						Document Code
	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences** **Biology Undergraduate Study Program**					

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Waste Management	4620102144	Study Program Elective Courses	**T=2**	**P=0**	**ECTS=3.18**	6	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Project Based Learning**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	PLO-6 — Able to apply logical, critical, systematic and innovative thinking in the context of developing or implementing science and/or technology according to their field of expertise.
	PLO-7 — Able to work independently and collaboratively, as well as responsibly, in completing various tasks in class, in the laboratory and in the field.
	Program Objectives (PO)
	PO - 1 — Able to apply Waste Management knowledge and technology to solve natural resource and environmental problems both in the laboratory and in real practice that supports profession and/or entrepreneurship
	PO - 2 — Able to design and conduct experiments in the field of Waste Management, manage, analyze, interpret, document and store research data, to manage biological natural resources
	PO - 3 — Able to apply transferable skills in Waste Management to develop ecopreneurship (ecoo-innovation, eco-opportunity, eco-commitment
	PO - 4 — Able to apply logical, critical, systematic and innovative thinking in the context of developing or implementing science and/or technology according to their field of expertise.
	PO - 5 — Able to work independently, responsibly, both as an individual and in a group, and able to work together
	PLO-PO Matrix

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

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																

Short Course Description	Study of the regulations that underlie waste management, types of waste, both solid, liquid and gas produced from human activities on a household, regional and industrial scale. Environmentally friendly management of solid (garbage) and liquid waste is studied using observation/field study methods, experiments, interviews and discussions. The material is presented in the form of theory and practice. The assessment activity ends with students' skills in communicating and concluding regional-scale waste planning and management models in a classical group discussion (FGD) forum.
References	**Main :**

1. Rouf, M.A, Islam, M.S., Rabeya, T., Mondal, A.K., Khanam, M., Samadder, P.R., and Ara, Y..2016.Biogas from slaughter house waste and optimization of the process. Bangladesh J. Sci. Ind. Res. 51(3) , 203-214, 2016
2. Fitihidajati, Herlina. Winarsih. 2017. Pengelolaan Limbah. Surabaya : Unesa University Press

Supporters:	

1. 1. Fitrihidajati, H. Ratnasari, E., Isnawati, Soeparno, G. 2014. Kualitas Hasil Fermentasi Pada Pembuatan Pakan Ternak Ruminansia Berbahan Baku Eceng Gondok (Eichornia crassipes). Biosaintifika : 7 (1) : 62-67
2. 2. Hieronymi Klaus, Ramzy Kahhat, Eric Williams. 2012. E-Waste Management From Waste to Resource. Routledge: London
3. 3. Rao M.N, Razia Sultana, Sri Harsha Kota. 2016. Solid and Hazardous Waste Management 1st Edition. Butterworth-Heinemann: Oxford
4. 4. UU Nomor 18 Tahun 2018 Tentang Sistem Pengolahan Sampah
5. 5. UU/32/2009 Tentang Perlindungan Dan Penggelolaan Hidup
6. 6. Fitrihidajati, H., Isnawati, Ratnasari, Evie.2013. Fermentasi Eceng Gondok Sebagai Pakan Ternak Ruminansia. Laporan Penelitian Hibah Bersaing . LPPM UNESA

Supporting lecturer	Dra. Herlina Fitrihidajati, M.Si. Dra. Winarsih, M.Kes.

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	Students can understand the definition, types and nature of waste	Understand laws and regulations regarding waste management Explain the definition of waste Determine the type of waste (liquid, solid/garbage, nature of waste) Explain how waste is processed Produce recycle production	**Criteria:** Written test, essay form. **Form of Assessment** : Participatory Activities		Lectures, Discussions 2 X 50	**Material:** • Definition of waste • Types and characteristics of waste • Waste processing (liquid, solid/garbage) • Recycling work results (economic value) **References:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press* **Material:** • Laws or regulations **Reference:** *5. UU/32/2009 concerning Protection and Management of Life* **Material:** • Laws or regulations **References:** *4. Law Number 18 of 2018 concerning Waste Management Systems*	2%

2	Students are able to make decisions based on observations about campus waste	Students can observe environmental conditions at Unesa (Ketintang and Lidah campuses) based on the UI Greenmetric instrument	**Criteria:** Attached **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, observations, interviews 2 X 50		**Material:** • Setting and Infrastructure (SI), Energy and Climate Change (EC), Waste (WS), Water (WR), Transportation (TR), Education (ED) **Bibliography:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press* **Material:** • Analysis of campus environmental conditions. **References:**	2%
3	Students are skilled at processing wet waste	• Students are able to explain 4 ways to process wet waste • Students can process waste in one of the 4 existing ways	**Criteria:** Attached **Form of Assessment** : Project Results Assessment / Product Assessment		Lectures, Discussions 2 x 50	**Material:** • How to process wet waste using the composting method • Liquid fertilizer/leachate • Methane gas • Biopori **Library:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	2%
4	Students are able to make decisions based on observations of environmental conditions in the Jambangan residential area	Students observe environmental conditions in the Jambangan residential area based on the Proklim instrument of the Ministry of Environment and Forestry/KLHK	**Criteria:** Attached **Form of Assessment** : Project Results Assessment / Product Assessment	Observation Interview Discussion 2 X 50		**Material:** • Controlling droughts, floods, landslides, • Increasing Food Security, • Controlling Climate-Related Diseases, • Solid and liquid waste management, Energy Saving, Preventing and managing forest, land and waste fires, Disaster Mitigation, Community Groups, and • Support Library sustainability **:**	5%

5	Students master theoretical concepts in the field of waste management, especially waste management and are able to formulate procedures for solving waste (garbage) problems	· Students present the results of field study observations on campus · Students present the results of field study observations in residential areas · Students present the results of article reviews	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation and discussion 2 X 50		**Material:** • Environmental conditions of the Unesa campus (SI, EC, WS, WR, TR, ED) • Environmental conditions of the Jambangan settlement (Proklim village) • Articles on the relevance of population and waste treatment, waste management models, minimization of increased waste management, zero waste strategy **Library :** *1. Fitrihidajati, H. Ratnasari, E., Isnawati, Soeparno, G. 2014. Quality of Fermentation Results in Making Ruminant Animal Feed Made from Water Hyacinth (Eichornia crassipes). Biosciences : 7 (1) : 62-67*	5%
6	Students create recycling works	Students are able to observe the physical and environmental conditions of wet waste processing. Students are able to make reports on the results of wet waste processing	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Observation, Discussion, Practicum 2 X 50		**Material:** • Condition of wet waste processing results • Data from observations **Literature:**	3%
7	Students are able to solve science and technology-based waste problems with a monodisciplinary approach	Students are able to present the results of processing wet waste. Students show the results of their dry waste recycling work	**Criteria:** Attached **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation and discussion 2 X 50 product display		**Material:** - **Library:**	6%
8	UTS	UTS	**Criteria:** UTS **Form of Assessment** : Project Results Assessment / Product Assessment, Test	UTS 2 X 50			20%

9	Students are skilled at processing water hyacinth waste	· Students explain the reasons for processing water hyacinth into animal feed · Students explain the principles of fermentation in processing water hyacinth weeds into animal feed. Students are independently able to prepare materials to process water hyacinth into animal feed through fermentation. Students are able to process water hyacinth into animal feed through fermentation Students are able to make a report about the results of water hyacinth fermentation. Students are able to communicate the results of making water hyacinth fermentation	**Criteria:** attached **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, Discussions, Assignments, presentations 2 X 50		**Material:** • Water hyacinth as a weed • Principles of water hyacinth fermentation • Water hyacinth fermentation procedures • Economic analysis of water hyacinth processing **References:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	5%
10	Students are skilled at processing water hyacinth waste	· Students explain the reasons for processing water hyacinth into animal feed · Students explain the principles of fermentation in processing water hyacinth weeds into animal feed. Students are independently able to prepare materials to process water hyacinth into animal feed through fermentation. Students are able to process water hyacinth into animal feed through fermentation Students are able to make a report about the results of water hyacinth fermentation. Students are able to communicate the results of making water hyacinth fermentation	**Criteria:** attached **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, Discussions, Assignments, presentations 2 X 50		**Material:** • Water hyacinth as a weed • Principles of water hyacinth fermentation • Water hyacinth fermentation procedures • Economic analysis of water hyacinth processing **References:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	5%

11	Students are skilled at processing water hyacinth waste	· Students explain the reasons for processing water hyacinth into animal feed · Students explain the principles of fermentation in processing water hyacinth weeds into animal feed. Students are independently able to prepare materials to process water hyacinth into animal feed through fermentation. Students are able to process water hyacinth into animal feed through fermentation Students are able to make a report about the results of water hyacinth fermentation. Students are able to communicate the results of making water hyacinth fermentation	**Criteria:** attached **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, Discussions, Assignments, presentations 2 X 50		**Material:** • Water hyacinth as a weed • Principles of water hyacinth fermentation • Water hyacinth fermentation procedures • Economic analysis of water hyacinth processing **References:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	0%
12	Students observe household-scale liquid waste processing installations	Students observe liquid waste processing installations/IPAL in people's homes	**Criteria:** attached **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, observation 2 X 50		**Material:** IPAL Method **Literature:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	5%
13	Students observe "Tahu" Home Industry liquid waste	Students observe the liquid waste disposal system of the Home Industry "Know" Students are able to conduct interviews	**Criteria:** attached	Observation, Discussion 2 X 50		**Material:** report on review of journals and textbooks Reader : *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	0%
14	Students conduct field studies on Waste Management in the Rungkut industry (SEER)	Students observe waste management installations. Students are able to make reports on observations of waste management installations at PT SIER	**Criteria:** attached **Form of Assessment** : Project Results Assessment / Product Assessment	Lecture Discussion Discussion 2 X 50		**Material:** • Waste management system • Journal review report. **Library:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	5%
15	Students are able to communicate the results of waste management at PT SIER	Students are able to present reports on the results of field studies on waste management at PT SIER	**Criteria:** attached **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion Presentation 2 X 50		**Material:** • PT SIER **Pustaka Waste Management:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press*	5%

| 16 | Final exams | | **Form of Assessment** : Project Results Assessment / Product Assessment, Test | | Written test 2 x 50 minutes | **Material:** Meeting material 9 - 15 **Reader:** *Fitihidajati, Herlina. Winarsih. 2017. Waste Management. Surabaya: Unesa University Press* | 30% |

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	11.5%
2.	Project Results Assessment / Product Assessment	63.5%
3.	Test	25%
		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.