand the development of the curriculum, design examples of curriculum component models and compile their syllabus, they are also expected to understand the implemented chemistry curriculum in certain level of the school.
15	MPK6202 Chemistry Learning Media	In this course we will discuss the meaning of learning media, the role and function of learning media, types of learning media, planning and selection of learning media, production techniques for learning media, learning media presentation techniques, and evaluation of learning media, which are specific to learning chemistry. It is expected that after completing this lecture students will be equipped with the use of learning media, especially the teaching and learning process in schools so that they can enhance the quality of the teaching and learning process which ultimately can improve the quality of learning outcomes
16	MPK6303 Instructional Strategies of Chemistry	Through this course, students are expected to be able to plan learning strategies that are suitable for chemistry subjects in schools (high school, vocational) which include approaches, methods, techniques, models, and the ability to develop learning models with a scientific approach. The course contains of the followings materials: understanding learning strategies, chemistry learning problems, basic teaching skills, public speaking, method approaches, techniques, and learning models, scientific approaches, learning models, strategies to face unexpected situations.
17	MPK 6204	This course is a compulsory subject for students of Chemistry Education FMIPA UNY. In this global era, ICT is seen as an

	ICT Application for Chemistry Teaching and Learning	important tool in learning, including learning Chemistry. ICT can help learning both as a learning media, as well as a means of delivering learning content in a delivery system. As a media, ICT helps students to understand learning material. As a tool in a delivery system, ICTs can increase flexibility in accessing learning content. By studying this course, students are expected to be able to understand the principles of ICT-based chemistry learning and be competent in utilizing ICT for learning chemistry both as a means of delivering learning content and as a learning media. This course discusses the notion of ICT, the integration of ICT in chemistry learning, the understanding and implementation of ICT-based chemical learning content systems, the understanding of learning media, the roles and types of ICT-based learning media, the planning and selection of chemical learning media, development, validation and evaluation ICT-based chemical learning media, as well as the implementation of ICT in chemistry learning. After this learning, students are expected to be able to develop ICT-based chemistry learning media and use it as virtual learning content by utilizing ICT as a delivery system.
18	MPK6305 Chemistry Learning Assessment	Chemistry Learning Assessment is a chemistry education discipline, which studies the problems of planning, implementing, and reporting the assessment of chemistry learning outcomes. Lecture material begins with the introduction of various terms commonly used in the assessment of chemistry learning outcomes, followed by techniques and instruments for evaluating chemistry learning outcomes, how to compile instruments for evaluating chemistry learning outcomes, processing assessment results, analyzing assessment instruments, and compiling reports. Various new approaches discussed in this lecture include the use of objective statements in the form of competencies, competency classification based on the dimensions of cognitive processes and alternative dimensions of knowledge and assessment.
19	MPK6215 Program Development of Chemistry Learning	This course is designed to provide skills for students in developing chemistry learning programs that are active, innovative, creative, interesting and authentic. Therefore, the discussion in this course includes: compiling the semester program, explaining the procedure of curriculum analysis, setting the indicators according to Core Competency-Basic Competency, determining the subject matter / study material

		for a Basic Competency, designing learning strategies that educate, student-centered contextual learning , designing learning media, as well as authentic assessment in the domain of attitudes, cognitive, and skills, and producing learning devices (Lesson Plan to assessment instruments)
20	MPK 6307 High School Chemistry	This course gives experience to students to analyze chemical concepts learned at the high school / MA level in accordance with the applicable curriculum. The course material is focused on content analysis in the curriculum, learning strategies that emphasize the nature of chemistry as part of Nature of Science (NOS), difficulties, mistakes (and misconceptions), and other problems that often occur in learning these concepts, and the latest developments on learning chemical concepts in high school. Lectures are carried out with discussions, demonstrations, assignments, and other strategies that can provide students with experience in learning chemistry at the high school level
21	MPK6208 Chemistry for Vocational High School	This course is a compulsory subject that must be taken by chemical education students who learn about the nature of chemistry learning in the curriculum structure in vocational schools, the problem of chemistry learning in vocational schools, chemical material analysis that fits the vocational context and enrichment of chemical materials relevant to the context of vocational schools. The chemical material studied includes enrichment of chemical material related to vocational field material in the field of expertise studies in vocational schools, namely technology and engineering; energy and considerations, agribusiness and agro-technology, maritime affairs, health and information and communication technology. The results of the chemical curriculum analysis in vocational schools and chemical enrichment materials are used as the basis for packaging chemical learning that is appropriate to the context of students in vocational schools. Lectures are conducted by collaborative learning, problem-based learning, class discussions, presentations, exercises and assignments, and other strategies that can provide experience to students to teach chemistry in accordance with the vocational context on its level.
22	MPK6208 Micro-Teaching	The micro-teaching course is a practical learning subject in front of peers in groups (each group of 7-10 students) and each group is guided by one or two lecturers who are

		competent in their fields. Before the practice of learning begins, it is given a micro-teaching orientation in the form of providing micro-teaching insights among others: Why, what, and how to implement micro-teaching; Overview of applicable curriculum and the spirit of learning; Review of applicable curriculum syllabus and determination of time allocation in the form of annual programs and semester programs; Discussion of examples of standard and complete Learning Preparation Planning (Student Worksheet); Observation to the school where students will carry out Field Experience Practices
23	MPK6310 Research Methodology for Chemistry Education	Chemical education research has benefits both theoretical benefits, namely for the development of chemical education, as well as for solving practical problems in the field of chemistry education and teaching. This course provides the principles of research methodology, so that chemistry education students can compile a feasible research proposal and proceed to Final Thesis.
24	MPK6211 Trend of Chemistry Research and Learning	This courses discusses new trends in the field of chemical education, both in research and in learning that are education issues in Indonesia and the world.
25	AMF6201 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
26	MDK 6211 English for Chemistry Classroom	This course studies about the principles and techniques of grammar-translation, direct, writing skills, audio-lingual, the silent way, listening skills, suggestopedia, community language learning, total physical response, communicative approach, and reading skills method with their application in the teaching and learning process of chemistry in classroom.
27	KIM 6401 Basic Chemistry	This course discusses about the 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.
28	KIM 6302 Physic Chemistry	for	In this course, the theory and practice of physical-phenomena related to mechanics (kinematics, motion, displacement, distance, speed, speed, acceleration, GLB, GLBB, GMB, force and effort, energy and impulse, fluid), heat (temperature and heat, calorimeter, heat type, heat transfer), sound (sound source, sound properties, sound intensity level, resonance, string sound on string, organa pipe), electricity (static and dynamic electricity), magnetism (magnetic material, magnetic induction, transformer, induction, Lorentz force) and optics (geometric optics and physical optics) will be briefly examined.
29	KIM 6303 Biology Chemistry	for	This course discusses about the basic definition of objects and biological issues, the scientific method in learning biology, the structure of biology; the living things' characteristics concept; energy and nutrition; changes of energy; entropy; metabolism; enzyme and energy transfer-ATP and survival living on earth, the level organization of life, ecosystems, and the benefits of biology for human life.
30	KIM 6303 Mathematic Chemistry	for	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.
31	KIM 6405 Chemical Equilibrium		Chemical Equilibrium subjects discuss the concept of gas 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.
32	KIM 6406 Molecular Dinamics		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
33	KIM 6407 Basic of Organic		This course covers the theory and practice which includes the basic concepts of organic reactions are the structure of organic molecule. mechanism of substitution and

	Chemistry	conformation reactions of alkane and cycloalkane compounds. Addition reactions to alkene and alkyne. Mechanism of the reaction of halo alkane compounds, SN1 / E1 and SN2 / E2 and SN. Aromaticity and mechanism of SE reactions to benzene and its derivatives. Steering group o / p, guide m. Stabilizer and stabilizing groups. Alkoxy alkane, diol and thiol. Alkanal, alkanon compounds, and mechanism of reaction of alkanonic acid compounds, and mechanism of reaction of amine nitrogen compounds
34	KIM 6408 Reactivity and Mechanism of Organic Reaction	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 polyfunctional groups, carbohydrate, lipids, amino acid, and protein
35	KIM 6409 Non-metal Inorganic 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.
36	KIM 6310 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.
37	KIM 6411 Basic of Analytical Chemistry	This course serves two purposes. The first purpose is to provide the students with a background in statistical principles to be a good user of statistical analysis. We will learn how to describe data effectively, how to run a simple regression, statistical inference, hypothesis testing, and how to interpret the results. The second purpose of this course is to provide them with the basic knowledge in probability theories, such as expected values or probability distributions, which are necessary in understanding other courses in science education research.

38	KMA 6412 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
39	KIM 6413 Biochemistry	This course concerns about chemical structures, functions, 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. Discusses nucleic acids, genetic engineering, hormones, nutrition and food, and practices about traits and chemical reactions of carbohydrates, lipids, proteins, and enzymes
40	KIM 6214 Nuclear Chemistry	This course discusses changes in core structure due to nuclear reactions. Nuclear reactions consist of 2 (two) types, namely nuclear decay (radioactivity) and nuclear firing reaction (Nuclear Bombardment Reaction). Lectures are emphasized on the ability to master lecture material logically and scientifically as well as the ability to use scientific methods in solving problems faced by students. Discovery of Radioactivity, Atomic Nucleus, Nucleus Structure, and Nuclear Characteristics, Nuclear Stability (viewed in various ways: mass, ratio of the number of protons to neutrons, the binding energy of the nucleus, the amount of energy released, the core structure with the core skin model, and the core structure with the model liquid drops), both qualitative and quantitative radioactivity, interaction of radiation with matter, detection of core radiation, core reaction (nucleus transformation) with the probability of occurrence and its relationship with the production of energetic radionuclides, protection against radiation, use of radionuclides
41	KIM 6215 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.

42	KIM 6215 Introduction to Quantum Chemistry	This course includes theories covering background, coordinate systems, differentials and integrals, determinants, vectors, operators, complex numbers, and eigenvalue equations; conservative system, Lagrange motion equation, Hamilton motion equation, internal coordinates and center mass movements, and basic assumptions of classical mechanics; atomic spectra, black matter radiation, photoelectric effects, the formulation and postulates of quantum mechanics; application of postulates of quantum mechanics, orthonormal and orthogonal properties of hybrid wave functions, and perturbation theory.
43	KIP 6402 Coordination Chemistry and Organometallic	This course discusses Coordination Chemistry and organometallic compounds with a weighting of 3 theoretical credits and 1 integrated practicum credit. Chemistry Coordination talks about the Chemical Transition Elements: understanding, electronic configuration, catalytic properties, magnetic properties, and spectroscopic terms. Complex compounds: boundaries, formulations, bonds, coordination numbers, formula writing formula, nomenclature, history of development of complex compound formulations according to Blomstrand-Jørgensen chain theory, Werner's theory, isomerism, and application of complex compounds. The concept of effective atomic number, and valence bond theory (hybridization), the theory of Crystal Fields (ligand field theory): d orbitals division and electronic configurations in octahedron, tetrahedron and square fields; energy of crystal field stability, Jahn-Teller distortion, crystal field strength (ligand) and how to measure it, color and introduction of electronic spectrum. Molecular orbital theory of complex compounds: Thermodynamics and kinetics of complex compounds: stability and instability, and constants of equilibrium; reaction mechanism: ligand substitution, trans effect, redox reaction. Chemical transition elements in (4f and 5f), and applications of complex compounds. Practicum of Aluminum Complex Compounds, chromium, iron, cobalt, nickel, copper with a variety of ligands. Organometallic compounds discuss the concepts and history of organometallic compounds, the mechanism of reaction of organometallic compounds includes the mechanism of oxidative addition, the mechanism of hydride elimination, the mechanism of transmetallation, carbomethacilation, and silylmetallation; example of the reaction of some organometallic reagents and their application. And the use of organometallic compounds in

		industry.
44	KIP 6303 Instrument Analysis Chemistry	This course covers theory and practice in the laboratory which includes the scope of instrument chemistry, colorimetry, and various modern analytical methods such as UV-VIS spectrophotometry, FTIR, Mass, NMR, and SSA
45	KIP 6204 Analysis Organic Compound Structures	on The course discusses the basic concepts of spectroscopy, the basic principles of UV, IR, NMR, and MS spectroscopy, and the elucidation of the structure of organic compounds based on spectroscopic data
46	KIP 6205 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
47	KIP 6206 Industrial Process on Chemistry	The Chemical Industry Process Course explains to students how to manage a chemical industry safely, efficiently and effectively. In addition, the process diagram in the industries explained: Sugar Cane, Paper, Portland Cement, Ammonia, Urea Fertilizer, Textile and Milk Powder. Explained in this course: the physical and chemical processes that occur in each of these industries. The next chapter explains how to calculate the heat released from a chemical process, using the help of experimental results curves, and examples of the use of the concept of stoichiometry in the chemical industry.
48	KIP 6209 Chemistry Research Project	This course contains useful chemical research project designs, conducting research, presenting research results and reporting them
49	PPL 6301 Educational Internship	This course is a course that is expected to be able to provide learning experiences for students, especially in terms of teaching, broadening horizons, training and developing the teaching potential needed in their fields, increasing independence, responsibility and ability to solve problems in

		learning. The implementation involves some elements including, Supervisor, Supervising Teacher, Principal / institution, Local Government, college students and students at the school. It includes several stages, namely the pre-PPL stage, the preparation of the program design, the implementation of the program, monitoring and preparation of the report.
50	SPK 6601 Undergraduate Thesis Writing	This course guides students to understand and be able to apply the basic concepts of research. Students are led to write research proposals by analyzing problems from a condition (background problems), identifying problems, problem constraints, formulating problems, research objectives, looking for relevant sources of study, making thinking frames, proposing temporary problem solving (hypotheses) or submitting more detailed research questions. Students are also guided to choose appropriate research methods, sample populations and data analysis techniques. The final assignment of the thesis is prepared in accordance with the Final Project Thesis Handbook.

Mata Kuliah Pilihan

Mahasiswa harus memilih 10 sks (5 mata kuliah pilihan) yang ditawarkan

a	MPK 6212 Chemistry History and Perspective	This course studies the development (history) of chemistry from prehistoric times to the early 20th century through a philosophical analysis of historical developments by emphasizing how chemists of the past thought and worked at the same time they also develop, evaluate, and use theory and new practical methods, and their applications in the process of learning chemistry schools.
b	MPK 6213 Chemistry Education Research Review	This course provides students the ability to choose and analyze journals in accordance with the topics of both domestic and foreign journals related to chemistry education.
c	MPK 6214 Chemistry Learning	This course is a practical course that aims to make students understand and be able to develop teaching aids for chemistry learning in secondary schools (SMA / SMK) to support

	Workshop	constructive, innovative and fun chemical learning. Workshop materials on chemistry learning include identification of chemical material that is considered difficult in high school / vocational school, alternative chemical teaching aids in the chemistry learning process in chemistry classes and labs, proposals for making teaching aids, and making teaching aids
d	MPK 6215 Materials Development on Chemistry	This course is an elective course with the aim of students being able to develop chemical teaching materials with current and up-to-date sources. This course includes material on the preparation of design, development, management and evaluation of teaching materials. The lecture implementation uses an active learning model with lecture, question and answer, discussion, and project learning methods.
e	MPK 6216 Chemistry Experiment at School	This course discusses the fundamentals of chemistry experiments in elementary and secondary schools, design experiments in chemistry learning in schools by looking at the analysis in terms of concepts, contexts, and implementation of experiments in schools, and various forms of application of chemical experiments in learning at school
f	MPK 6217 Products of Chemical Technology	This course discusses knowledge and skills about simple chemical technology that can be developed into everyday products
g	MPK 6218 Entrepreneurship in IT-Based Learning	Through this course students are prepared to design and produce IT-based learning media in the form of multimedia applications, games, virtual labs. The learning materials include identification of chemistry learning problems in high school and university, identification of alternative learning solutions through IT-based media, identification of CAI learning support media, website-based learning, and mobile-based learning, development of audio-visual learning media, web 2.0-based learning media and html5, and Android, IOS-based media, media validation, media production, and media marketing.
h	MPK 6221 Academic Writing for Chemistry Education	This course studies academic writing which includes punctuation, sentences (clauses and dependent clauses), types of sentences (simple sentences, compound sentences, and complex sentences), paragraphs (topic selection, main symbols / main thoughts, supporting sentences, closing sentences), cohesiveness / coherence of paragraphs. Students also learn

		the procedure for writing 2000 word argumentative essays consisting of opening paragraphs (thesis statements, hooks, transitions), content paragraphs, and closing paragraphs, and studying citation and referencing to avoid plagiarism
i	KIM 6215 Pharmaceutical Chemistry	This course discusses the concepts of drug limits, drug forms, drug classifications, drug use methods, drug biopharmaceutical aspects, main effects and side effects of drug use, drug structure interactions - receptors, chemical structure of drug molecules and their biological activities, drug analgesics, and central nervous system suppression drugs
j	KIP 6207 Food Chemistry	Through this course students are expected to have an understanding of basic concepts in food chemistry, composition, properties of chemical changes, including browning reactions, damage to food ingredients and their prevention, food additives, packaging, and descriptions of important food ingredients.
k	KIP 6206 Chemistry Macromolecule	Macromolecular chemistry courses discuss the basic concepts of polymer science, polymerization reactions, polymer characterization, polymer properties and the development of polymers based on research that has been done
l	KMA 6207 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
m	KMA 6238 Petroleum Chemistry	This course discusses about the importance of petroleum mines and their results for life and human activities in general. In this course the process of forming petroleum is explained, the processing process becomes a product that can be used. Besides that, a number of petroleum products are also explained, including: methods of manufacture, chemical and physical properties, and measures of quality. In addition, this course also explains the preliminary stages of the establishment of the petroleum refining industry
n	KMA 6242 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 Temperatures. Meanwhile, electroplating and its uses include Electroplating Concepts, Electroplating Methods, Electrodeposition and Electro-catalysis, Electrochemical Materials, Waste, Electrochemicals, and Applications.
o	KMA 6246 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
p	KMA6249 Geochemistry	This lecture includes theories covering following material; the principles and history of geochemistry, earth and relations with the universe, the structure and content of the earth, thermodynamics and chemical crystals, magmatism and igneous rocks, sedimentation and sedimentary rocks, and isotope geochemistry