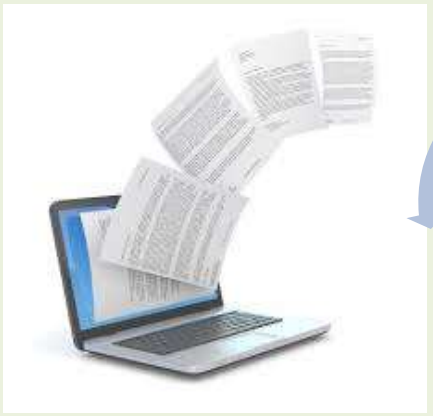
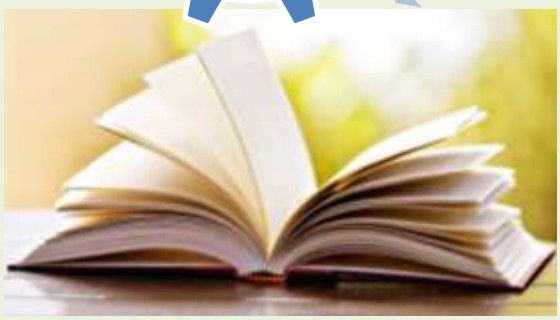
MODULE HANDBOOK





Master of Education In Chemistry
Graduate School
Universitas Negeri Yogyakarta
2020

STRUCTURE OF CURRICULUM AND COURSE DISTRIBUTION
MASTER OF EDUCATION IN CHEMISTRY
2019

A. Structure of Curriculum

No.	Courses	Credit Unit		CU Total	Explanation
1	Scientific Fondation	7		40	Personality Development Courses
2	Expertise Study Programme: • Pedagodic	33	18		Scientific and Skills Courses
	• Chemistry (Subject Matter)		11		
3	Elective		4		Provided 20 CU
4	Additional capabilities	0 to 4		0 to 4	Additional Skills Courses (Courses outside the study program that support the thesis)
5	Matriculation	9		9	Mandatory for graduates of non-educational study programmes

B. Course Distribution

No.	Code	Course	CU	T	P	L	Sem				Credit Unit (CU)
							1	2	3	4	
SEMESTER I											
1	PPS8201	Science Philosophy	2	√			2				18
2	PPS8202	Statistics	2	√			2				
3	PPS8304	Educational Research Methodology	3	√			3				
4	MPK8202	Design and Implementation of Chemistry Curriculum	2	√			2				
5	MPK8204	Current Issues in Chemistry Education	2	√			2				
6	MPK8206	Inorganic Sructural Chemistry	2	√			2				
7	MPK8209	Biomolecule and Genetics Engineering	2	√			2				
8	MPK8110	Chemical Practicum	1		√		1				
9	**Elective Course**		2				2				
SEMESTER II											
10	MPK8211	Thesis Proposal	2	√	√			1/1			14
11	MPK8201	Innovation in Chemistry Learning	2	√				2			
12	MPK8203	Development of Assessment and Evaluation in Chemistry Education	2	√				2			

13	MPK8205	Chemical Spectroscopy	2	√				2			
14	MPK8207	Structure Elucidation of Organic Chemistry	2	√				2			
15	MPK8208	Solution Chemistry and Analytical Electrochemistry	2	√				2			
16	**Elective Course**		2	√				2			
SEMESTER III											
17	MPK8213	Academic Writing	2	√	√				1/1		2
SEMESTER IV											
18	MPK8612	Thesis	6		√					6	6
TOTAL											**40**

ELECTIVE COURSES

1	MPK8214	Computers Skill In Chemistry	2	√	√		1/1			4
2	MPK8215	Models of ChemistryTeaching and Learning	2	√			2			
3	MPK8216	Visual and Visualization in Chemistry Education	2	√			2			
4	MPK8217	ChemistryTeaching and Learning Practices	2			√	2			
5	MPK8218	Special Topics in Chemistry	2	√			2			
6	MPK8219	Mechanisms and Reactivity of Organic and Inorganic Reactions	2	√			2			
7	MPK8220	Science and Ethics In Chemistry	2	√			2			
8	MPK8221	Problem Solving In Chemistry Education	2	√			2			

Additional Expertise Courses *										
	----	Courses organized by other Study Programs and to support Thesis (0-4 credits unit)	0-4	√			0 – 4			0 – 4
Matriculation Courses **										
1	PIK302	Chemistry Teaching and Learning Strategic								3
2	PIK304	Assessment in Chemistry Teaching and Learning								3
3	PIK305	Chemistry Education Research Methodology								3

Explanation:

- Elective courses to be taken = 4 credits from 16 credits of courses provided.
- * Additional expertise courses are 0 to 4 credits which are Courses organized by other Study Programs and to support Thesis
- ** Matriculation courses are held in the intermediate semester

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Science Philosophy**
Module level, if applicable:	Master
Code:	PAS8201
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1
Module coordinator:	Prof. AK. Prodjosantoso, M.Sc., Ph.D
Lecturer(s):	Prof. AK. Prodjosantoso, M.Sc., Ph.D and Prof. Dr. Nurfina Aznam, Apt, SU
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. show concern for development and position of philosophy as science CO2. gain knowledge about the philosophers and science development from the ancient Greek era up to the present. CO3. Collaborate actively to construct understanding of science philosophy CO4. develop logical, critical, and systematic thinking to enrich their knowledge about science philosophy for which could be scientifically accounted.
Content:	This course is a core unit for graduate students of chemistry education study program which includes the discussion of 1. definition of science and philosophy; 2. scopes and position of philosophy of science; 3. philosophers;

	4. history of the science development; 5. foundation, facilities, methods and scientific truths; 6. development of science, technology and culture and scientific ethics. This course aims to examine the development of philosophical theories as a scientific foundation in digging truth into the origin and integrating science with moral, ethics and religion.
Study/examachievements:	Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitudeif they show it significantlycompared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of therequirements to pass the course. Students will pass from this course if at least have a good attitude.
Formsof media:	Board, LCD Projector, Laptop/Computer
References:	P1. Kind, A. (2019). *Philosophy of mind in the twentieth and twenty-first centuries*. Abingdon: Routledge P2. Hansson, S. O. (2015). *Philosophy of science and philosophy of technology*. Dordrecht: Springer P3. Wagenknecht, S., Nersessian, N. J. & Andersen, H. (eds.) (2015). Empirical Philosophy of Science: Introducing Qualitative Methods into Philosophy of Science. Heidelberg : Springer P4. Suriasumantri, J. S. (2009). *Filsafat ilmu: Sebuah pengantar populer*. Jakarta: Sinar Harapan. P5. Tim dosen. (2007). *Filsafat ilmu: Sebagai dasar pengembangan ilmu pengetahuan*. Yogyakarta: Liberty Yogyakarta

PROGRAMME LEARNING OUTCOMES (PLO)

	Programme Learning Outcomes (PLO)
Attitude and Value	PLO1. 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. PLO2. 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 PLO3. Upholding the rule of law and having the spirit to prioritize the interests of the nation and the wider community. PLO4. 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	PLO5. 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. PLO6. 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. PLO7. Publishing the results of research in the field of chemistry education in scientific journals nationally and internationally accredited. PLO8. Increasing the capacity of independent learning. PLO9. Having structured learning skills for self-development, science, and career sustainability. PLO10. Enabling to think critically, make informed decisions, and communicate effectively, academically, and ethically.
Knowledge Assignment	PLO11. Documenting, storing, auditing, securing, and rediscovering research data for further research purposes. PLO12. Identifying the scientific field of the research object and positioning it into a research map. PLO13. 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	PLO14. Developing and maintaining networks with colleagues, including in the broader research institutions and communities. PLO15. 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.

ASSESSMENT WEIGHT

No	Course Outcames	Object of assessment	Valuation Techniques	Quality
1	CO 1, and 2	The independent task of writing and / or listening skills	Assignment	15%
2	CO 1, and 2	Structured tasks are reading and / or writing skills	Assignment	15%
3	CO 3, 4	Speaking ability and presentation skills journal analysis (Skills)	Speaking ability	15%
4	CO 3 and 4	Attitude and Value	Observation of Attitude	15%
5	CO 1, 2, 3 and 4	Midterm Exam	Written Test	20%
6	CO 1, 2, 3 and 4	Final Exam	Written Test	20%
Total				**100%**

PLO ANDCO MAPPING

		¨Pogramme Learning Outcomes (PLO)														
		Attitude and Value				*Work Ability*						*Knowledge Assignment*			*Authority and Responsibility*	
		PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12	PLO 13	PLO 14	PLO 15
Course : PAS8201 - Science Philosophy																
Course Outcames	CO1										√	√	√			
	CO2					√	√					√	√	√		
	CO3	√	√	√	√					√	√				√	√
	CO4	√	√	√	√			√	√		√				√	√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Prof. AK Prodjosantoso, PhD
NIP 19601028 1985031002

ANALYSIS OF ACHIEVEMENT CO / PLO

Study Program : Master of Education in Chemistry
Course : Science Philosophy
Code : PAS8201
Credit Unit (sks) : 2 (Theory)
Semester : 1
Prerequisite Course : -
Course Lecturer : Prof. AK Prodjosantoso, PhD

A. TABLE OF OF ACHIEVEMENT CO

Task/ Exam	CO 1	CO 2	CO 3	CO 4
Structured Tasks 1	85			
Structured Tasks 2		86		
Independent task 1		86		
Independent task 2	85			
Skills			80	76
Attitude			80	76
Midterm Exam				74
Final Exam				78
AVERAGE	85	86	80	76

B. TABLE OF OF ACHIEVEMENT PLO

	CO 1	CO 2	CO 3	CO 4	AVERAGE
PLO 1			86	82	**84**
PLO 2			84	86	**85**
PLO 3			82	84	**83**
PLO 4			86	82	**84**
PLO 5		82			**82**
PLO 6		86			**86**
PLO 7				76	**76**
PLO 8				78	**78**
PLO 9			78		**78**
PLO 10	84		80	76	**80**
PLO 11	82	76			**79**
PLO 12	86	80			**83**
PLO 13		76			**76**
PLO 14			84	80	**82**
PLO 15			82	82	**82**
AVERAGE					**81.33**

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Statistics**
Module level, if applicable:	Master
Code:	PAS8202
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1
Module coordinator:	Kismiantini, Ph.D
Lecturer(s):	Kismiantini, Ph.D and Dr. Djamilah Bondan Widjajanti, M.Si
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. explain multivariate statistics concepts and its aspects CO2. analyze multivariate data and its computation CO3. conduct data analysis in educational research
Content:	This course discusses concepts and aspects of multivariate analysis, random matrices and vectors, multivariate analysis for comparing several average vectors, multivariate variance analysis, assumptions in multivariate variance analysis, analysis of multivariate covariance, and assumptions in multivariate covariance analysis. The topics covered in this course: 1. Multivariant analysis aspects 2. Matrices and covariance matrices 3. Testing one vector of population averages

<table>
<tr><td></td><td>4. Internal trust for one vector of population averages
5. Testing two vectors of population averages
6. Post Hoc in multivariate variance analysis of two vector population averages
7. Testing K vector of population averages
8. Post Hoc in multivariate variance analysis K vector of population averages
9. Independence assumption
10. Multivariate normality
11. Homogeneity of the covariance matrices
12. Two-way multivariate variance analysis
13. Analysis of covariance
14. Analysis of multivariate covariance
15. Assumptions in the analysis of multivariate covariance
16. Exploratory factor analysis</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:
<table><tr><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr><tr><td>CO1, CO2, and CO3</td><td>a. Individual Assignment
b. Mid-term exam
c. Final Exam</td><td>Written assignment
Written test
Written test</td><td>40%
30%
30%</td></tr><tr><td colspan="3">Total</td><td>100%</td></tr></table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>References:</td><td>Shirali, S., & Vasudeva, H. L. (2011). Multivariable analysis. Springer
Pituch, K.A., & Stevens, J.P. (2016). Applied multivariate statistics for the social sciences 6th edition. New York: Routledge.
Johnson, R.A., & Wichern, D.W. (2007). Applied multivariate statistical analysis. New Jersey: Pearson Prentice Hall.
Meyers, L.S., Gamst, G., & Guarino, A.J. (2006). Applied multivariate research: design and interpretation. London: Sage.</td></tr>
</table>

MAPPING PLO AND CO

		Learning Outcomes (LO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO 1	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**	**PLO 12**	**PLO 13**	**PLO 14**	**PLO 15**
Course : Statistics																
Course Outcames	CO1	√												√		
	CO2			√		√			√							
	CO3							√			√					√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Kismiantini, Ph.D
NIP 19790816 200112 2 001

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Educational Research Methodology**
Module level, if applicable:	Master
Code:	PAS8304
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1
Module coordinator:	Dr. Antuni Wiyarsi, M.Sc.
Lecturer(s):	Prof. Dr. Sri Atun, M.Si. and Dr.rer.nat. Senam
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. show concern for the problems surrounding chemistry education and appreciate people's thoughts and discovery related to chemistry education research CO2. analyze the basic concepts of educational research, examine the characteristics and samples of descriptive, experimental, quasi-experimental, pre-experimental, correlational, comparative, development, survey, and action research comprehensively CO3. collaborate effectively to construct and confirm understanding of contemporary studies in chemistry education CO4. develop logical, critical, and systematic thinking to construct ideas and arguments upon the chemistry education research methodology and communicate those ideas well.

Content:	Educational Research Method is a compulsory subject for graduate students of Chemistry Education study program that provides basic knowledge to design and carry out research as well as to report the results of educational research. Students are expected to develop social sensitivity to educational problems and appreciate other thoughts and findings. Students understand the types of educational research approaches and design. Through this course, students learn the basic concepts of educational research, starting from formulating, identifying, analyzing problems; recognizing types of variables and hypotheses, understanding various sampling techniques, developing instruments and techniques of data analysis on educational research. In addition, students also study research approaches (descriptive research, experimental research, quasi-experimental research, pre-experimental research, correlational study, comparative research, research and development, survey, phenomenology and action research) comprehensively and common features of the problem, variables, sampling techniques, instruments and data analysis techniques. The course provides students with the research samples published in reputable national and international journals. The topics covered in this course: 1. Basic concepts of educational research 2. Variables, hypotheses and sampling techniques 3. Research instruments and data analysis techniques for educational research 4. Types of educational research 5. Descriptive research 6. Pre-experimental research 7. Quasi-experimental research 8. Research experiments 9. Correlational study 10. Comparative research 11. Survey 12. Research and Development 13. Classroom action research (CAR) 14. Phenomenology research 15. Research methodology of chemical education research in the journal
Study / exam achievements:	Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in

<table>
<tr><td></td><td>the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:

<table>
<tr><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>CO1, CO2, and CO3</td><td>a. Individual and groupwork assignment
b. Mid-term exam
c. Participation</td><td>Written assignment

Written test
Observation</td><td>50%

30%
20%</td></tr>
<tr><td></td><td></td><td>Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>References:</td><td>Handbooks:
P1. Burke, J. R. 2014. Educational research: Quantitative, qualitative, and mixed approaches, Fifth edition. Thousand Oak : SAGE Publications, Inc.
P2. Sagor, R. 2010. Action Research for Teacher Candidates. Maryland: Rowman & Littlefield Education.
P3. Borg, W.R. & Gall, M.D. 1983. Educational Research An Introduction Fourth edition. Boston: Allyn and Bacon.
P4. Creswell, J.D. 2008. Educational Research. New Jersey: Pearson Prentice Hall.
P5. Gall, M.D., Gall, J.P. & Borg, W.R. 2003. Educational Research An Introduction. Seventh Edition. Boston: Allyn and Bacon
P6. Wilkinson, D. & Birmingham, P. 2003. Using Research Instruments. New York: Routledge Falmer.
Suggested readings:
S1. Tomal, D.R. 2010. Action Research for Educators. Maryland: Rowman & Littlefield Education.
S2. Wiersma, W. & Jurs, S.G. 2009. Research Methods in Education. Boston: Allyn & Bacon.
S3. Akker, J. van den. 1999. Principles and Methods of Development Research. Dalam Plomp, T; Nieveen, N; Gustafson, K; Branch, R.M; dan van den Akker, J (eds). Design Approaches and Tools in Education and Training. London: Kluwer Academic Publisher.
S4. Thiagarajan, S; Semmel, D.S; & Semmel, M.I. 1974. Instructional Development for Training Teachers of Exceptional Children: A Sourcebook. Indiana: Indiana University.</td></tr>
</table>

ASSESSMENT WEIGHT

No	Course Outcames	Object of assessment	Valuation Techniques	Quality
1	CO 1	The independent task of writing and / or listening skills	Assignment	10%
2	CO 2	Structured tasks are reading and / or writing skills	Assignment	10%
3	CO 2 dan CO3	Structured tasks are reading, communication and / or writing skills	Observation of Attitude	30%
4	CO 4	Structured tasks are reading, speaking and / or writing skills	Observation of Attitude	20 %
5	CO 1 dan CO 2	Midterm Exam	Written Test	30%
Total				**100%**

PLO and CO mapping

		¨Pogramme Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO 10**	**PLO 11**	**PLO 12**	**PLO 13**	**PLO 14**	**PLO 15**
Course Outcames	CO1	√	√								√					
	CO2					√						√	√			
	CO3			√	√					√				√	√	
	CO4				√			√	√		√				√	√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Dr. Antuni Wiyarsi, M.Sc
NIP 19800825 200501 2 002

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Design and Implementation of Chemistry Curriculum**
Module level, if applicable:	Master
Code:	MPK8202
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	2
Module coordinator:	Dr. Antuni Wiyarsi, M.Sc.
Lecturer(s):	Dr. Antuni Wiyarsi, M.Sc. and Dr. Dra. Eli Rohaeti, M.Si
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate concern about the problems surrounding chemistry curriculum and be open-minded toward Chemistry curriculum changes in Indonesia CO2. analyze basic concepts on curriculum as well as curriculum basis, models, and development; analyze the 2013 curriculum and describe it into a chemistry learning media in schools; analyze the history of the curriculum comparison in Chemistry learning in Indonesia, analyze the comparison of current Chemistry curriculum in Indonesia, ASEAN countries and developed countries; and comprehensively analyze issues and trends of the latest curriculum development in reputable international journals CO3. collaborate effectively to construct and confirm their understanding about concepts, development, and implementation of Chemistry curriculum between Indonesia and several developed countries CO4. develop logical, critical, systematic thinking to organize lesson plans for Chemistry learning, as well as bring ideas and opinions together based on the study upon Chemistry curriculum concepts, development, and implementation.
Content:	This course is compulsory for graduate students of Chemistry

<table>
<tr><td></td><td>Education study program, which serves as the basic knowledge for students to design and implement curriculum at an operational level in the classroom. This course aims to encourage students to be open-minded about curriculum changes and raise their sensitivity to curriculum issues in Indonesia. It also foster students to solve the problems about Chemistry learning in schools. Through this course, 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 and examine resources for curriculum implementation. In addition, students can review the 2013 curriculum concept and analyze chemistry curriculum in high schools and vocational schools. Students are also required to develop learning media to implement 2013 curriculum in high schools and vocational schools and analyze SNPT as a basis for curriculum development in higher education. Lastly, students are expected to be able to apply concepts about current curriculum components and models by analyzing the history of Chemistry curriculum in Indonesia, comparing Chemistry curriculum with other countries countries and analyzing current curriculum issues and trends in the reputable international journals.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude. The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3, CO4</td><td>a. Individual assignment
b. Group assignment
c. Participation</td><td>Written assignment
Presentation
Observation</td><td>50%
30%
20%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>P1. Oliva, P. & Gordon, W. 2013. Developing the curriculum. New Jersey: Pearson Education
P2. Khosrow-Pour, M. (eds). 2015. Curriculum design and classroom management: concepts, methodologies, tools, and applications. Hershey: IGI Global.
P2. Drake, S.M. 2012. Creating Standards-Based Integrated curriculum: The common core state standards. California: Sage
P1. McNeil, J.D. 1990. Curriculum a comprehensive introduction. Illinois: Scott</td></tr>
</table>

ASSESSMENT WEIGHT

No	Course Outcames	Object of assessment	Valuation Techniques	Quality
1	CO 1	The independent task of writing and / or listening skills	Assignment	10%
2	CO 2	Structured tasks are reading and / or writing skills	Assignment	15%
3	CO 3	Structured tasks are reading, communication and / or writing skills	Observation of Attitude	15%
4	CO 4	Structured tasks are reading, speaking and / or writing skills	Observation of Attitude	20 %
5	CO 1 dan CO 2	Midterm Exam	Written Test	40%
Total				**100%**

PLO and CO mapping

		Learning Outcomes (LO)														
		Attitude and Value				*Work Ability*						*Knowledge Assignment*			*Authority and Responsibility*	
		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15
Course Outcames	CO1	√	√	√	√											
	CO2						√		√	√	√					
	CO3							√				√		√		
	CO4												√		√	√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Dr. Antuni Wiyarsi, M.Sc
NIP 19800825 200501 2 002

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Current Issues in Research on Chemistry Education**
Module level, if applicable:	Master
Code:	MPK8204
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1
Module coordinator:	Dr. Antuni Wiyarsi, M.Sc.
Lecturer(s):	Dr. Antuni Wiyarsi, M.Sc. and Dr. Dra. Eli Rohaeti, M.Si.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate concern upon the problems found in Chemistry education and appreciate people's thoughts and discovery as an innovation in Chemistry learning CO2. Analyze basic concepts on learning theories, which serve as the background for creating innovation in Chemistry learning CO3. collaborate effectively to construct and confirm their understanding about innovation in Chemistry learning CO4. develop logical, critical, systematic thinking to bring ideas and opinions together derived from innovative research on Chemistry learning, based on scientific rules.

<table>
<tr><td>Content:</td><td>This course is compulsory for graduate students of Chemistry Education study program, which facilitates students to improve their ability to analyze international articles, especially within the issues of chemistry education. The article analysis focuses on the research background, objectives, methods, and results of the study. Each student is required to analyze a number of international articles that have a similar theme and certain periods of publication. Apart from analyzing, students must also synthesize the articles, thus they can get an overview of rationales (research background), formulation of the problem, research objectives, and the research gap and innovative points of the study that will be carried out.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3, CO4</td><td>a. Individual and group assignment

b. Participation</td><td>Written assignment/ Presentation

Observation</td><td>78%

22%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>P1. Leavy, . 2017. Research design: quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches. New York: The Guilford Press
P2. Creswell, J.D. 2008. Educational research. New Jersey: Pearson Prentice Hall.
P3. Singh, Y. K. 2017. Fundamental of research methodology and statistics. New Delhi: New Age International (P) Ltd., Publishers
P4. Gall, M.D., Gall, J.P. & Borg, W.R. 2003. Educational research an introduction. seventh edition. Boston: Allyn and Bacon
P5. Sagor, R. 2010. Action research for teacher candidates. Maryland: Rowman & Littlefield Education.</td></tr>
</table>

ASSESSMENT WEIGHT

No	Course Outcames	Object of assessment	Valuation Techniques	Quality
1	CO 1 dan CO 2	Structured tasks are reading, communication and / or writing skills	Observation of Attitude	28%
2	CO 2, CO 3, dan CO 4	Structured tasks are reading, speaking (presentation) and / or writing skills	Observation of Attitude Individual Task	72 %
Total				**100%**

PLO and CO mapping

		Programme Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO 1	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**	**PLO 12**	**PLO 13**	**PLO 14**	**PLO 15**
Course Outcames	CO1	√	√	√	√											
	CO2								√		√		√			
	CO3						√	√		√						
	CO4											√		√	√	√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Dr. Antuni Wiyarsi, M.Sc
NIP 19800825 200501 2 002

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODUL HANDBOOK

COURSE	CODE	COURSE GROUP	CREDIT UNIT	SEM.	DEVELOPMENT DATE
Inorganic Structural Chemistry	MPK8206	Master of Education in Chemistry	2	1	Jan 2, 2019
Authorization	**Course Lecturer**				**Head of Study Program**
	Prof. Dr. Hari Sutrisno, M.Si.				Prof. Dr. Hari Sutrisno, M.Si.

	Programme Learning Outcomes (PLO) – Study Program	
Learning Outcomes	**Attitude and Value**	PLO1. 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. PLO2. 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 PLO3. Upholding the rule of law and having the spirit to prioritize the interests of the nation and the wider community. PLO4. 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	PLO5. 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. PLO6. 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. PLO7. Publishing the results of research in the field of chemistry education in scientific journals nationally and internationally accredited. PLO8. Increasing the capacity of independent learning. PLO9. Having structured learning skills for self-development, science, and career sustainability. PLO10. Enabling to think critically, make informed decisions, and communicate effectively, academically, and ethically.

	Knowledge Assignment	PLO11. Documenting, storing, auditing, securing, and rediscovering research data for further research purposes. PLO12. Identifying the scientific field of the research object and positioning it into a research map. PLO13. 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	PLO14. Developing and maintaining networks with colleagues, including in the broader research institutions and communities. PLO15. 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.
	Course Outcames	
Course Outcames	CO1	Demonstrate an awareness of responsible and ethical conducts as well integrity in the context of their profession and obligations to society
	CO2	Demonstrate knowledge of advanced theories and methods of chemistry
	CO3	Demonstrate proficiency in analyzing, applying, and solving engineering problems using the acquired chemical methods.
	CO4	Demonstrate the problem-solving ability in understand, extract and analyze engineering problems and reorganize the knowledge in chemistry forms for specific purposes
	CO5	Ability to convey ideas on chemistry knowledge clearly and effectively in both written and spoken forms. In addition, ability to work collaboratively as part of a team undertaking a range of different team roles
	CO6	Demonstrate the awareness of contemporary issues in Inorganic chemistry and the ability to respond the Challenges
	CO7	Ability to pursue independent study and demonstrate the awareness for lifelong learning and professional development
Short Description of Course	Inorganic Structurale Chemistry courses are courses for students of Master of Education in Chemistry with descriptions including: chemical structure description, symmetry and molecular groups, chemical bonds and lattice energy, 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.	

<table>
<tr><td>Learning Materials / Subjects</td><td colspan="2">Subjects include:
1. Description of chemical structure
2. Theory of repulsion of valence electron pairs
3. Symmetry and molecular groups
4. Chemical bonds and lattice energy
5. Atom size size
6. Symmetry and crystal groups
7. Molecular structure 1: compounds of the main group elements
8. Molecular structure 2: transition metal compounds
9. Structure of nonmetal elements
10. X-ray diffractometer
11. Determination of simple crystal structure</td></tr>
<tr><td rowspan="4">References</td><td colspan="2">Primary</td></tr>
<tr><td colspan="2">P1. Li, W. K., Cheung, Y. S., Mak, K. K. W. & Mak, T. C. W. (2013). Problems In Structural Inorganic Chemistry. Hong Kong: Oxford Press
P2. Pfennig, B.W. (2015). Principles of inorganic chemistry. New Jersey: John Wiley & Sons, Inc.
P3. Muller, U., (2006). Inorganic Structural Chemistry, second edition. West Sussex: John Wiley & Sons Ltd
P4. Huheey, J. E., Keiter, E. A. & Keiter, R. L. (1993). Inorganic Chemistry: Principle of Structure and Reactivity. New York : Harper Collins College Publisher.
P5. Li, W. K., Zhou, G. D. & Wai Mak, T. C. (2008). Advanced Structural Inorganic Chemistry. New York: Oxford Science Publication
P6. Miessler, G. L. & Tarr, D. A. (2009). Inorganic Chemistry, third edition. New Delhi: Pearson Education .</td></tr>
<tr><td colspan="2">Support</td></tr>
<tr><td colspan="2">S1. West, A. R. (2014). Solid State Chemistry and Its Applications. second edition. Singapore: John Wiley & Sons Ltd.
S2. Journal Inorganic Chemistry</td></tr>
<tr><td rowspan="2">Instructional Media</td><td>Software</td><td>Hardware</td></tr>
<tr><td>File dan Powerpoint</td><td>Laptop
Board and stationery
Projector</td></tr>
<tr><td>Team-Teaching</td><td colspan="2">- Prof. Dr. Hari Sutrisno
- Dr. Dyah Purwaningsih</td></tr>
<tr><td>Prerequisite Course</td><td colspan="2">-</td></tr>
</table>

ASSESSMENT WEIGHT

No	Course Outcames	Object of assessment	Valuation Techniques	Quality
1	CO 3	The independent task of writing and / or listening skills	Assignment	15%
2	CO 5 dan 7	Structured tasks are reading and / or writing skills	Assignment	15%
3	CO 3, 4	Speaking ability and presentation skills journal analysis (Skills)	Speaking ability	10%
4	CO 1 dan 2	Attitude and Value	Observation of Attitude	10%
5	CO 3, 5 dan 6	Midterm Exam	Written Test	25%
6	CO 3; 6; dan 7	Final Exam	Written Test	25%
Total				**100%**

PLO AND CO MAPPING

		Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**PLO13**	**PLO14**	**PLO15**
Course : KIM8207 - Inorganic Sructural Chemistry																
Course Outcames	CO1	√		√	√											
	CO2					√	√									
	CO3		√							√						
	CO4				V							√			√	
	CO5		√					√			√		√			
	CO6								√			√		√		
	CO7												√			√

Yogyakarta, Nov 2, 2020

Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Lecturer

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Biomolecules and Genetics Engineering**
Module level, if applicable:	Master
Code:	MPK8209
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1
Module coordinator:	Dr. rer. nat. Senam, M.Si.
Lecturer(s):	Dr. rer. nat. Senam, M.Si.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate obedience and humanity in developing biomolecule and genetics engineering which could raise a controversy if not handled properly, for example gene cloning for human being CO2. perform an ability to analyze and develop foundation of science; types, processes, and application of biomolecules and genetices engineering in survival of human beings and the environment CO3. collaborate with peers effectively to construct knowledge upon the current genetices engineering development CO4. develop logical, critical, systematic, innovative, creative, and advanced thinking on utilizing tools in a variety of methods towards biomolecule development and engineering
Content:	This course provides basic knowledge for graduate students

<table>
<tr><td></td><td>in Chemistry Education pertaining to biomolecular processes and various genetic engineering techniques, such as PCR, Sequencing, Gene Cloning and so on. This course aims to encourage students to be open-minded about the processes, development, positive and negative impacts of biomolecules and genetic engineering, be it in the view of science and in the view of research.
The materials include:
1. PCR (Polymerase Chain Reaction)
2. Gene cloning
3. Gene structure
4. Sequencing
5. Construction Vector
6. Gene Expression
7. Southern Blotting
8. Northern Blotting
9. Western Blotting
10. Gene Expression in the Equary</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:
<table><tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr><tr><td>1</td><td>CO1, CO2, CO3, CO4</td><td>a. Individual and group assignment
b. Participation
c. Final exam</td><td>Presentation /written test
Written test
Written test</td><td>50%
20%
30%</td></tr><tr><td colspan="4">Total</td><td>100%</td></tr></table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>P1. Khan, M. S., Khan, I. A. & Barh, D. (2016). Applied Molecular Biotechnology The Next Generation of Genetic Engineering. New York: CRC Press Taylor & Francis Group
P2. Walla, P. J. (2014). Modern biophysical chemistry: detection and analysis of biomolecules. Weinheim: Wiley-VCH</td></tr>
</table>

PLO and CO mapping

	Programme Learning Outcames (PLO)														
	Attitude and Value					***Work Ability***					***Knowledge Assignment***			***Authority and Responsibility***	
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO 10**	**PLO 11**	**PLO 12**	**PLO 13**	**PLO 14**	**PLO 15**
CO1		√				√									
CO2							√							√	
CO3			√						√				√		
CO4					√					√					

Yogyakarta, Nov 2, 2020

Head of Study Program

Lecturer

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Dr. re. nat. Senam, M.Si
NIP

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
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
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Chemical Practicum**
Module level, if applicable:	Master
Code:	MPK8110
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1st
Module coordinator:	Prof. Dr. Hari Sutrisno, M.Si.
Lecturer(s):	Dr. Retno Arianingrum, M.Si. Dr. Dyah Purwaningsih, M.Si.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Subject
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks
Credit points:	2 SKS (3,29 ECTS)
Prerequisites course(s):	-
Course Outcomes	After taking this course, the students are expected to be able to: CO1. demonstrate concern upon the problems found in Chemistry and appreciate people's thoughts and discovery which relate to research projects on chemistry CO2. operate analytical tools in the laboratory as an application of chemistry knowledge in analyzing components of organic and inorganic compounds comprehensively CO3. collaborate with peers to construct and confirm their understanding upon analysis of organic and inorganic compound structures CO4. develop logical, critical, systematic thinking to bring ideas and opinions together based on the scientific

	rules, and communicate them well.
Content:	This course is compulsory for graduate students of Chemistry Education study program. It expects students to gain skills in conducting practical and project activities in chemistry. This course consists of two parts, namely practical and project activities. In practical activities, students are tested through inorganic chemistry experiments with the support of manuals. In project activities, students are not only required to do practical activities, but also need to design these activities independently. Students write reports and present the results of experiments in the laboratory for both practical activities and chemistry projects. The materials include: 1. Basic concepts of spectroscopy in analysis of organic and inorganic compounds 2. The acidity of a hydrated metal ion 3. Phosphoric Acid pH 4. Phosphoric Acid Dosage 5. Thermochromic 6. Degradation of Colored Organic Compounds 7. Identification of Protein Levels in Biuret 8. aIdentification of Protein Levels with the Lowry Method 9. Thin Layer Chromatography 10. Identification of Glucose Levels in Beverages 11. Identification of Protein Levels 12. Identification of Carbohydrate Levels 13. Identification of Fat Levels
Study / exam achievements	The final mark will be weight as follow:
Forms of media:	Board, LCD Projector, Laptop/Computer
References:	**Handbooks:** P1. Strohfeldt, K. A. (2015). *Essentials of inorganic* Chemistry.West Sussex: John Wiley & Sons, Ltd P2. Silverstein R.M., (1997), *Spectrometric identification of Organic Compounds*, sixth ed.John, Wiley & Sons, New York. P3. Lambert. J. B,(1998), *Organic structural spectroscopy,* Prentice Hall, New Jersey. **Suggested reading:** S1. Donald L. Pavia, et al., 2010. Introduction to Spectroscopy, Brooks/Cole, US.Margenau, H. and Murphy, G.M., 1943, The Mathematics of Physics and Chemistry, New York: D., Van Nostrand Company, Inc.

PLO and CO mapping

		Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**PLO13**	**PLO14**	**PLO15**
Course : MPK8110 - Chemical Practicum																
CO	CO1		√		√											
	CO2	√						√				√				
	CO3									√						√
	CO4		√		√									√		

Yogyakarta, Nov 2, 2020

Head of Study Program

Lecturer

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Dr. Dyah Purwaningsih, M.Si
NIP

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Thesis Proposal**
Module level, if applicable:	Master
Code:	MPK8211
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	3
Module coordinator:	Dr. Antuni Wiyarsi, S.Pd.Si., M.Sc.
Lecturer(s):	Dr. Antuni Wiyarsi, S.Pd.Si., M.Sc.and Prof. Dr. Hari Sutrisno, M.Si.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate concern on problems surrounding Chemistry education and appreciate people's thoughts and discovery about research on Chemistry education CO2. perform an ability to analyze basic concepts on educational research, examine its characteristics, and discuss its sample comprehensively CO3. collaborate effectively to construct and confirm knowledge their understanding upon research in Chemistry education CO4. develop logical, critical, systematic thinking in proposing ideas and opinions about study results upon research methods on chemistry education based on scientific rules

<table>
<tr><td>Content:</td><td>This course is compulsory for graduate students of Chemistry Education study program. It serves as a monitoring attempt of students' readiness in undertaking Master's thesis study. This course aims to encourage students to think scientifically and be able to carry out research and write its report using appropriate research methods. This course is carried out through a research proposal seminar program where students are required to present the progress of their research including research background, literature review, and research methodology. The course output is that students are expected to conduct their study properly through the provided guidance and advice during teaching and learning process.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:
<table><tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr><tr><td>1</td><td>CO1, CO2, CO3, CO4</td><td>a. Master's thesis proposal
b. Participation</td><td>Presentation /written test
Observation</td><td>80%
20%</td></tr><tr><td colspan="4">Total</td><td>100%</td></tr></table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>Handbooks:
P1. Eco, U. 2015. How to Write a Thesis Massachusetts: Massachusetts: The MIT Press
P2. Evans, D., Gruba, P. & Zobel, J. 2014. How to Write a Better Thesis. New York: Springer
P3. Pequegnat, W., Stover, E., & Boyce, C. A. (Eds). 2011. How to Write a Successful Research Grant Application: A Guide for Social and Behavioral Scientists. second edition. New York: Springer.
P4. Sagor, R. 2010. Action Research for Teacher Candidates. Maryland: Rowman & Littlefield Education.
P5. Creswell, J.D. 2008. Educational Research. New Jersey: Pearson Prentice Hall.</td></tr>
</table>

	P6. Gall, M.D., Gall, J.P. & Borg, W.R. 2003. *Educational Research An Introduction*. Seventh Edition. Boston: Allyn and Bacon P7. Wilkinson, D. & Birmingham, P. 2003. *Using Research Instruments*. New York: Routledge Falmer. **Suggested readings:** S1. Tomal, D.R. 2010. Action Research for Educators. Maryland: Rowman & Littlefield Education S2. Wiersma, W. & Jurs, S.G. 2009. Research Methods in Education. Boston: Allyn & Bacon. S3. Akker, J. van den. 1999. Principles and Methods of Development Research. Dalam Plomp, T; Nieveen, N; Gustafson, K; Branch, R.M; dan van den Akker, J (eds). Design Approaches and Tools in Education and Training. London: Kluwer Academic Publisher.

ASSESSMENT WEIGHT

No	Course Outcames	Object of assessment	Valuation Techniques	Quality
1	CO 1 dan CO 2	Structured tasks are reading, communication and / or writing skills	Observation of Attitude	20%
2	CO 2, CO 3, dan CO 4	Structured tasks are reading, speaking (presentation) and / or writing skills	Observation of Attitude Individual Task	80%
Total				**100%**

PLO and CO mapping

		Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**PLO13**	**PLO14**	**PLO15**
Course : MPK8211 – Thesis Proposal																
CO	CO1	√	√													
	CO2				√			√	√		√	√		√		√
	CO3	√							√	√	√					√
	CO4		√		√						√					√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Dr. Antuni Wiyarsi, M.Sc
NIP 19800825 200501 2 002

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Chemistry Learning Innovation**
Module level, if applicable:	Master
Code:	MPK8201
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1
Module coordinator:	Dr. Antuni Wiyarsi, M.Sc.
Lecturer(s):	Dr. Antuni Wiyarsi, M.Sc. and Drs. Jaslin Ikhsan, M.App.Sc., Ph.D.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate concern upon the problems found in Chemistry education and appreciate people's thoughts and discovery as an innovation in Chemistry learning CO2. Analyze basic concepts on learning theories, which serve as the background for creating innovation in Chemistry learning CO3. collaborate effectively to construct and confirm their understanding about innovation in Chemistry learning CO4. develop logical, critical, systematic thinking to bring ideas and opinions together based on the innovative research on Chemistry learning and the scientific rules.
Content:	This course is compulsory for graduate students of

<table>
<tr><td></td><td>Chem Edu. study program as a means of applying their innovative skills on Chemistry learning. As an attempt to improve the quality of Chemistry learning, innovation is needed through learning models, teaching methods, teaching approaches, media and others. In this course, students are required to conduct small scale research to see how the students design an innovation on Chemistry learning. Prior to conducting this project, students are required to gain the basic knowledge of various learning theories and its innovations as well as the basic concepts of educational innovation. It expects that the small scale research can be carried out properly.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weig ht</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3, CO4</td><td>a. Individual assignment
b. Group assignment
c. Participation</td><td>Written assignment
Presentation
Observation</td><td>60%
10%
30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>P1. Mintzes, J. J., Walter, E. M. (Eds). 2020. Active learning in college science: The case for evidence-based practice. Cham: Springer
P2. Cummings J. B. & Blatherwick, M. L. (eds.). 2017. Creative Dimensions of Teaching and Learning in the 21st Century. Rotterdam: Sense Publishers,
P3. Sagor, R. 2010. Action Research for Teacher Candidates. Maryland: Rowman & Littlefield Edu.
P4. Creswell, J.D. 2008. Educational Research. New Jersey: Pearson Prentice Hall.
P4. Oon-Seng Tan. (2003). Problem-based Learning Innovation: Using problems to power learning in the 21st century. Singaore: Cengage Learning
P5. Gall, M.D., Gall, J.P. & Borg, W.R. 2003. Educational Research An Introduction. Seventh Edition. Boston: Allyn and Bacon</td></tr>
</table>

ASSESSMENT WEIGHT

No	Course Outcames	Object of assessment	Valuation Techniques	Quality
1	CO 1 dan CO 2	Structured tasks are reading, communication and / or writing skills	Observation of Attitude	30%
2	CO 2, CO 3, dan CO 4	Structured tasks are reading, speaking (presentation) and / or writing skills	Observation of Attitude Individual Task	60%
3	CO 1 dan CO 2	Presentation about the rsult of practice at school	Group Task	10%
Total				**100%**

PLO AND CO MAPPING

		Programme Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO 1	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**	**PLO 12**	**PLO 13**	**PLO 14**	**PLO 15**
Course : KIM8201 - Chemistry Learning Innovation																
Course Outcames	CO1	√	√		√											
	CO2					√			√							
	CO3									√	√	√				
	CO4							√					√	√	√	√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Dr. Antuni Wiyarsi, M.Sc
NIP 19800825 200501 2 002

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Development of Assessment and Evaluation in Chemistry Education**
Module level, if applicable:	Master
Code:	MPK8203
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	2
Module coordinator:	Dr. Das Salirawati, M.Si.
Lecturer(s):	Dr. Das Salirawati, M.Si. & Dr. Supahar, M.Si.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. understand the principles, techniques, and types of instruments used in measurement, assessment, evaluation of Chemistry learning CO2. Design and develop assessment instruments which meet validity and reliability criteria in terms of measurement, assessment, evaluation in Chemistry learning CO3. Analyze and interpret the assessment results as well as use the results to conduct an evaluation on Chemistry learning CO4. develop logical, critical, systematic thinking to comprehend evaluation on Chemistry learning.
Content:	This course discusses about principles of measurement, assessment and evaluation in the context of Chemistry learning; various assessment techniques, assessment instruments, assessment and evaluation procedures in Chemistry learning. It includes the materials such as design and development of assessment and measurement instruments

<table>
<tr><td></td><td>which meet the validity and reliability criteria used in Chemistry learning, be it for the needs of research, or classroom assessment; analysis and interpretation based on the results of measurement, assessment and evaluation in Chemistry learning; and the ways of using the assessment results to evaluate Chemistry learning.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1,
CO2,
CO3,
CO4</td><td>a. Individual and group assignment
b. Final exam
c. Participation</td><td>Presentation/ written assignment
Written test
Observation</td><td>75%

20%
5%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>Handbooks:

Nitko, A.J & Brookhart, S. M. (2011). Educational assessment of students. (6th ed). Boston: Pearson Education, Inc.

Harlen, W. (2007). Assessment of Learning. London: Sage Publication Ltd

Miller, M.D, Linn, R.L, & Gronlund, N.E. 2009. Measurent and assessment in teaching. Boston : Pearson Education Ltd.

Johnson, R.L, Penny, J.A, & Gordon, B. 2009. Assessing performance. New York: Guilford Press Atkin, J.M & Coffey, J.E. (2003). Everyday assessment in the science classroom. Virginia: NSTA Press

Mardapi, D. (2012). Pengukuran, penilaian, dan evaluasi pendidikan. Yogyakarta: Nuha Litera.

Miller, M.D, Linn, R.L, & Gronlund, N.E. 2009. Measurent and assessment in teaching. Boston : Pearson Education Ltd.

Popham, W.J. (2005). Classroom assessment: What teachers need to know (4-thed). Boston: Pearson Education, Inc.

Haladyna, T. M. (2004). Devoping and validating multiple Choice test items. New Jersey: Lawrence Erlbaum Associates, Inc

Suggested readings:

Adams, R.J. & Kho, Seik-Tom. (1996). Acer quest version 2.1. Camberwell, Victoria: The Australian Council for Instructional Research.</td></tr>
</table>

	Azwar, S (2013). *Penyusunan skala psikologi, edisi ke-2*. Yogyakarta: Pustaka Pelajar Offset. Azwar, S. (2013). *Tes pretasi: fungsi dan pengembangan pengukuran prestasi belajar, edisi ke-2.* Yogyakarta: Pustaka Pelajar Offset. Glencoe. (t.t.). *Performance assessment in the science classroom*. Professional Glencoe Science series. New York: McGraw-Hill. .Kemendikbud. (2013). *Model Penilian Pencapaian Kompetensi Peserta Didik* Sekolah *Menengah Pertama.* Jakarta: Direktotar Pembinaan SMP Ditjen Dikdas Kemendikbud Oriondo, L.L. & Dallo-Antonio, E.M. (1998). *Evaluation educational outcomes*. Manila: Rex Printing Compagny, inc. *Peraturan Menteri Pendidikan & Kebudaayaan Republik Indonesia Nomor 65 Tahun 2013 Standar Proses Pendidikan dasar dan Menengah.* *Peraturan Menteri Pendidikan & Kebudayaan Republik Indonesia Nomor 66 Tahun 2013 tentang Standar Penilaian Pendidikan.* *Peraturan Menteri Pendidikan & Kebudaayaan Republik Indonesia Nomor 69 Tahun 2013 tentang Kerangka Dasar dan Struktur Kurikulum Sekolah menengah Atas/Madrasah Aliyah.* Rezba, R.J. et al. (1995). *Learning and assessing science process skills*. 3rd ed. Iowa: Kendall/Hunt Publishing Company.

PLO and CO mapping

	Programme Learning Outcomes (PLO)														
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**PLO13**	**PLO14**	**PLO15**
CO1		√				√									
CO2							√								
CO3			√						√				√		
CO4										√					√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020

Lecturer

Dr. Das Salirawati, M.Si
NIP

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Chemical Spectroscopy**
Module level, if applicable:	Master
Code:	MPK8205
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	1
Module coordinator:	Prof. Drs. K.H. Sugijarto, M.Sc., Ph.D
Lecturer(s):	Prof. Drs. K.H. Sugijarto, M.Sc., Ph.D and Prof. Dr. Endang Wijayanti LFX
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate obedience and mutual respect in learning process CO2. explain the spectroscopy principle its types and terms CO3. understand spectroscopy implementation and its types CO4. interpret spectra and its types CO5. understand theory of orbital symmetry groups CO6. understand electronic transition
Content:	This course is a compulsory subject for graduate students of the Chemical Education Study Program which discusses symmetry, group theory: point-group representation, non-degenerate representation, matrix and degenerate representation, irreducible and reducible representation, direct products; symmetry of atomic orbitals in molecules. The relationship between molecular symmetry and rotational and

<table>
<tr><td></td><td>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. This course also entails discussion about the electronic spectrum of the first transition complex compound, d^1 - d^{10} and its applications in photoelectron spectroscopy and spin resonance spectroscopy.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:
<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3, CO4, CO5, CO6</td><td>a. Individual and group assignment
b. Participation
c. Mid-term exam
d. Final exam</td><td>Presentation /written test
Observation
Written test
Written test</td><td>40%
20%
20%
20%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, spectrum sheet, Molimot stick geometry model, stationery</td></tr>
<tr><td>References:</td><td>Handbooks:
McHale, J. L. 2017. Molecular Spectroscopy, Second Edition. CRC Press
Molloy, K. C. 2011. Group theory for chemists: fundamental theory and applications. Swastom: Woodhead Publishing Limited,
Atkins,.P. W.. 2006. Physical Chemistry. Mc. Graw Hill.
Stephanos, J.J. & Addison, A. W. 2017. Electrons, Atoms, and Molecules in Inorganic Chemistry: A Worked Examples Approach. London: Academic Press
Sugiyarto, K. H.. 2013. Aplikasi teori Grup. UNY Press.

Suggested readings:
Aaron M. Pejlovas Onur Oncer, Lu Kang Stephen G. Kukolich, 2016, Microwave spectrum and gas phase structure of maleimide, Journal of Molecular Spectroscopy, 316, 26-29</td></tr>
</table>

	N. A. Borisevich, I. V. Skornyakov, V. A. Khripach, G. B. Tolstorozhev, and V. N. Zhabinskii, 2007, Manifestation of Structure and Intermolecular Interaction of Biologically active Brassino steroids in Infrared Spectra , *Journal of Applied Spectroscopy*, Vol. 74, No. 5, 673-680 Arias, F., and Sagues, F., "Obtaining Russell-Saunders Terms" in Education in Chemistry,1990, May, pp.83-84 Hyde, K.E., "Methods for Obtaining Russell-Saunders Term Symbols for Electronic Configurations" in Journal of Chemical Education, 1975, 52, No.2, pp. 87-89 Kiremire, E.M.R., "A Numerical Algorithm Technique for Deriving Russell-Saunders (R-S) Terms" in Journal of Chemical Education, 1987, 64, No.11, pp. 951-953 Quinn, C.M., McKiernan, J.G., and Redmon, D.B., Journal of Chemical Education, 1984, July, Vol. 61, No. 7, p. 572 Vicente, J., "A Simple Method for Obtaining Russell-Saunders Term Symbols" in Journal of Chemical Education, 1983, 60, No.7, pp.560-561

PLO and CO mapping

	PLO													
	Attitude & Value				Work Ability					Knowledge Assignment				
	1	2	3	4	5	6	8	9	10	11	12	13	14	15
CO1	v	v												
CO2										v	v			
CO3											v			
CO4												v		
CO5													v	
CO6														v

PLO = Programme Study Learning Outcome
CO = Course Outcoming
Attitude and value = PLO 1 untill PLO 4

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Prof K.H. Sugiyarto, Ph.D
NIP

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Structure Elucidation of Organic Chemistry**
Module level, if applicable:	Master
Code:	MPK8207
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	2
Module coordinator:	Prof. Dr. Sri Atun
Lecturer(s):	Prof. Dr. Nurfina Aznam, SU. Apt. and Prof. Dr. Indyah Sulistyo Arty, M.Si.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate concern upon the chemical problems and appreciate people's discovery about analysis on inorganic compound structures CO2. demonstrate an ability to analyze basic concepts of spectroscopy namely UV-Vis, IR, 1H NMR, 13 CNMR, and MS to analyze inorganic compound structures comprehensively CO3. collaborate with peers to construct and confirm their understanding upon structure determination of organic compounds in chemical synthesis and isolation process CO4. develop logical, critical, systematic thinking in compiling ideas and opinions based on scientific rules responsibly, and communicate them
Content:	This course develops students' ability in Chemistry, especially non-education programs. This course demands an increase in student understanding of the basic concepts of UV

<table>
<tr><td></td><td>spectroscopy, IR, NMR, and MS analysis and expects the students to apply them to identify molecular structures of organic compounds. This understanding is achieved through the basic competencies of the materials which include basic concepts of spectroscopy in general, and basic concepts of spectroscopy UV-Vis, IR, 1H NMR, 13C NMR, and MS.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.

The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1,
CO2,
CO3,
CO4</td><td>a. Individual and group assignment
b. Participation
c. Mid-term exam
d. Final exam</td><td>Presentation /written test
Observation
Written test
Written test</td><td>40%

12%
18%
30%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>

Feinstein, K.(2018). Guide to Spectroscopic Identification of organic compounds. CRC Press

Lambert. J. B, (1998), Organic structural spectroscopy, Prentice Hall, New Jersey.

Pavia, D. L. et. al., (2010). Introduction to Spectroscopy, Brooks/Cole, US.

Silverstein, R. M., Webster, F. X., Kiemle, D.J. & Bryce, D. J. (2015). Spectrometric identification of organic compounds. New York: John, Wiley & Sons.

Sri Atun, 2016. Elusidasi struktur senyawa organic, Yogyakarta: UNY Press

</td></tr>
</table>

PLO and CO mapping

		Programme Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**PLO13**	**PLO14**	**PLO15**
Course Outcames	CO1	√	√													
	CO2			√	√				√		√		√		√	
	CO3									√						
	CO4						√	√				√		√		√

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Prof. Dr. Sri Atuni, M.Si
NIP

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Solution Chemistry and Analytical Electrochemistry**
Module level, if applicable:	Master
Code:	MPK8208
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	2
Module coordinator:	Prof. Dr. Suyanta, M.Si
Lecturer(s):	Prof. Dr. Suyanta, M.Si and Dr. Isana Supiah Yosephine Louise, M.Si
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. Appreciate one another during teaching and learning process CO2. understand the scope of solutions CO3. Understand the concepts of electrochemistry CO4. Apply electroanalytic chemistry within potentiometry and voltammetry
Content:	This course is a compulsory subject for graduate students of Chemical Education, which discusses the scope of solutions: solution composition, activity & activity coefficient, solution balance; electrochemistry; electrified interfaces, electrodes and electrochemical cells; and electroanalytic chemistry: potentiometry and voltammetry. In this lecture, theoretical concepts and practices of cation-anion analysis is discussed in the view of electrochemical analysis.

<table>
<tr>
<td>Study / exam achievements:</td>
<td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.
The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3, CO4</td><td>a. Individual and group assignment
b. Participation
c. Mid-term exam
d. Final exam</td><td>Presentation /written test
Observation
Written test
Written test</td><td>50%
10%
20%
20%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td>
</tr>
<tr>
<td>Forms of media:</td>
<td>Board, LCD projector, laptop/computer, stationery</td>
</tr>
<tr>
<td>References:</td>
<td>Handbooks:

Bagotsky, V. S (2006). Fundamentals of electrochemistry second edition. New Jersey: John Wiley & Sons Inc

Girault, H. H. (2004). Analytical and physical electrochemistry. Lausanne: EPFL Press

Hargis, L.G. (1988). Analytical Chemistry Principles and Techniques. New Jersey: Prentice-Hall, Inc

Hibbert, D.B. (1993). Introduction to Electrochemistry. London: The Macmillan Press Ltd

Skoog, D.A., West, D.M., and Holler, F.J. (1988). Fundamentals of Analytical Chemistry. Fifth Edition. New York: Saunders College Publishing

Zoski, C. G. (2007). Handbook of Electrochemistry. Amsterdam: Elsevier

Suggested readings:

Bockris, J.O'M., and Reddy, A.K.N. (1977). Modern Electrochemistry, Volume 1. New York: Plenum Press

Bockris, J.O'M., and Reddy, A.K.N. (1977). Modern Electrochemistry, Volume 2. New York: Plenum Press

Bockris, J.O'M., and Khan, S.U.M. (1993). Surface Electrochemistry: A Molecular Level Approach. New York: A Plenum Press

Gosser, D.K. (1993). Cyclic Voltammetry. New York: VCH Publisher

Wang, Yoseph. (2000). Analytical Electrochemistry. New York: John Wiley & Sons</td>
</tr>
</table>

PLO and CO mapping

		Learning Outcomes (PLO)														
		Attitude and Value				***Work Ability***						***Knowledge Assignment***			***Authority and Responsibility***	
		PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**PLO13**	**PLO14**	**PLO15**
CO	CO1		√		√											
	CO2	√						√				√				
	CO3									√						√
	CO4		√		√									√		

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Prof. Dr. Suyanta, M.Si
NIP

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Academic Writing**
Module level, if applicable:	Master
Code:	MPK8213
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	3
Module coordinator:	Prof. Drs. K.H. Sugijarto, M.Sc., Ph.D.
Lecturer(s):	Prof. Drs. K.H. Sugijarto, M.Sc., Ph.D.
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	100 minutes lectures and 120 minutes structured activities per week.
Workload:	Total workload is 90.67 hours per semester which consists of 100 minutes lectures, 120 minutes structured activities, and 120 minutes individual study per week for 16 weeks.
Credit points:	2 SKS (3 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. demonstrate good attitude in religious and humanistic aspects within scientific publication, e.g. avoiding plagiarism CO2. demonstrate an ability to analyze various perspectives on Chemistry education and examine the research objects well so as to be publishable and give impact for reserach on Chemistry education CO3. collaborate with their colleagues to map development and dynamic of Chemistry education CO4. develop logical, critical, systematic thinking to write a research-based article which is publishable and valid
Content:	This course includes a discussion about various types of international journals, publication fees, journal templates,

<table>
<tr><td></td><td>scopes of international journal, basic concepts of research problems, methodology, as well as results and discussions derived from the results of the research. This course aims to enable students to identify criteria, writing structures and costs for international journal publication, and train students to write scientifically by thinking critically, objectively and rationally. A piece of scientific writing should be always supported by scientific evidence that the data validity can be accounted for.</td></tr>
<tr><td>Study / exam achievements:</td><td>Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.

The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3, CO4</td><td>a. Individual and group assignment
b. Final exam</td><td>Presentation /written test
Written test</td><td>50%
50%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery</td></tr>
<tr><td>References:</td><td>
American Psychological Association. (2019). The Publication Manual of the American Psychological Association 7th edirion. Washington DC:. American Psychological Association.

Carter, S. Guerin , C. & Aitchison, C. (2020). Doctoral Writing: Practices, Processes and Pleasures. Singapore Springer

Jalongo, M. R. & Saracho, O. N. (2016). Writing for Publication Transitions and Tools that Support Scholars' Success. Springer International Publishing Switzerland.

Parija, S. C. & Kate. (2017). Writing and Publishing a Scientific Research Paper. Singapore: Springer

Triyono, M.B. (2017). Pedoman tesis dan disertasi. Kemenristek UNY. Yogyakarta.
</td></tr>
</table>

PLO and CO mapping

		Programme Learning Outcomes (PLO)														
		Attitude and Value				*Work Ability*						*Knowledge Assignment*			*Authority and Responsibility*	
		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15
Course Outcomes	**CO1**	√		√	√											
	CO2					√	√									
	CO3		√							√						
	CO4				V							√			√	

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si

Yogyakarta, Nov 2, 2020
Lecturer

Prof. Dr. K. H. Sugiyarto, Ph.D

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION
UNIVERSITAS NEGERI YOGYAKARTA
GRADUATE SCHOOL
MASTER OF EDUCATION IN CHEMISTRY
Colombo Street, No. 1, Karangmalang Campus, Yogyakarta 55281
Tel. +62274-550836 (front office), Fax. +62274-520326
Email: pps@uny.ac.id, humas_pps@uny.ac.id

MODULE HANDBOOK

Module name:	**Thesis**
Module level, if applicable:	Master
Code:	MPK8612
Sub-heading, if applicable:	-
Classes, if applicable:	-
Semester:	4
Module coordinator:	Prof. Dr. Hari Sutrisno, M.Si
Lecturer(s):	ALL academic staff of Graduate Program in Chemistry Education
Language:	Bahasa Indonesia
Classification within the curriculum:	Compulsory Course
Teaching format / class hours per week during the semester:	300 minute lecture in week 1 and 300 minute supervision per week starting from week 2
Workload:	Total workload is 272 hours per semester which consists of 300 minute lecture, supervision, and oral thesis defence
Credit points:	6 SKS (12 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	After taking this course, the students are expected to be able to: CO1. Demonstrate concern upon the rationality of a given problem, which could have an impact for wider community CO2. Demonstrate an ability to analyze research requirements to complete CO3. Collaborate with the supervisor during thesis completion period CO4. Develop logical, critical, systematic thinking on their conducted research CO5. Communicate effectively in a written and oral presentation, thinck critically, and perform good decision making
Content:	This course is compulsory for graduate students of Chemical Education study program, which serves as an evaluation upon students' progress and a way for preparing students to study an area in depth, after experiencing a series of learning processes. This course aims to encourage students to to think and write scientifically based on the selected research methods.
Study / exam achievements:	Attitude assessment is carried out at each meeting by observation and/or self-assessment techniques using the assumption that

<table>
<tr><td></td><td>basically every student has a good attitude. The student is marked very good or not good attitude if they show it significantly compared to other students in general. The result of attitude assessment is not taken into account in the final grades, but as one of the requirements to pass the course. Students will pass from this course if at least have a good attitude.

The final mark will be weight as follow:

<table>
<tr><th>No</th><th>CO</th><th>Assessment Object</th><th>Assessment Technique</th><th>Weight</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3, CO4, and CO5</td><td>a. Thesis writing

b. Oral thesis defense</td><td>Written piece
Presentation</td><td>60%

40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Forms of media:</td><td>Board, LCD projector, laptop/computer, stationery, handbooks for thesis and dissertation writing</td></tr>
<tr><td>References:</td><td>

American Psychological Association. (2019). The Publication Manual of the American Psychological Association 7th edirion. Washington DC:. American Psychological Association.

Carter, S. Guerin , C. & Aitchison, C. (2020). Doctoral Writing: Practices, Processes and Pleasures. Singapore Springer

Eco, U. 2015. How to Write a Thesis Massachusetts: Massachusetts: The MIT Press

Evans, D., Gruba, P. & Zobel, J. 2014. How to Write a Better Thesis. New York: Springer

Jalongo, M. R. & Saracho, O. N. (2016). Writing for Publication Transitions and Tools that Support Scholars' Success. Springer International Publishing Switzerland.

Parija, S. C. & Kate. (2017). Writing and Publishing a Scientific Research Paper. Singapore: Springer

Pequegnat, W., Stover, E., & Boyce, C. A. (Eds). 2011. How to Write a Successful Research Grant Application: A Guide for Social and Behavioral Scientists. second edition. New York: Springer.

</td></tr>
</table>

PLO and CO mapping

		Learning Outcomes (LO)														
		Attitude and Value				Work Ability						Knowledge Assignment			Authority and Responsibility	
		LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12	LO13	LO14	LO15
Course : MPK8612 - Thesis																
Course Outcames	CO1	√		√	√											
	CO2					√	√									
	CO3		√							√						
	CO4				V							√			√	
	CO5		√					√			√		√			

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	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	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	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.

Knowing,
Head of Study Program

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002

Yogyakarta, Nov 2, 2020
Lecturer

Prof. Dr. Hari Sutrisno, M.Si
NIP 196704071992031002