	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Bachelor of Science Education Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Biotechnology	8420102026		T=2	P=0	ECTS=3.18	6	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Erman, M.Pd.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-5	Demonstrate scientific, critical, and innovative attitudes in integrated science learning, laboratory activities, and professional-related tasks
	PLO-11	Design and conduct research about learning of integrated science, and acquire, analyze, and interpret the research data
	Program Objectives (PO)	
	PO - 1	Students show and demonstrate logical, critical, systematic and innovative thinking in the context of developing or implementing science and technology in accordance with the field of biotechnology
	PLO-PO Matrix	

P.O	PLO-5	PLO-11
PO-1		

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																

Short Course Description	This course discusses the study and development of reasoning regarding the principles of biotechnology including fermentation biotechnology, industrial biotechnology, genetic engineering, primary metabolites, secondary metabolites, and tissue culture by integrating an entrepreneurial perspective. Lectures are carried out with modeling, presentations, discussions and practicums.	
References	**Main :**	

1. Agbon Eddy C., 2012. Innovations in Biotechnology . Washington DC: InTech.
2. Becker, M. J., Caldwell, G. A., Zachgo, E. A. 1996. Biotechnology: a Laboratory Course . 2nd Edition. New York: Academic Press.
3. Evans, Gareth M. AndJudith c. Furlong. 2003. Environmental Biotechnology Theory and Application. San Francisco: John Wiley & Sons Ltd.
4. Hidayat, N., Masdiana C. Pandaga dan Sri Suhartini. 2006. Mikrobiologi Industri. Yogyakarta: ANDI.
5. Peter, kolchinsky. 2004. Start up The Entrepreneur 19s Guide to A Biotech Startup . New York. Assobiotec.
6. Rai, R. V (Ed). 2016. Advances in Food Biotechnology . India: Wiley Blackwell.
7. Satyanarayana, T. and Gotthard Kunze. 2009. Yeast Biotechnology: Diversity and Applications. New York: Springer.

Supporters:	
Supporting lecturer	Dra. Evie Ratnasari, M.Si. Dr. Dyah Astriani, S.Pd., M.Pd. Dr. Hasan Subekti, S.Pd., M.Pd. dr. Sonny Soebjanto, Sp. T.H.T.K.L Aris Rudi Purnomo, S.Si., M.Pd., M.Sc. Fasih Bintang Ilhami, S.Kep., M.T., Ph.D.

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	Utilize ICT-assisted learning resources and learning media to explore data and collect information to support learning implementation. Mastering theoretical concepts of understanding	Explain the meaning of biotechnology	**Criteria:** 1. Score 3: Students help answer or add answers to questions from other students 2. Score 2: Students ask questions related to the subject being discussed 3. Score 1: Students listen to explanations during the learning process **Form of Assessment** : Participatory Activities	Presentation and discussion 2 X 50	-	**Material:** Definition and scope of biotechnology **References:** *William, JT, Micheal, AP, Palladino. 2014. Introduction to Biotechnology. Pearson New International Edition:United States of America* **Material:** Definition and scope of biotechnology **Reference:** *Agbon Eddy C., 2012. Innovations in Biotechnology. Washington DC: InTech* **Material:** Definition and scope of biotechnology **References:** *Becker, MJ, Caldwell, GA, Zachgo, EA 2005. Biotechnology: a Laboratory Course. 2nd Edition*	5%
2	Explain the meaning of biotechnology in the environmental and agricultural fields.	1. Explain the meaning of biotechnology in the environmental and agricultural fields. 2. Explains the methods used in environmental and agricultural biotechnology (covers the latest research that is being developed) 3. Explain the applications of environmental and agricultural biotechnology in everyday life.	**Criteria:** 1. Score 3: Students help answer or add answers to questions from other students 2. Score 2: Students ask questions related to the subject being discussed 3. Score 1: Students listen to explanations during the learning process **Form of Assessment** : Participatory Activities	Presentation and discussion 2 x 50	-	**Material:** Environmental Biotechnology **References:** *Evans, Gareth M. AndJudith c. Furlong. 2003. Environmental Biotechnology Theory and Application. San Francisco: John Wiley & Sons Ltd* **Material:** Agricultural Biotechnology **Reader:** *Arie Altman. 2017. Agriculture Biotechnology. New York: Marcel Dekker Inc.*	5%

3	1. Students can explore several case studies regarding problems in the scope of environmental and agricultural biotechnology 2. Students can be responsible for communicating the results of information and data analysis in writing (scientific articles/literature studies)	1. Find the latest reading ideas, discuss, and convey the results of the reading in the form of written scientific papers in the form of scientific articles/literature studies. 2. Know how to compose good and correct scientific writing.	**Criteria:** 1. Score 4: The writing results follow the rules of good and correct scientific writing and include the latest case study data (at least the last 10 years). 2. Score 3: The written results follow the rules of good and correct scientific writing and do not include recent case data (at least the last 10 years). 3. Score 2: The written results do not follow the rules of good and correct scientific writing and do not include recent case data (at least the last 10 years). 4. Score 1: Not compiling scientific articles/literature studies **Form of Assessment** : Portfolio Assessment	Discussion 2 x 50	-	**Material:** Find the latest reading ideas, discuss, and convey the results of the reading in the form of written scientific papers in the form of scientific articles/literature studies related to Environmental Biotechnology. **Library:** *Evans, Gareth M. AndJudith c. Furlong. 2003. Environmental Biotechnology Theory and Application. San Francisco: John Wiley & Sons Ltd* **Material:** Find the latest reading ideas, discuss, and convey the results of the reading in the form of written scientific papers in the form of scientific articles/literature studies related to Agricultural Biotechnology. **Library:** *Arie Altman. 2017. Agriculture Biotechnology. New York: Marcel Dekker Inc.*	10%
4	Students can provide information and data analysis results orally (presentation).	1. Find the latest reading ideas, discuss, and present the results of the discussion in the form of a group presentation. 2. Know how to present data and discussion results properly and correctly.	**Criteria:** 1. Score 4: Power point contains clear and interesting information and includes the latest case study data (at least the last 10 years). 2. Score 3: Power point contains clear and interesting information and does not include recent case data (at least the last 10 years). 3. Score 2: Power point does not contain clear and uninteresting information and does not include recent case data (at least the last 10 years). 4. Score 1: Did not prepare presentation material **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation and group discussion 2 x 50	-	**Material:** Presentation and discussion related to articles obtained **by the Library:**	10%

5	1. Utilize ICT-assisted learning resources and learning media to explore data and collect information to support learning implementation. 2. Mastering the theoretical concepts of food biotechnology.	1. Students are able to explain the meaning of food biotechnology. 2. Students are able to explain the methods used in food biotechnology (covering the latest research that is being developed).	**Criteria:** 1. Score 3: Students help answer or add answers to questions from other students 2. Score 2: Students ask questions related to the subject being discussed 3. Score 1: Students listen to explanations during the learning process **Form of Assessment** : Participatory Activities	Presentation and discussion 2 x 50	-	**Material:** Definition and Scope of Food Biotechnology **Reference:** *Rai, R. V (Ed). 2016. Advances in Food Biotechnology. India: Wiley Blackwell* **Material:** Definition and Scope of Food Biotechnology **References:** *Satyanarayana, T. and Gotthard Kunze. 2009. Yeast Biotechnology: Diversity and Applications. New York: Springer*	5%
6	Students can understand and be able to carry out practical work on tape making	Students are able to carry out tape-making experiments using easily found materials while still paying attention to potential taste and texture.	**Criteria:** 1. Score 2: Students are able to follow and repeat the practical steps demonstrated without help 2. Score 1: Students are able to follow and repeat the practical steps demonstrated with assistance **Form of Assessment** : Practical Assessment	Students carry out a practice in making tape by using materials that are easy to find while still paying attention to potential taste and texture. 2 x 50	-		5%
7	Students are able to present the results of experiments on making tape using materials that are easily found while still paying attention to potential taste and texture.	Students are able to present the results of experiments on making tape using materials that are easily found while still paying attention to potential taste and texture.	**Criteria:** 1. Score 4: Power point contains clear and interesting information and provides a summary of activities during the practicum process. 2. Score 3: Power point contains clear and interesting information and does not provide a summary of activities during the practicum process. 3. Score 2: Power point does not contain clear and uninteresting information and does not provide a summary of activities during the practicum process. 4. Score 1: Did not prepare presentation material **Form of Assessment** : Participatory Activities, Practice/Performance	Presentation and discussion 2 x 50	-		5%
8	UTS	Meetings 1 to 7	**Criteria:** Meetings 1 to 7	-			0%

9	1. Utilize ICT-assisted learning resources and learning media to explore data and collect information to support learning implementation. 2. Mastering the theoretical concepts of biotechnology and bioinformatics in the health sector.	1. Students are able to explain the meaning and scope of health biotechnology. 2. Students are able to explain the methods used in the scope of health biotechnology (can contain the latest research) including: gene therapy, stem cells, vaccine production 3. Students are able to explain Bioinformatics within the scope of health biotechnology	**Criteria:** 1. Score 3: Students help answer or add answers to questions from other students 2. Score 2: Students ask questions related to the subject being discussed 3. Score 1: Students listen to explanations during the learning process **Form of Assessment** : Participatory Activities	Presentation and discussion 2 x 50		**Material:** Biotechnology in the Health Scope **References:** *Emily, PW, Ronald, E., Narahari, SP 2014. Vaccine Development and Manufacturing. Wiley* **Material:** Biotechnology in the Scope of Health (Vaccines) **References:** *Tarun, B., Surendra, N. 2021. The Design and Development of Novel Drugs and Vaccines. Elsevier* **Material:** Biotechnology in the Scope of Health (Vaccines) **References:** *Rebecca, S. 2018. Fundamentals of Biological Regulation: Vaccines and Biotechnology Medicines. Elsevier*	5%

10	1. Utilize ICT-assisted learning resources and learning media to explore data and collect information to support learning implementation 2. Mastering the theoretical concepts of using biotechnology in the health sector in the process of making Nano Medicine and Vaccines.	1. Utilize ICT-assisted learning resources and learning media to explore data and collect information to support learning implementation. 2. Mastering the theoretical concepts of using biotechnology in the health sector in the process of making Nano Medicine and Vaccines.	**Criteria:** 1. Score 3: Students help answer or add answers to questions from other students 2. Score 2: Students ask questions related to the subject being discussed 3. Score 1: Students listen to explanations during the learning process **Form of Assessment** : Participatory Activities	Presentation and discussion 2 x 50		**Material:** Biotechnology in the Health Scope (Manufacture of Nanomedicine and Vaccines) **References:** *Emily, PW, Ronald, E., Narahari, SP 2014. Vaccine Development and Manufacturing. Wiley* **Material:** Biotechnology in the Health Scope (Manufacture of Nano Medicine and Vaccines) **References:** *Tarun, B., Surendra, N. 2021. The Design and Development of Novel Drugs and Vaccines. Elsevier* **Material:** Biotechnology in the Health Scope (Manufacture of Nanomedicine and Vaccines) **References:** *Rebecca, S. 2018. Fundamentals of Biological Regulation: Vaccines and Biotechnology Medicines. Elsevier* **Material:** Biotechnology in the Health Scope (Manufacture of Nanomedicine and Vaccines) **References:** *Christine, M., Anja van de, S., Bernard, R., Hans. C 2021. Stem Cell 3rd Edition. Elsevier* **Material:** Biotechnology in the Health Scope (Manufacture of Nanomedicine and Vaccines) **References:** *Jonatan, M, W, S. 2018. The Science Stem Cells. Wiley* **Material:** Biotechnology in the Health Scope (Manufacture of Nanomedicine and Vaccines) **References:** *Adam, CB, Sarah, HB, Steve, O. 2014. Stem Cells Therapies. Elsevier*	5%

11	Responsible for informing the results of information and data analysis in writing (scientific articles/literature studies).	Students can explore several case studies regarding problems in the scope of health biotechnology.	**Criteria:** 1. Score 4: The writing results follow the rules of good and correct scientific writing and include the latest case study data (at least the last 10 years). 2. Score 3: The written results follow the rules of good and correct scientific writing and do not include recent case data (at least the last 10 years). 3. Score 2: The written results do not follow the rules of good and correct scientific writing and do not include recent case data (at least the last 10 years). 4. Score 1: Not compiling scientific articles/literature studies **Form of Assessment** : Project Results Assessment / Product Assessment	Writing scientific papers 2 x 50			10%
12	Students can explore several case studies regarding problems in the scope of health biotechnology.	Students can explore several case studies regarding problems in the scope of health biotechnology.	**Criteria:** 1. Score 4: Power point contains clear and interesting information and includes the latest case study data (at least the last 10 years). 2. Score 3: Power point contains clear and interesting information and does not include recent case data (at least the last 10 years). 3. Score 2: Power point does not contain clear and uninteresting information and does not include recent case data (at least the last 10 years). 4. Score 1: Did not prepare presentation material **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation and discussion 2 x 50			10%
13		Students are able to carry out experiments on making VCO and simple DNA isolation techniques	**Criteria:** Score 2: Students are able to follow and repeat the practical steps demonstrated without help **Form of Assessment** : Practical Assessment	Practical 2 x 50			10%

14	Students are able to present the results of experiments on making VCO and simple DNA isolation techniques	Students are able to present the results of experiments on making VCO and simple DNA isolation techniques	**Criteria:** 1. Score 4: Power point contains clear and interesting information and provides a summary of activities during the practicum process 2. Score 3: Power point contains clear and interesting information and does not provide a summary of activities during the practicum process. 3. Score 2: Power point does not contain clear and uninteresting information and does not provide a summary of activities during the practicum process. 4. Score 1: Did not prepare presentation material **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation and discussion 2 x 50			10%
15	Utilize ICT-assisted learning resources and learning media to explore data and collect information to support learning implementation.	1. Explain the meaning of Bioethics. 2. Explaining Bioethics on biotechnology topics or issues and their potential impact on society (discussion of socioscientific issues, such as problems in genetic engineering).	**Criteria:** 1. Score 3: Students help answer or add answers to questions from other students 2. Score 2: Students ask questions related to the subject being discussed 3. Score 1: Students listen to explanations during the learning process **Form of Assessment** : Participatory Activities	Presentation and discussion 2 x 50		**Material:** Bioethics **References:** *Jonatan, M, W, S. 2018. The Science Stem Cells. Wiley* **Material:** Bioethics **References:** *Adam, CB, Sarah, HB, Steve, O. 2014. Stem Cells Therapies. Elsevier*	5%
16	UAS						0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	47.5%
2.	Project Results Assessment / Product Assessment	25%
3.	Portfolio Assessment	10%
4.	Practical Assessment	15%
5.	Practice / Performance	2.5%
		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** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities 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.