	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
Advanced Biochemistry	4710202025		T=2	P=0	ECTS=4.48	2	July 17, 2024

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

Learning model	**Project Based Learning**
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

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

Short Course Description	This course explains the study of techniques used in Biochemical research such as isolation of enzymes, proteins and DNA from various sources, purification and characterization of proteins, enzymes and DNA
References	**Main :**

1. Brown, T.A., 1989, Genetics : A Molecular Approach, London : Van Nostrand Reinhold (International) Co. Ltd.
2. Bollag D. 1996. Protein Method . New York: John Willey and Sons. Inc
3. Boyer R, 2000 . Modern Experimental Biochemistry . San Francisco: Addison Wesley Longman
4. Glick,B.R.,and Pasternak, J.J.,1994, Molecular Biotechnology : Principles and Application of Recombinant DNA, Washington, D.C : ASM Press.
5. Alexander R.R. and Griffiths J.M., 1993, Basic Biochemical Methods, New York : John Willey and Sons. Inc

Supporters:	
Supporting lecturer	Prof. Dr. Hj. Rudiana Agustini, M.Pd. Prof. Dr. Nuniek Herdyastuti, 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 understand the nature of proteins and environmental factors that can influence the results of protein or enzyme isolation	1. Explain the basic properties of proteins 2. Explain buffer solutions and how to make them 3. Explain how to store proteins with buffer solutions 4. Give several examples of salts and metal ions and their effects on proteins 5. Define detergent compounds and explain the effect of detergents on proteins or enzymes 6. Explain the effect of surface, temperature and storage on proteins or enzymes 7. Explain the effect of proteases on proteins and enzymes 8. Explain methods to overcome the presence of proteases	**Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture, discussion, question and answer 2 X 50		**Material:** protein properties and environmental factors that can influence the results of protein or enzyme isolation. **Reference:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	5%
2	Able to understand protein or enzyme isolation techniques, protein identification and concentration	1. Explain the types of cells as a source of protein 2. Able to differentiate between extracellular and intracellular proteins or enzymes 3. Able to choose techniques for breaking down proteins or enzymes whether physical, chemical or enzymatic 4. Able to explain protein concentration techniques and their stages 5. Able explain the basic principles of the dialysis process	**Criteria:** Oral test **Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture, discussion, question and answer 2 X 50		**Material:** protein or enzyme isolation techniques, protein identification and concentration. **Reference:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	5%
3	Able to determine protein concentration or enzyme activity as well as enzyme kinetics	1. Able to explain the basic principles of determining protein concentration using several methods (Bradford, Lowry, BCA) 2. Able to calculate protein concentration using a standard curve 3. Able to determine the method used to calculate the activity of isolated enzymes 4. Able to determine the kinetics of isolated enzymes	**Criteria:** Oral test **Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture, and 2 X 50 case studies		**Material:** Determination of protein concentration or enzyme activity and enzyme kinetics **Reference:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	7%
4	Able to understand the technique of determining molecular weight using SDS-PAGE (Sodium Dodecyl Sulphate - polyacrylamide gel electrophoresis)	1. Able to explain the mechanism of SDS-PAGE 2. Able to explain the stages in the SDS-PAGE process 3. Able to choose the gel concentration and explain how to make it 4. Able to explain the sample preparation and running process 5. Able to choose the type of staining gel used with Comassie blue or silver nitrate 6. Able to determine the molecular weight of proteins or enzymes using SDS-PAGE	**Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture and PJBL Student assignment: make an assignment in the form of a video about determining molecular weight using SDS-PAGE 2 X 50		**Material:** technique for determining molecular weight using SDS-PAGE (Sodium Dodecyl Sulphate - polyacrylamide gel electrophoresis) **References:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	5%

5	Able to understand protein or enzyme purification methods	1. Be able to differentiate crude extracts of protein/enzymes from pure proteins/enzymes 2. Explain several ways to purify proteins or enzymes 3. Explain the immunoblotting method 4. Explain the purification of proteins or enzymes using the ion exchange chromatography method 5. Explain the purification of proteins or enzymes using the method gel filtration 6. Explain the purification of proteins or enzymes using the affinity chromatography method	**Criteria:** Oral test **Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture, and 2 X 50 case studies		**Material:** protein or enzyme purification methods **Reference:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	7%
6	Able to master concepts regarding isolation, characterization and application of proteins or enzymes based on relevant articles	Able to analyze concepts regarding isolation, characterization and application of proteins or enzymes based on relevant articles	**Form of Assessment** : Participatory Activities	Form: lecture Method: 2 X 50 case study		**Material:** isolation, characterization and application of proteins or enzymes based on relevant articles **References:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	7%
7	Able to master concepts regarding isolation, characterization and application of proteins or enzymes based on relevant articles	Able to analyze concepts regarding isolation, characterization and application of proteins or enzymes based on relevant articles	**Form of Assessment** : Project Results Assessment / Product Assessment	Form: lecture Method: 2 X 50 case study		**Material:** isolation, characterization and application of proteins or enzymes based on relevant articles **References:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	8%
8	Midterm Evaluation/Midterm Exam		**Form of Assessment** : Test	Offline 2 X 50			10%
9	Able to understand the nature of DNA and environmental factors that can influence DNA isolation results	1. Explain the basic properties of DNA 2. Explain environmental factors that can influence DNA isolation results 3. Explain how to store DNA 4. Explain the relevance of DNA isolation	**Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture, discussion, question and answer Student assignment: DNA properties and environmental factors that can influence the results of DNA isolation 2 X 50		**Material:** DNA properties and environmental factors that can influence DNA isolation results. **References:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press.*	5%

10	Able to understand cell breakdown techniques to obtain DNA from various sources and concentration	1. Explain the types of cells as sources of DNA 2. Explain cell breakdown techniques 3. Describe the stages of DNA concentration	**Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture, discussion, question and answer 2 X 50		**Material:** cell breaking techniques to obtain DNA from various sources and concentration. **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	8%
11	Able to understand isolation DNA identification techniques and purification processes	1. Describe the identification of isolated DNA 2. Explain DNA identification techniques (spectrophotometer l = 260 nm and nano drop) 3. Determine the concentration of DNA 4. Explain DNA purification techniques 5. Explain the method for storing isolated DNA	**Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture, discussion, question and answer 2 X 50		**Material:** isolation DNA identification techniques and purification process. **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	10%
12	Able to understand the technique of separating and determining the size of DNA using electrophoresis	1. Explain the mechanism and stages of electrophoresis for DNA 2. Explain the materials and equipment needed for DNA electrophoresis 3. Explain how to make a gel and types of gel concentration 4. Explain the preparation and method of running samples on a gel 5. Explain how to stain DNA electrophoresis 6. Explain how to identify electrophoresis results 7. Explain several examples of DNA sizes from various sources 8. Determine DNA size using the linear regression equation	**Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture and PJBL 2 X 50		**Material:** technique for separating and determining the size of DNA using electrophoresis. **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	7%
13	Able to understand the technique of separating and determining the size of DNA using electrophoresis	1. Explain the mechanism and stages of electrophoresis for DNA 2. Explain the materials and equipment needed for DNA electrophoresis 3. Explain how to make a gel and types of gel concentration 4. Explain the preparation and method of running samples on a gel 5. Explain how to stain DNA electrophoresis 6. Explain how to identify electrophoresis results 7. Explain several examples of DNA sizes from various sources 8. Determine DNA size using the linear regression equation	**Form of Assessment** : Participatory Activities	Form: lecture Method: Lecture and PJBL 2 X 50		**Material:** technique for separating and determining the size of DNA using electrophoresis. **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	6%

14	Able to master concepts regarding isolation, characterization and application of DNA based on relevant articles	Able to analyze concepts regarding isolation, characterization and application of proteins or enzymes based on relevant articles	**Form of Assessment** : Participatory Activities	Form: lecture Method: 2 X 50 case study		**Material:** isolation, characterization and application of DNA based on relevant articles. **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	0%
15	Able to master concepts regarding isolation, characterization and application of DNA based on relevant articles	Able to analyze concepts regarding isolation, characterization and application of proteins or enzymes based on relevant articles	**Form of Assessment** : Project Results Assessment / Product Assessment	Form: lecture Method: 2 X 50 case study		**Material:** isolation, characterization and application of DNA based on relevant articles **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	0%
16			**Form of Assessment** : Project Results Assessment / Product Assessment	offline			10%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	72%
2.	Project Results Assessment / Product Assessment	18%
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.