STUDENT HANDBOOK

Master of Eductaion In Chemistry
Graduate School
Universitas Negeri Yogyakarta
2016

UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Phone +62274-550836 (front office), Fax. +62274-520326
Website : http://pkim.pps.uny.ac.id
Email: pps@uny.ac.id, humas_pps@uny.ac.id

STUDENT HANDBOOK OF THE MASTER OF EDUCATION IN CHEMISTRY, GRADUATE SCHOOL, UNIVERSITAS NEGERI YOGYAKARTA

1. VISION AND MISSION

A. Vision

To become a reliable and superior of Master of Education in Chemistry in the *Tri Dharma* College of Higher Education to produce superior and globally competitive masters with characters of piety, independence and scholarship.

B. Mission

1). Organizing education to produce Master/Strata-2 (S-2) level educators with chemistry education expertise who have competencies in pedagogical, social and professional personalities who are reliable at the global level.
2). Taking an active role in the development of chemistry education related to theory and practice, research, management policies, curriculum, evaluation and learning technology.
3). Taking an active role in developing basic competencies in the field of chemistry education based on seven basic competency categories for professional teachers.
4). Developing communication skills of scientific concepts through writing in the form of national and international scientific articles and presenting the results of studies or results of research on national and international communities (seminars).
5). Developing original research that can trigger new knowledge about chemistry education.
6). Taking an active role in the application of chemistry education to the community.

2. PROGRAMME OBJECTIVES

The Programme Objectives (PO) of MEC are to graduate students who are in demand by employers and who lead fulfilling professional careers through their abilities to

PO1. Demonstrate the professional practice skills (pedagogic, personal, social and professional competencies) needed to be successful in their professional practice;
PO2. Demonstrate the ability to master the theory, principles and practice of generale chemistry;
PO3. Understand the field of chemistry education in terms of terminology from theory and practice, research, curriculum design and teaching-learning;
PO4. Conduct research, develop and practice in chemistry teaching techniques and methods, so that learning chemistry might be easy and fun;
PO5. Analyze education management policies, curricula, evaluation and teaching technologies related to chemistry learning;

PO6. Apply the knowledge gained from research and discovery in the learning process for instructional development and curriculum;

PO7. Demontrate the leadership roles in general chemistry education, including specifically leadership in teaching, research, curriculum and instruction.

3. GRADUATE'S PROFILE AND SUBJECT-SPECIFIC CRITERIA

No.	Graduate's Profile	Subject-Specific Criteria
1	Lecturer in Higher Education in the field of chemical education and Teachers in High Schools in Chemistry	**Specialist competences** - able to master the concepts and general principles of fundamental and deep chemical fields in the field of chemistry which include structure, dynamics, energy, and measurement. - able to design, implement, evaluate and develop chemical learning in secondary schools with character-oriented learning. - master the concepts and basic principles of pedagogy and innovative chemistry learning methodologies. - able to solve chemical learning problems through a multidisciplinary approach. **Social competences** - have responsibility for learning chemistry in schools independently and can be given responsibility for the achievement of work results of institutions or organizations by prioritizing the development of potential and character formation of students. - has the spirit of leadership and is able to apply management principles to manage education
2	Chemistry Education Researcher	**Specialist competences** - able to master the concepts and general principles of fundamental and deep chemical fields in the field of chemistry which include structure, dynamics, energy, and measurement. - able to design, implement, evaluate and develop chemical learning in secondary schools with character-oriented learning. - master the concepts and basic principles of pedagogy and innovative chemistry learning methodologies. - able to solve chemical learning problems through a multidisciplinary approach. - mastering educational research methods for innovation and improvising chemistry learning - has the ability to research and develop chemical teaching techniques and methods so learning chemistry will be easy and fun. **Social competences** - have responsibility for learning chemistry in schools

		independently and can be given responsibility for the achievement of work results of institutions or organizations by prioritizing the development of potential and character formation of students.
3	Chemical Education Consultant	**Specialist competences** - able to master the concepts and general principles of fundamental and deep chemical fields in the field of chemistry which include structure, dynamics, energy, and measurement. - able to design, implement, evaluate and develop chemical learning in secondary schools with character-oriented learning. - master the concepts and basic principles of pedagogy and innovative chemistry learning methodologies. - able to solve chemical learning problems through a multidisciplinary approach. - have responsibility for learning chemistry in schools independently and can be given responsibility for the achievement of work results of institutions or organizations by prioritizing the development of potential and character formation of students. **Social competences** - has the spirit of leadership and is able to apply management principles to manage education - has responsibility in managing parts of the chemical education process or in preparing, handling, and managing chemicals in the environment and manufacturing processes in government and private institutions.
4	Chemical Education Policy Analyst	**Specialist competences** - able to design, implement, evaluate and develop chemical learning in secondary schools with character-oriented learning. - master the concepts and basic principles of pedagogy and innovative chemistry learning methodologies. - able to solve chemical learning problems through a multidisciplinary approach. - has the ability to analyze education management policies, curricula, evaluations and teaching technologies related to chemical learning. **Social competences** - has the spirit of leadership and is able to apply management principles to manage education - have responsibility in managing parts of the chemical education process or in preparing, handling, and managing chemicals in the environment and manufacturing processes in government and private institutions

4. LEARNING OUTCOMES

The strata-2 (S-2) or Master study programme has level 8 qualifications based on the Indonesian Qualifications Framework (IQF). The learning outcomes of MEC are defined as follows. After the completion of MEC the students should demonstrate the followings:

Table 1.1.1: Parametrs Description and Learning Outcomes

PARAMETERS DESCRIPTION (IQF)	LEARNING OUTCOMES
ATTITUDE AND VALUE	LO1. Enabling to cooperate and having good morals, ethics and personality in completing their duties, social sensitivity and high concern for the community and its environment. LO2. Respect to the diversity of cultures, views, beliefs, and religions as well as other people's original opinions/ findings and love the country and support world peace as citizens LO3. Upholding the rule of law and having the spirit to prioritize the interests of the nation and the wider community. LO4. Enabling to internalize the entrepreneurial spirit, academic values and norms that are properly related to honesty, ethics, attribution, copyright, confidentiality and ownership of data
WORK ABILITY *(Able to develop knowledge, technology, and or art in the scientific field or professional practice through research, to produce innovative and tested works)*	LO5. Implementing and developing knowledge and technology in the field of chemistry education through reasoning and scientific research based on logical, critical, systematic, and creative thinking. LO6. Developing chemistry education through scientific research, or producing scientific works along with study concepts based on scientific rules arranged in the form of a thesis. LO7. Publishing the results of research in the field of chemistry education in scientific journals nationally and internationally accredited. LO8. Increasing the capacity of independent learning. LO9. Having structured learning skills for self-development, science, and career sustainability. LO10. Enabling to think critically, make informed decisions, and communicate effectively, academically, and ethically.
KNOWLEDGE ASSIGNMENT *(Able to solve the problems of science, technology, and or art in the scientific field through an inter or multidisciplinary approach)*	LO11. Documenting, storing, auditing, securing, and rediscovering research data for further research purposes. LO12. Identifying the scientific field of the research object and positioning it into a research map. LO13. Carrying out chemistry education research based on research maps, with an inter- or multi-disciplinary approach, independently or in collaboration with other institutions.

AUTHORITY AND RESPONSIBILITY *(Able to manage research and development that is beneficial to society and science, and able to get national and international recognition)*	LO14. Developing and maintaining networks with colleagues, including in the broader research institutions and communities. LO15. Arranging and communicating ideas and arguments that can be scientifically accountable and academic ethics, through various forms of media to the community, especially the academic community.

5. STRUCTURE OF CURRICULUM AND COURSE DISTRIBUTION

A. Structure of Curriculum

No.	Courses	ECTS		ECTS Total	Credit Unit		CU Total	Explanation
1	Scientific Fondation	9.87		**69.02**	6		42	Personality Development Courses
2	Expertise Study Programme: • Pedagodic	49.28	29.56		30	18		Scientific and Skills Courses
	• Chemistry (Subject Matter)		19.72			12		
3	Elective	9.87			6			Provided 20 sks
4	*Matriculation*	9.87		9.87	*6*		*6*	*Mandatory for graduates of non-educational study programmes*

B. Course Distribution

Sem.	Course Code	Course Name(1)	Credit Unit	Course Type		CU Total
				T	P	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I	PAS8201	Science phylosophy	2	√		17
	PAS8202	Educational Research Methods	2	√		
	PAS8203	Statistics	2	√		
	KIM8201	Chemistry Learning Innovation	2	√		
	KIM8204	Latest Research Study on Chemistry Education	2	√		
	KIM8206	Chemical Spectroscopy	2	√		
	KIM8207	Inorganic Structural Chemistry	2	√		
	KIM8214	Biomolecules and Genetic Engineering	2	√		
	KIM8216	Practical and Chemical Projects	1		√	
II	KIM8110	Project for Writing Thesis Proposals	1		√	15
	KIM8202	Design and Implementation of Chemistry Curriculum	3	√		
	KIM8203	Development of Chemical Learning Assessment and Eval.	3	√		
	KIM8208	Elucidation of the Structure of Organic Compounds	1	√		

	KIM8209	Solution Chemistry and Analytical Electrochemistry	1	√		
		ELECTIVE courses	6	√		
III	KIM8211	Thesis Proposal Seminar	2	√	√	4
	KIM8113	Writing Scientific Work	2	√	√	
IV	KIM8612	Thesis	6		√	6
	TOTAL					**42**

6. FACILYTIES

a. Seminar Room
b. Class Room
c. Computere Laboratory
d. Studio
e. Graduate School Library
f. UNY Library
g. Digital Library
h. Chemisry Laboratories

7. LECTURERS

No	Lecturers[(1)]	Birth Date	Acad. Posi-tion	Academic Degree		Education S1, S2, S3 dan College Origin	Field of Expertise for Every Level of Education
(1)	(2)	(4)	(5)	(6)		(7)	(8)
1	Prof. K.H. Sugiyarto, M.Sc., Ph.D (***)	Sukoharjo, Sept.15, 1948	Prof.	S1	Drs.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Sc.	Inorganic Chemistry, UNSW	Inorganic Chemistry
				S3	Ph.D.	Inorganic Chemistry, UNSW	Inorganic Chemistry
2	Prof. Dr. Nurfina Aznam, Apt., S.U(***)	Bandung, Dec. 6, 1956	Prof.	S1	Dra.	Pharmacy UGM	Pharmacy
				S2	S.U.	Pharmacy UGM	Pharmacy
				S3	Dr.	Pharmacy UGM	Pharmacy
3	Prof. Dr. Indyah Sulistyo Arty, M.S (***)	Boyolali, April 6, 1951	Prof.	S1	Dra.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.S.	Chemistry, UGM	Organic Chemistry
				S3	Dr.	Chemistry, UGM	Organic Chemistry
4	Prof. A.K. Prodjosantosa, M.Sc., Ph.D (***)	Purworejo, Oct. 28, 1960	Prof.	S1	Drs.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Sc.	Inorganic Chemistry, University of Sydney	Inorganic Chemistry
				S3	Ph.D.	Inorganic Chemistry, University of Sydney	Inorganic Chemistry

5	Prof. Dr. Sri Atun, M.Si (***)	Kulon Progo, Oct. 12, 1965	Prof.	S1	Dra.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Si.	Chemistry, ITB	Organic Chemistry
				S3	Dr.	Chemistry, ITB	Organic Chemistry
6	Prof. Dr. Endang Widjajanti LFX, M.Si (***)	Semarang, Dec. 3, 1962	Prof.	S1	Dra.	Chemistry Education, IKIP Semarang	Chemistry Education
				S2	M.S.	Chemistry, ITB	Physical Chemistry
				S3	Dr.	Chemistry, Universite de Paris VI France	Physical Chemistry
7	Prof. Dr. Hari Sutrisno, M.Si (***)	Banyuwangi, April 7, 1967	Prof.	S1	Drs	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Si.	Chemistry, ITB	Inorganic Chemistry
				S3	Dr.	Ecole Doctorale STIM, Univ. de Nantes, France	Inorganic Chemistry
8	Dr. Isana SYL, M.Si (***)	Semarang, Sept. 23, 1961	Assoc. Prof.	S1	Dra.	Chemistry Education, IKIP Semarang	Chemistry Education
				S2	M.S.	Chemistry, UGM	Physical Chemistry
				S3	Dr.	Chemistry, UGM	Physical Chemistry
9	Dr. Crys Fajar Partana, M.Si (***)	Yogyakarta, Dec.30, 1963	Assoc. Prof.	S1	Dra.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.S.	Chemistry, UGM	Physical Chemistry
				S3	Dr.	Chemistry, UGM	Physical Chemistry
10	Prof. Dr. Suyanta, M.Si (***)	Blora, May 8, 1966	Prof.	S1	Drs.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Si.	Chemistry, UGM	Analytical Chemistry
				S3	Dr.	Chemistry, ITB	Analytical Chemistry
11	Dr. rer. nat. Senam, M.Si (***)	Kulon Progo, March 6, 1967	Assoc. Prof.	S1	Drs.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Si.	Chemistry, ITB	Biochemistry
				S3	Dr.rer. nat.	Chemistry, Technische Universitat Dresden	Biochemistry
12	Dr. Eli Rohaeti, M.Si (***)	Garut, 29 Des.1969	Assoc. Prof.	S1	Dra.	Chemistry Education, IKIP Bandung	Chemistry Education
				S2	M.Si.	Chemistry, ITB	Physical Chemistry
				S3	Dr.	Chemistry, ITB	Physical Chemistry
13	Jaslin Ikhsan, M.appl.Sc., Ph.D (***)	Pati, June 29, 1968	Assoc. Prof.	S1	Drs.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Sc.	Pharmacy, La Trobe University	Physical Chemistry
				S3	Ph.D.	Pharmacy, La Trobe University	Physical Chemistry

14	Dr. Antuni Wiyarsi, M.Si	Temanggung, August. 25, 1980	Assoc. Prof.	S1	Drs.	Chemistry Education, IKIP Yogyakarta	Chemistry Education
				S2	M.Si.	Chemistry, UGM	Analytical Chemistry
				S3	Dr.	Science Education (Chemistry Education), UPI	Chemistry Education
15	Dr. Das Salirawati, M.Si	Sukoharjo, Oct. 16, 1965	Assist.. Prof.	S1	Dra.	Chemistry Education, IKIP Jakarta.	Chemistry Education
				S2	M.Si.	Chemistry, ITB	Biochemistry
				S3	Dr.	Assesment and Evaluation Learning, UNY	Assesment and Evaluation of Chemistry Learning

9. COURSE DESCRIPTION AND ASSESMENT

A. COURSE DESCRIPTION

1). Solution Chemistry and Analytical Electrochemistry

Course Description:

Lectures discuss the scope of solutions: solution composition, activity & activity coefficient, solution balance; and electrochemistry: electrified interfaces, electrodes and electrochemical cells; and electroanalytic chemistry: potentiometry and voltammetry. In this lecture, theoretically and the practice of cation-anion analysis is discussed in an electrochemical analysis

2). Education Research Method

Course Description:

This course is a compulsory subject for MEC students that underlies the ability of students to design and carry out research and report on the results of educational research. This course is intended so that students can develop social sensitivity to educational problems and respect the thoughts and findings of others. Students understand the types of research and design education. Through this course learning students are expected to be able to master the basic concepts of educational research which include finding, identifying, analyzing problems, characterizing types of variables and hypotheses, distinguishing various sampling techniques, developing instruments and techniques of data analysis on educational research well. In addition, students are also expected to be able to study a type of research (descriptive, experimental, quasi-experimental, pre-experimental, correlational, comparative, development, survey, phenomenology and action research) comprehensively on the characteristics of the problem, variables, and sampling techniques, type of research design, determination of instruments and data analysis techniques and provide examples of the results of these studies which are published in reputable national and international journals.

3). Evaluation of Chemistry Learning

Course Description:

This course contains a discussion of: principles of measurement, assessment and evaluation of chemistry learning; various techniques, forms of instruments, assessment procedures and evaluation of chemistry learning: the design and development of measurement and assessment instruments that meet the validity and reliability requirements used in chemistry learning, both for the needs of Classroom Assessment and research; and analysis and interpretation of the results of measurement, assessment and evaluation of chemistry learning; and can apply the assessment results to evaluate chemistry learning

4). Chemical Spectroscopy

Course Description:

This course studies symmetry, group theory: point-group representation, non-degenerate representation, matrix and degenerate representation, irreducible and reducible representations, direct products; symmetry of atomic orbitals in molecules. The relationship between molecular symmetry and rotational and vibration spectroscopy. Application of group theory in ligand field theory: division diagrams d and f orbitals, term/ state diagrams-Orgel and Tanabe-Sugano in cube fields and low symmetry fields. Electronic transition: the type of electronic transition and the intensity of the transition band. The electronic spectrum of the first transition complex compound, d^1 - d^{10}. Its applications in photoelectron spectroscopy and spin resonance spectroscopy.

5). Study of Latest Chemistry Education Research

Course Decription:

This course is a compulsory subject for students of MEC that underlies the ability of students to design chemical education research with themes, methodologies and focus of study that are in line with new trends or developments in chemical education. This course is intended so that students can analyze the trends in the scope of chemical education research, chemical education research methodology and the focus of the field of chemical education research based on studies of national journal articles in the last five years and international journals in the last seven years. Students are also expected to be able to criticize the weaknesses and advantages of articles from chemistry education research published in national and international journals, and can formulate problems in chemical education research based on the results of a study of journal articles and compile a research design proposed to solve these problems.

6). Currriculum and Design Implementation

Course Description:

This course is a compulsory subject for MEC students that underlies the ability of students to design and implement curricula at the operational level in the classroom. This course is intended so that students can develop open-mindedness related to curriculum change and sensitivity to curriculum issues in Indonesia in general and find the solutions needed related to the implementation of chemical learning in schools. Through this course learning students are expected to be able to master the basic concepts of the curriculum, analyze the foundation of curriculum development, analyze curriculum models and curriculum development models and support resources for curriculum implementation. In addition, students can review the 2013 curriculum concept and analyze the high school and vocational chemistry curricula, and develop chemistry learning tools to implement K-13s in high schools and vocational schools and analyze SNPT as a basis for curriculum development in universities. After mastering theories about the curriculum, students are expected to be able to apply concepts about the components and models of existing curricula by analyzing history.

7). Theory and Mechanism of Reaction of Organic Compounds

Course Description:

Theoretical courses and the mechanism of reaction of organic compounds includes: basic concepts of theory and reaction mechanisms organic, which includes substitution reactions (SN1; SN2); addition and elimination reaction; radical reaction; condensation reaction; and polymerization; understand and explain the mechanism of reaction for the formation of organic compounds and natural materials contained in scientific journal articles or the results of recent research, understand and explain the reaction mechanism for making organic compounds that have been utilized in everyday life.

8). Organic Structure Elucidation

Course Description:

This course is a course of study that develops students' abilities in the field of chemistry. This course demands an increase in student understanding of the basic concepts of UV spectroscopy, IR, NMR,

and MS analysis and is able to apply them to the identification of molecular structures of organic compounds. This understanding was achieved through the basic competencies of each subject of this course which included basic concepts of spectroscopy in general, basic concepts of UV-Vis, IR, ^{1}H NMR, ^{13}C NMR, and MS.

9). Science Philosopy

Course Description:

The philosophy of science course is a scientific foundation course for students of MEC which includes: the definition of science and philosophy, the scope and position of philosophy of science, philosophical figures, the history of the development of science, foundation, means, methods and scientific truths, the development of science , technology and culture and scientific ethics. This course aims to examine the development of philosophical theories as a scientific foundation in investigating the truth to the origin and uniting the results of science on moral, ethical and religious.

10). Statistics

Course Description:

This course is a subject for MEC students who study concepts and aspects of multivariate analysis, multivariate analysis and random vector, multivariate vector analysis, multivariate variance analysis, assumptions in multivariate variance analysis, multivariate covariance analysis, assumptions in multivariate covarination analysis.

11). Proposal Writing Project

Course Description:

Proposal writing project subjects include: Rationality, problem constraints, functions and objectives, administrative and academic requirements that must be done by researchers in conducting research, thesis preparation procedures, reporting the results of thesis research, languages, rules for writing bibliography following what style and systemic implementation thesis exam. This course aims to prepare a student's framework for the research that will be conducted, prepare a thesis proposal that will be presented with grammar and the rules of writing a good and correct thesis, and eliminate the awkwardness of students in writing thesis proposals

12). Seminar Proposal Thesis

Course Description:

This course is a compulsory subject that must be taken by MEC students as a monitoring of the readiness of students in taking thesis research. This course is intended so that students have the ability to think scientifically and be able to carry out and compile scientific research reports using appropriate research methods. This course is carried out through a research proposal seminar program where students are required to present the development of their research on the background, literature review, and research methodology. The output of this course is that students can compile and present thesis research proposals and research instruments that are ready to be used to retrieve research data.

13). Thesis

Course Description:

This course is a compulsory subject that must be taken by MEC students as an evaluation of the readiness and maturity of students after taking the entire learning process. This course is intended so that students are able to use their scientific thinking skills to design and carry out chemical education research in addressing the problem of chemistry education and communicating it verbally or in writing.

14). Writing of Scientific Research

Course Description:

The scientific writing courses include: knowing international journals, fees, templates, international journal scopes to be published for publication, basic concepts of problems that will be the object of scientific writing, methodologies to be carried out, results and discussions to be written based on research results which is conducted. This course aims to enable students to know the criteria, systematic writing and costs in the intended international journals, as well as train students to write scientifically by thinking critically, objectively and rationally along with scientific evidence that the data validity can be accounted for.

15). Chemical Learning Innovation

Course Description:

This course is a compulsory subject that must be taken by MEC students as an application of their abilities in chemical learning innovation. In an effort to improve the quality of chemical learning, innovation is needed through both learning models, methods, approaches, media and others. In this course students are required to conduct small research as an application of chemically designed learning innovations. However, before the application, students must have the basic abilities regarding various learning theories and innovations as well as the basic concepts of innovation in education so that small research applications can be implemented properly and correctly.

16). Chemical Curriculum Design and Implementation

Course Description:

This course is a compulsory subject for MEC students that underlies the ability of students to design and implement curricula at the operational level in the classroom. This course is intended so that students can develop open-mindedness related to curriculum change and sensitivity to curriculum issues in Indonesia in general and find the solutions needed related to the implementation of chemical learning in schools. Through this course learning students are expected to be able to master the basic concepts of the curriculum, analyze the foundation of curriculum development, analyze curriculum models and curriculum development models and support resources for curriculum implementation. In addition, students can review the 2013 curriculum concept and analyze the high school and vocational chemistry curricula, and develop chemistry learning tools to implement K-13s in high schools and vocational schools and analyze SNPT as a basis for curriculum development in universities. After mastering the theory of curriculum, students are expected to be able to apply concepts about existing curriculum components and models by analyzing the history of chemical curriculum comparisons in Indonesia, analyzing chemical curriculum comparisons in Indonesia, countries in ASEAN and developed countries and analyzing current curriculum issues and trends in the journal international reputation.

17). Development of Chemical Learning and Evaluation

Course Description:

This course contains a discussion about: the principles of measurement, assessment and evaluation of Chemistry learning; various techniques, forms of instruments, assessment procedures and evaluation of Chemistry learning: design and development of measurement and assessment instruments that meet the validity and reliability requirements used in Chemistry learning, both for the needs of Classroom Assessment and research; and analysis and interpretation of the results of measurement, assessment and evaluation of Chemistry learning; and can apply the results of the assessment to evaluate Chemistry learning.

18). Inorganic Chemical Structure

Course Description:

The subject of inorganic chemical structure is a subject for students of MEC which includes: description of chemical structure, symmetry of chemical structures, polymorphosis and phase transitions, chemical bonds and lattice energy, molecular structures 1 and 2, and lattice structures in

diamonds. This course aims to enable students to understand the structure and grid contained in molecular compounds 1 and 2.

19). Biomolecule and Genetic Engineering

Course Description:

This course is a subject for MEC students that underlies the ability of students to know biomolecular processes and various genetic engineering techniques, such as PCR, Sequencing, Genetic Cloning and so on. This course aims to make students have open-minded knowledge about the processes, developments, positive and negative impacts of biomolecules and genetic engineering both in the world of science and in the world of research.

20). Practicum and Chemical Project

Course Description:

This course is a compulsory subject for MEC students, where the expected output is the formation of student skills in conducting practicum and chemical projects. This course consists of two parts, namely practical and project activities. In practical activities, the ability of students through inorganic chemistry experiments with the support of practicum manuals. In project activities, students are not only required to do practicum, but also have to design these activities independently. From practical activities and chemical projects, students write reports and present the results of experiments in the laboratory.

21). Chemical Learning Practicum

Course Description:

This course is an elective course for students of MEC that underlies the ability of students to design chemistry learning practices in the classroom. Through this course learning students are expected to be able to master the basic concepts and techniques of chemical learning. After mastering the theory of chemistry learning, students are expected to practice it in class.

22). Model and Modeling in Chemical Learning

Course Description:

Model and chemistry learning modeling are elective courses for students of MEC that underlie the ability of students to know various learning models that can be done in the chemistry learning process, including learning processing information models, personal, social interactions and behavior. This course aims to enable students to innovate in the learning process, find out various models or methods that are developing in other countries through analysis of international articles and can develop the latest learning models in chemistry learning.

23). Visualization in Chemical Education

Course Description:

This course is an elective subject for students of Chemistry Education Study Program, Postgraduate Program, UNY Postgraduate Program. The quality of learning Chemistry must be pursued with various scientific efforts. Less optimal student learning outcomes, especially in the cognitive aspects can be used concepts and chemistry learning materials and chemistry learning processes that tend to be abstract. To reduce the level of abstractness, visualization of chemical concepts and material must be done. Visualization in Chemistry learning is intended to optimize interactions between students, teaching resources using various organs given by God Almighty. This course begins with developing the importance of visualization in Chemistry learning, identifying abstract material in High School Chemistry learning, discussing alternative visualization solutions, determining the type of visualization, developing visualization media, developing learning visualizations, and planning learning with visualization.

24). Problem and Solving in Chemistry Education

Course Description:

This course is an elective course of study that develops students' ability to explore problems in the field of chemical education and determine solutions to problem solving. The issues discussed are up to date and a priority in chemistry education both in Indonesia and abroad obtained through field observations and studies of the results of research in scientific articles. The scope of the problem includes chemical learning programs, approaches, strategies, and learning models, misconceptions, creativity, judgments, interests, motivations and student learning styles, pedagogical content knowledge, and multiple representation.

25). Qualitative Research Methods in Chemistry Education

Course Description:

Qualitative courses are elective courses for students of MEC that underlie the ability of students to design and carry out various studies and report on the results of educational research. Through this course, students are expected to be able to understand the types of research and qualitative education research designs which include: phenomenology, case studies, narrative, ethnography and grounded theory and provide examples of the results of research published in reputable national and international journals. After studying this course students are expected to be able to carry out simple qualitative research.

26). Computer Skills in Chemistry

Course Description:

This course is an elective course of study that develops students' abilities in chemistry learning applications, especially in terms of computer technology. Because chemical material is a concept (abstract), visualization is needed to explain chemical phenomena in the form of symbolic and even submicroscopic with the help of computer technology, so that chemistry education students can facilitate chemical learning that is not in accordance with the correct concept.

27). Special Topics in Chemical Science

Course Description:

This course is an elective course of study that develops students' abilities in the field of chemistry. This course enhances the ability of students to analyze misconceptions found in high school chemistry material, both in student handbooks and high school chemistry teacher books. The justification of these concepts is explained and supported by sources and references from the English textbook and articles from reputable scientific journals. Some of the chemistry topics analyzed for their misconceptions in this course are quantum numbers and electronic configurations, acid bases, buffer solutions, salt hydrolysis, reaction rates, chemical equilibrium, stoichiometry, oxidation reduction reactions, solubility and solubility, colligative properties of solutions, and others.

28). Modern Technical Analysis

Course Description:

This course is an elective course for students of the UNY Postgraduate School of Chemistry Education undergraduate program which underlies students in understanding the basic concepts and ways of analyzing with modern chemical instruments. Through this course learning, students are expected to be able to master modern analytical methods, namely voltammetry, visible spectrophotometry, ultra violet, infrared, mass, XRD, SEM, and TEM.

B. EVALUATION

Assessment of courses conducted by lecturers can be through assignments, midterms, final semester exams, practice exams, and thesis examinations. Weighting for each component of the assessment is determined by the lecturer lecturer. Course studies produce values that symbolize the

ability of students to achieve the objectives of learning courses. The final grade of students is determined by the results of midterm examinations, final semester examinations, individual or group assignments, or chemical research projects in chemical laboratories.

C. LEARNING PROCESS

All students of the Master of Educatio in Chemistry must attend lectures in the form of face-to-face meetings held at the Graduate School Building and at the Chemistry Laboratory of the Mathematics and Natural Sciences, UNY. Requirements for the number of meetings in study are 16 meetings. Based on the academic regulations of the Postgraduate Program, it is emphasized that the course examination requirements are only permitted for students who can take at least 75% lectures. For students whose attendance is less than 75%, they must repeat the following year or be able to fulfill the lack of meetings by the lecturer concerned. In connection with this, students will experience difficulties if they live outside the area, therefore students must live not far from the Karangmalang campus in Yogyakarta.

Face-to-face lectures are held in the lecture hall at the Graduate School Building from Monday-Friday. For practicum carried out in chemical laboratories, language laboratories and in schools. Practicum in a chemical laboratory is carried out for practicums related to laboratory work. MEC organizes lectures that are supported by special assignments. Lectures are conducted through face-to-face meetings with a time allocation of 50 minutes/credits, structured learning tasks 60 minutes/credits, as well as 60 minutes independent learning/redit unit independent learning assignments. Face-to-face lectures are conducted with a variety of methods, including lectures, question and answer, case discussions, case presentations, book reviews, paper writing, and review articles from international journals (in English). In accordance with the academic rules that apply in the Master of Educatio in Chemistry, students are permitted to take thesis courses if students have completed all theoretical courses with a minimum GPA of 3.0