



**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
Enzymology	4710202023	Study Program Elective Courses	T=2 P=0 ECTS=4.48	1	July 17, 2024
AUTHORIZATION	SP Developer		Course Cluster Coordinator		Study Program Coordinator
	Dr. Prima wikandari, M.Si		Prof.Dr.Rudiana Agustini, M.Pd		Prof. Dr. Nuniek Herdyastuti, M.Si.

Learning model	Case Studies
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Program Learning Outcomes (PLO)	PLO study program that is charged to the course
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Program Learning Outcomes (PLO)	Program Objectives (PO)
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PO - 1	CLO 1 Have basic knowledge about enzymes, catalysis reactions, production and determination of enzyme activity and their use in the environment, health and product development.
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PO - 2	Able to solve environmental problems, product development technology and health diagnosis through an enzymology approach that is beneficial to society and science
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PO - 3	Demonstrate an attitude of working together in a team and be responsible for their work to achieve teamwork
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Program Learning Outcomes (PLO)	PLO-PO Matrix
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	<table border="1" style="margin: auto;"> <tr><td>P.O</td></tr> <tr><td>PO-1</td></tr> <tr><td>PO-2</td></tr> <tr><td>PO-3</td></tr> </table>	P.O	PO-1	PO-2	PO-3
P.O					
PO-1					
PO-2					
PO-3					

Program Learning Outcomes (PLO)	PO Matrix at the end of each learning stage (Sub-PO)
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	<table border="1" style="margin: auto;"> <thead> <tr> <th rowspan="2">P.O</th> <th colspan="16">Week</th> </tr> <tr> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th> </tr> </thead> <tbody> <tr> <td>PO-1</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-2</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-3</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>	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																
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Short Course Description	Brief Description: MK Enzymology is a course that includes knowledge about the basic theory of enzymes, catalysis mechanisms, screening, separation and purification of enzymes, determining enzyme activity and the application of enzymes in the environment, food industry and health.
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References	<p><b>Main :</b></p> <ol style="list-style-type: none"> <li>Palmer, T., Bonner, P., (2011). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, Second Edition. Wood Publishing, New Delhi</li> <li>Copeland, R. A. (2000). Enzymes: a practical introduction to structure, mechanism, and data analysis. John Wiley &amp; Sons.</li> <li>Brahmachari, G., Demain, A. L., &amp; Adrio, J. L. (Eds.). (2016). Biotechnology of microbial enzymes: production, biocatalysis and Industrial applications. Academic Press.</li> <li>Liu, X., &amp; Kokare, C. (2023). Microbial enzymes of use in industry. In Biotechnology of microbial enzymes (pp. 405-444). Academic Press.</li> </ol> <p><b>Supporters:</b></p>
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Supporting lecturer		Prof. Dr. Hj. Rudiana Agustini, M.Pd. Dr. Prima Retno Wikandari, 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	Able to explain the basic theory of enzymes (structure and function, classification and nomenclature and molecular biology)	1.Be able to explain the structure and function of enzymes 2.Be able to explain the classification of enzymes 3.Able to explain nomenclature 4.Able to explain the molecular biology of enzymes	<b>Criteria:</b> Writing test  <b>Form of Assessment :</b> Participatory Activities		2 x 50 minute discussions	<b>Material:</b> Structure and function of enzymes, classification, nomenclature, molecular biology of enzymes  <b>References:</b> <i>Palmer, T., Bonner, P., (2011). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, Second Edition. Wood Publishing, New Delhi</i>  <hr/> <b>Material:</b> Structure and function of enzymes, classification, nomenclature, molecular biology of enzymes.  <b>Reference:</b> <i>Copeland, RA (2000). Enzymes: a practical introduction to structure, mechanisms, and data analysis. John Wiley &amp; Sons.</i>	5%

2	Able to explain the basic theory of enzymes (structure and function, classification and nomenclature and molecular biology)	<ol style="list-style-type: none"> <li>1. Be able to explain the structure and function of enzymes</li> <li>2. Be able to explain the classification of enzymes</li> <li>3. Able to explain nomenclature</li> <li>4. Able to explain the molecular biology of enzymes</li> </ol>	<p><b>Criteria:</b> Writing test</p> <p><b>Form of Assessment :</b> Participatory Activities</p>		2 x 50 minute discussions	<p><b>Material:</b> Structure and function of enzymes, classification, nomenclature, molecular biology of enzymes</p> <p><b>References:</b> <i>Palmer, T., Bonner, P., (2011). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, Second Edition. Wood Publishing, New Delhi</i></p> <hr/> <p><b>Material:</b> Structure and function of enzymes, classification, nomenclature, molecular biology of enzymes.</p> <p><b>Reference:</b> <i>Copeland, RA (2000). Enzymes: a practical introduction to structure, mechanisms, and data analysis. John Wiley &amp; Sons.</i></p>	5%
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3		Writing test	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.1. Be able to explain the factors that influence catalysis activity</li> <li>2.2. Able to understand the definition of enzyme activity units</li> <li>3.3. Be able to explain the principles of measuring enzyme activity</li> </ol> <p><b>Form of Assessment</b> : Participatory Activities</p>		Discussion, Case Study 2x50 minutes	<p><b>Material:</b> Factors that influence catalysis activity; enzyme activity units, principles of measuring enzyme activity.</p> <p><b>Reference:</b> <i>Palmer, T., Bonner, P., (2011). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, Second Edition. Wood Publishing, New Delhi</i></p> <hr/> <p><b>Material:</b> Factors that influence catalysis activity; enzyme activity units, principles of measuring enzyme activity.</p> <p><b>Reference:</b> <i>Copeland, RA (2000). Enzymes: a practical introduction to structure, mechanisms, and data analysis. John Wiley &amp; Sons.</i></p>	0%
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4		Writing test	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.1. Be able to explain the factors that influence catalysis activity</li> <li>2.2. Able to understand the definition of enzyme activity units</li> <li>3.3. Be able to explain the principles of measuring enzyme activity</li> </ol> <p><b>Form of Assessment</b> : Participatory Activities</p>		Discussion, Case Study 2x50 minutes	<p><b>Material:</b> Factors that influence catalysis activity; enzyme activity units, principles of measuring enzyme activity.</p> <p><b>Reference:</b> <i>Palmer, T., Bonner, P., (2011). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, Second Edition. Wood Publishing, New Delhi</i></p> <hr/> <p><b>Material:</b> Factors that influence catalysis activity; enzyme activity units, principles of measuring enzyme activity.</p> <p><b>Reference:</b> <i>Copeland, RA (2000). Enzymes: a practical introduction to structure, mechanisms, and data analysis. John Wiley &amp; Sons.</i></p>	0%
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5	Able to understand the production, separation and purification of enzymes	Writing test	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.1. Be able to explain the principles of enzyme production by microbes</li> <li>2.2. Be able to explain the principles of isolation and purification</li> <li>3.3. Be able to explain enzyme immobilization</li> </ol> <p><b>Form of Assessment :</b> Participatory Activities, Portfolio Assessment</p>		Discussion, case study 2 x 50 minutes	<p><b>Material:</b> Principles of enzyme production by microbes; isolation and purification; enzyme immobilization</p> <p><b>References:</b> <i>Brahmachari, G., Demain, AL, &amp; Adrio, JL (Eds.). (2016). Biotechnology of microbial enzymes: production, biocatalysis and Industrial applications. Academic Press.</i></p> <hr/> <p><b>Material:</b> Principles of enzyme production by microbes; isolation and purification; immobilization of enzymes</p> <p><b>References:</b> <i>Liu, X., &amp; Kokare, C. (2023). Microbial enzymes of use in industry. In Biotechnology of microbial enzymes (pp. 405-444). Academic Press.</i></p>	0%
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6	Able to understand the production, separation and purification of enzymes	Writing test	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.1. Be able to explain the principles of enzyme production by microbes</li> <li>2.2. Be able to explain the principles of isolation and purification</li> <li>3.3. Be able to explain enzyme immobilization</li> </ol> <p><b>Form of Assessment :</b> Participatory Activities, Portfolio Assessment</p>		Discussion, case study 2 x 50 minutes	<p><b>Material:</b> Principles of enzyme production by microbes; isolation and purification; enzyme immobilization</p> <p><b>References:</b> <i>Brahmachari, G., Demain, AL, &amp; Adrio, JL (Eds.). (2016). Biotechnology of microbial enzymes: production, biocatalysis and Industrial applications. Academic Press.</i></p> <hr/> <p><b>Material:</b> Principles of enzyme production by microbes; isolation and purification; immobilization of enzymes</p> <p><b>References:</b> <i>Liu, X., &amp; Kokare, C. (2023). Microbial enzymes of use in industry. In Biotechnology of microbial enzymes (pp. 405-444). Academic Press.</i></p>	0%
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7		Writing test	<p><b>Criteria:</b></p> <p>1.1. Be able to explain enzyme screening</p> <p>2.2. Be able to explain the stages of enzyme technology</p> <p><b>Form of Assessment :</b></p> <p>Participatory Activities, Portfolio Assessment</p>		Discussion, case study 2 x 50 minutes	<p><b>Material:</b></p> <p>Enzyme screening, enzyme technology</p> <p><b>References:</b></p> <p><i>Palmer, T., Bonner, P., (2011). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, Second Edition. Wood Publishing, New Delhi</i></p> <hr/> <p><b>Material:</b></p> <p>Enzyme screening, enzyme technology</p> <p><b>References:</b></p> <p><i>Brahmachari, G., Demain, AL, &amp; Adrio, JL (Eds.). (2016). Biotechnology of microbial enzymes: production, biocatalysis and Industrial applications. Academic Press.</i></p> <hr/> <p><b>Material:</b></p> <p>Enzyme screening, enzyme technology</p> <p><b>References:</b></p> <p><i>Liu, X., &amp; Kokare, C. (2023). Microbial enzymes of use in industry. In Biotechnology of microbial enzymes (pp. 405-444). Academic Press.</i></p>	0%
8							0%
9							0%
10							0%
11							0%
12							0%
13							0%
14							0%
15							0%
16							0%



No	Evaluation	Percentage
1.	Participatory Activities	10%
		10%

#### 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.