UNESA	**Universitas Negeri Surabaya** **Faculty of Mathematics and Natural Sciences** **Chemistry Masters Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Synthesis methods and design of bioactive compounds	4710203016		**T=3**	**P=0**	**ECTS=6.72**	1	July 21, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Prof. Dr. Suyatno, M.Si.	Prof. Dr. Suyatno, M.Si.	Prof. Dr. Nuniek Herdyastuti, M.Si.

Learning model	**Project Based Learning**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	Program Objectives (PO)	
	PO - 1	Explain the meaning, use and basis for designing the synthesis of organic compounds.
	PO - 2	Applying a synthesis strategy through disconnection of aromatic compounds.
	PO - 3	Implementing a synthesis strategy via carbon-heteroatom bond disconnection.
	PO - 4	Implementing a synthesis strategy via carbon-carbon bond disconnection.
	PO - 5	Applying synthesis strategies via bond disconnection in bifunctional compounds.
	PO - 6	Applying synthesis strategies via bond disconnection in cyclic compounds.
	PO - 7	Applying protecting groups in organic chemical synthesis reactions
	PO - 8	Explain chemoselective and stereoselective reactions in organic chemical synthesis.
	PO - 9	Review articles in journals related to the synthesis of bioactive compounds.
	PLO-PO Matrix	

P.O
PO-1
PO-2
PO-3
PO-4
PO-5
PO-6
PO-7
PO-8
PO-9

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																
PO-3																
PO-4																
PO-5																
PO-6																
PO-7																
PO-8																
PO-9																

Short Course Description	This course examines the basic principles of designing the synthesis of organic compounds using a disconnection approach, synthesis strategies through disconnection: aromatic compounds, carbon-heteroatom bonds, carbon-carbon bonds, bifunctional compounds and cyclic compounds, protecting groups, chemoselective and stereoselective reactions, applications of synthetic reactions in the synthesis of bioactive compounds.
References	**Main :**
	1. 1. Carruthers, W. & Coldam, I. (2004). Modern Methods of Organic Synthesis. 4th Ed. New York: Cambridge University Press. 2. 2. Michael B. Smith, M.B. & March, J. (2007). March's Advanced Organic Chemistry, Reaction, Mechanism, and Structure, 6th ed. New Jersey: Jonh Wiley and Son, Inc. 3. 3. Tukiran dan Suyatno (2018). Sintesis Kimia Organik. Surabaya: Unesa University Press. 4. Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.
	Supporters:
	1. Artikel jurnal yang terkait dengan sintesis senyawa bioaktif
Supporting lecturer	Prof. Dr. Suyatno, M.Si. Prof. Dr. Tukiran, M.Si. Dr. Ratih Dewi Saputri, S.Si., M.Si.

Week-	**Final abilities of each learning stage (Sub-PO)**	**Evaluation**		**Help Learning, Learning methods, Student Assignments, [Estimated time]**		**Learning materials [References]**	**Assessment Weight (%)**
		Indicator	**Criteria & Form**	**Offline (*offline*)**	**Online (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Describe the meaning of organic chemical synthesis.	1. Explain the meaning and use of organic chemical synthesis. 2. Explain the principles of organic chemical synthesis. 3. Explain the basic principles in designing synthetic organic compounds.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, questions and answers, problem solving, and assignment Model: case method 3 x 50 minutes		**Material:** 1. Understanding and use of organic chemical synthesis, 2. Principles of organic chemical synthesis, and 3. Basic principles in designing organic compound synthesis. **References:** *Tukiran and Suyatno (2018). Organic Chemical Synthesis. Surabaya: Unesa University Press.*	5%

2	Understand synthesis strategies through bond disconnection in aromatic compounds.	Applying a synthesis strategy through bond disconnection in aromatic compounds.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, questions and answers, problem solving, and assignment Model: case method' 3 x 50 minutes		**Material:** Synthesis strategy through bond disconnection in aromatic compounds **References:** *Tukiran and Suyatno (2018). Organic Chemical Synthesis. Surabaya: Unesa University Press.* **Material:** Synthesis strategy through bond disconnection in aromatic compounds **References:** *Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.*	5%
3	Understand synthesis strategies through bond disconnection in aromatic compounds.	Applying a synthesis strategy through bond disconnection in aromatic compounds.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, questions and answers, problem solving, and assignment Model: case method' 3 x 50 minutes		**Material:** Synthesis strategy through bond disconnection in aromatic compounds **References:** *Tukiran and Suyatno (2018). Organic Chemical Synthesis. Surabaya: Unesa University Press.* **Material:** Synthesis strategy through bond disconnection in aromatic compounds **References:** *Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.*	5%
4	Understand synthesis strategies through disconnection of carbon-heteroatom bonds and carbon-carbon bonds.	Applying synthesis strategies through disconnection of carbon-heteroatom and carbon-carbon bonds.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, questions and answers, problem solving, and assignment Model: case method 3 x 50 minutes		**Material:** Synthesis strategy through carbon-heteroatom bond disconnection. **References:** *1. Carruthers, W. & Coldam, I. (2004). Modern Methods of Organic Synthesis. 4th Ed. New York: Cambridge University Press.*	5%

5	Understand synthesis strategies through disconnection of carbon-heteroatom bonds and carbon-carbon bonds.	Applying synthesis strategies through disconnection of carbon-heteroatom and carbon-carbon bonds.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, questions and answers, problem solving, and assignment Model: case method 3 x 50 minutes		**Material:** Synthesis strategy through carbon-heteroatom bond disconnection. **References:** *1. Carruthers, W. & Coldam, I. (2004). Modern Methods of Organic Synthesis. 4th Ed. New York: Cambridge University Press.*	5%
6	Understand synthesis strategies through disconnection of compounds that have 2 functional groups (bifunctional): 1,2; 1.3; 1.4; 1.5 and 1.6.	Applying a synthesis strategy through disconnection of compounds that have 2 functional groups: 1,2; 1.3; 1.4; 1.5 and 1.6.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, questions and answers, problem solving, and assignment Model: case method 3 x 50 minutes		**Material:** compound disconnection that has 2 functional groups: 1,2; 1.3; 1.4; 1.5 and 1.6. **References:** *1. Carruthers, W. & Coldam, I. (2004). Modern Methods of Organic Synthesis. 4th Ed. New York: Cambridge University Press.*	5%
7	Understand synthesis strategies through disconnection of compounds that have 2 functional groups (bifunctional): 1,2; 1.3; 1.4; 1.5 and 1.6.	Applying a synthesis strategy through disconnection of compounds that have 2 functional groups: 1,2; 1.3; 1.4; 1.5 and 1.6.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, questions and answers, problem solving, and assignment Model: case method 3 x 50 minutes		**Material:** compound disconnection that has 2 functional groups: 1,2; 1.3; 1.4; 1.5 and 1.6. **References:** *Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.*	5%
8	Mid-Semester Exam to assess the achievement of Final Skills from TM 1 to 7	Sub-summative test, carried out once, assessing all relevant indicators through a written test (UTS) and given a weighting (2)	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities, Tests	Test 2 x 50 minutes		**Material:** all material 1-7 **References:** *1. Carruthers, W. & Coldam, I. (2004). Modern Methods of Organic Synthesis. 4th Ed. New York: Cambridge University Press.* **Material:** all materials 1-7 **References:** *Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.*	10%

9	Understand the synthesis strategy through disconnection of cyclic compounds that have rings 3,4,5 and 6.	Applying a synthesis strategy through disconnecting compounds that have rings 3, 4, 5 and 6.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	discussion, question and answer, problem solving, assignment Model: case method. 3 x 50 minutes		**Material:** Synthesis strategy through disconnection of cyclic compounds having rings 3,4,5 and 6. **References:** *3. Tukiran and Suyatno (2018). Organic Chemical Synthesis. Surabaya: Unesa University Press.* **Material:** Synthesis strategy through disconnection of cyclic compounds having rings 3,4,5 and 6. **References:** *Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.*	5%
10	Understand the synthesis strategy through disconnection of cyclic compounds that have rings 3,4,5 and 6.	Applying a synthesis strategy through disconnecting compounds that have rings 3, 4, 5 and 6.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	discussion, question and answer, problem solving, assignment Model: case method. 3 x 50 minutes		**Material:** Synthesis strategy through disconnection of cyclic compounds having rings 3,4,5 and 6. **References:** *3. Tukiran and Suyatno (2018). Organic Chemical Synthesis. Surabaya: Unesa University Press.* **Material:** Synthesis strategy through disconnection of cyclic compounds having rings 3,4,5 and 6. **References:** *Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.*	5%

11	Understand the meaning, selection of protective groups and their application in the synthesis of organic compounds.	1. Explain the meaning of protective groups. 2. Explain the selection of protective groups. 3. Applying protecting groups in organic synthesis.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Participatory Activities	Discussion, question and answer, problem solving, assignment Model: case method 3 x 50 minutes		**Material:** 1. Understanding protective groups and 2. Use of protective groups in organic synthesis. **References:** *3. Tukiran and Suyatno (2018). Organic Chemical Synthesis. Surabaya: Unesa University Press.*	5%
12	Understanding chemoselective and stereoselective in organic synthesis.	1. Explain chemoselectiveness in organic synthesis. 2. Explaining stereoselectivity in organic synthesis.	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, questions and answers, problem solving, assignments Model: Model: case method 3 x 50 minutes		**Material:** 1. Chemoselective in organic synthesis and 2. Stereoselective in organic synthesis. **References:** *Warren, S. & Wyatt, P. (2008). Organic Synthesis: the Disconnection Approach. 2nd Ed. London: John Wiley and Sons, Inc.*	5%
13	Able to review journal articles related to the synthesis of bioactive compounds.	Able to review journal articles related to the synthesis of bioactive compounds	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, question and answer, problem solving, assignment Model: Project based learning 3 x 50 minutes		**Material:** Review of bioactive compound synthesis articles in national and international journals. **Bibliography:** *Journal articles related to the synthesis of bioactive compounds*	10%
14	Able to review journal articles related to the synthesis of bioactive compounds.	Able to review journal articles related to the synthesis of bioactive compounds	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, question and answer, problem solving, assignment Model: Project based learning 3 x 50 minutes		**Material:** Review of bioactive compound synthesis articles in national and international journals. **Bibliography:** *Journal articles related to the synthesis of bioactive compounds*	10%
15	Able to review journal articles related to the synthesis of bioactive compounds.	Able to review journal articles related to the synthesis of bioactive compounds	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer. **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, question and answer, problem solving, assignment Model: Project based learning 3 x 50 minutes		**Material:** Review of bioactive compound synthesis articles in national and international journals. **Bibliography:** *Journal articles related to the synthesis of bioactive compounds*	10%

16	Final exams	Final exams	**Criteria:** 5 **Form of Assessment** : Test	Final Exam Semester 2 x 50 minutes		**Material:** all materials 9-15 **References:** *3. Tukiran and Suyatno (2018). Organic Chemical Synthesis. Surabaya: Unesa University Press.* **Material:** all material 9-15 **Bibliography:** *2. Michael B. Smith, MB & March, J. (2007). March's Advanced Organic Chemistry, Reaction, Mechanism, and Structure, 6th ed. New Jersey: Jonh Wiley and Son, Inc.*	5%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	52.5%
2.	Project Results Assessment / Product Assessment	37.5%
3.	Test	10%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.