	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
Characterization of Bioactive Compounds	4710202052	Study Program Elective Courses	T=2	P=0	ECTS=4.48	2	January 28, 2023

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

Learning model	**Case Studies**

Program Learning Outcomes (PLO)

PLO study program that is charged to the course

Program Objectives (PO)

PO - 1	Master theoretical concepts about techniques or methods that underlie biochemical research such as isolation of enzymes, proteins and DNA from various sources, purification and characterization of proteins, enzymes and DNA
PO - 2	Able to solve scientific and technological problems in the field of biochemistry and have skills in isolating and identifying enzymes, proteins and DNA from various sources as well as applying relevant technology
PO - 3	Able to determine isolation, identification and characterization techniques for proteins, enzymes and DNA that will be determined in several cases

PLO-PO Matrix

P.O
PO-1
PO-2
PO-3

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																

Short Course Description	This course explains the study of techniques used in biochemical research such as the isolation of enzymes, proteins, carbohydrates, lipids and DNA from various sources, their purification and characterization.

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	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.Mention several examples of salts and metal ions and their effects on proteins 5.5. 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	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Participatory Activities		Discussion and questions and answers	**Material:** Properties of proteins 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*	0%
2	understand protein or enzyme isolation techniques, protein identification and concentration	1.Explain the types of cells as sources of protein 2.Able to differentiate between extracellular and intracellular proteins or enzymes 3.Able to choose protein or enzyme breakdown techniques whether physical, chemical or enzymatic 4.Able to explain protein concentration techniques and their stages 5.Able to explain the basic principles of the dialysis process	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Participatory Activities		Presentation and discussion	**Material:** protein or enzyme isolation techniques, protein identification and concentration. **Reference:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	6%

3	determine protein concentration or enzyme activity and 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 via a standard curve 3. Able to determine the method used to calculate the activity of isolated enzymes	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Participatory Activities		Class presentations and discussions	**Material:** Determination of protein concentration or enzyme activity and enzyme kinetics **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	6%
4	understand the technique of determining molecular weight using SDS-PAGE (Sodium Dodecyl Sulphate - polyacrylamide gel electrophoresis)	1. Able to explain the SDS-PAGE mechanism 2. Able to explain the stages of 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	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Participatory Activities		Class presentations and discussions	**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	understand protein or enzyme purification methods	1. Able to differentiate crude protein/enzyme extract from pure protein/enzyme 2. Describes 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. Explains the purification of proteins or enzymes using the gel filtration method 6. Explain the purification of proteins or enzymes using the affinity chromatography method	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Participatory Activities		Class presentations and discussions	**Material:** protein or enzyme purification methods. **Reference:** *Bollag D. 1996. Protein Method. New York: John Willey and Sons. Inc*	5%
6	master the concepts regarding isolation, characterization and application of proteins or enzymes based on relevant articles	analyze concepts regarding the isolation, characterization and application of carbohydrates based on relevant articles	**Form of Assessment** : Participatory Activities		Presentation and discussion	**Material:** Analysis of one of the articles related to the isolation, characterization and application of carbohydrates based on that article. **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	5%
7	master the concepts regarding isolation, characterization and application of carbohydrates based on relevant articles	Analysis of articles related to the isolation, characterization and application of carbohydrates based on these articles	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment		Analyze articles related to the isolation, characterization and application of carbohydrates based on these articles	**Material:** Analysis of articles related to the isolation, characterization and application of carbohydrates based on these articles. **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	5%
8	UTS		**Form of Assessment** : Test				15%

9	Able to understand the concept of bioactive compounds that can be produced by nucleic acids	Students accurately understand the concept of techniques for obtaining bioactive compounds from lipids as well as identification and characterization	**Form of Assessment** : Participatory Activities		Students look for articles from journals from the last 5 years related to bioactive compound material (by writing journal name, author, year, volume, number) and make a summary of articles relevant to the material 2 x 50	**Material:** Articles on bioactive nucleic acid compounds. **Reference:** *Alexander RR and Griffiths JM, 1993, Basic Biochemical Methods, New York: John Willey and Sons. Inc*	5%
10	Able to understand the concept of bioactive compounds that can be produced by nucleic acids	Students are able to understand bioactive compounds obtained from nucleic acids	**Form of Assessment** : Participatory Activities, Tests		Discuss articles related to bioactive nucleic acid compounds that students have obtained in week 9 2 x 50	**Material:** Articles on bioactive nucleic acid compounds. **Reference:** *Alexander RR and Griffiths JM, 1993, Basic Biochemical Methods, New York: John Willey and Sons. Inc* **Material:** Recombinant DNA **Bibliography:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology : Principles and Application of Recombinant DNA, Washington, DC : ASM Press.*	5%
11	Able to understand techniques for obtaining bioactive nucleic acid compounds as well as identification and characterization	Students are able to understand the concept of techniques for obtaining bioactive nucleic acid compounds as well as identification and characterization	**Form of Assessment** : Participatory Activities, Tests		Discuss the isolation, identification and characterization techniques for 2 x 50 nucleic acid bioactive compounds	**Material:** EXPLORATION AND TESTING OF BIOACTIVE BACTERIAL COMPOUNDS OF BIOLOGICAL AGENSIA TO CONTROL CRACK DISEASE IN RICE **References:**	5%
12	Able to understand techniques for obtaining bioactive nucleic acid compounds as well as identification and characterization	Students are able to understand the concept of techniques for obtaining bioactive nucleic acid compounds as well as identification and characterization	**Form of Assessment** : Participatory Activities		Student presentations based on articles on bioactive nucleic acid compounds that have been analyzed 2 x 50	**Material:** Articles on bioactive nucleic acid compounds. **Reference:** *Alexander RR and Griffiths JM, 1993, Basic Biochemical Methods, New York: John Willey and Sons. Inc* **Material:** Articles on bioactive nucleic acid compounds **References:**	8%

13	Able to understand techniques for obtaining bioactive compounds from lipids as well as identification and characterization	Students master the technical concepts of obtaining bioactive lipid compounds as well as identification and characterization	**Form of Assessment** : Participatory Activities, Tests		Discuss techniques for isolation, identification and characterization of bioactive compounds from lipids 2 x 50	**Material:** Bioactive Lipid Activity Test against SARS-CoV-2 **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman* **Material:** Bioactive Lipid Activity Test against SARS-CoV-2 **References:**	5%
14	Able to understand techniques for obtaining bioactive compounds from lipids as well as identification and characterization	Students accurately understand the concept of techniques for obtaining bioactive compounds from lipids as well as identification and characterization	**Form of Assessment** : Participatory Activities, Portfolio Assessment		Student presentations based on articles on bioactive compounds from lipids that have been analyzed 2 x 50	**Material:** Articles on bioactive compounds from lipids **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	8%
15	Able to understand techniques for obtaining bioactive compounds from lipids as well as identification and characterization	Students are able to understand techniques for obtaining bioactive compounds from lipids as well as identification and characterization	**Form of Assessment** : Participatory Activities, Portfolio Assessment		Student presentations based on articles on bioactive compounds from lipids that have been analyzed 2 x 50	**Material:** Articles on bioactive compounds from lipids **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	8%
16	Able to understand techniques for obtaining bioactive compounds from lipids as well as identification and characterization	Students are able to master the technical concepts of obtaining bioactive compounds from lipids as well as identification and characterization	**Form of Assessment** : Participatory Activities, Portfolio Assessment		Student presentations based on articles on bioactive compounds from lipids that have been analyzed 2 x 50	**Material:** Articles on bioactive compounds from lipids **Reference:** *Boyer R, 2000. Modern Experimental Biochemistry. San Francisco: Addison Wesley Longman*	9%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	60%
2.	Project Results Assessment / Product Assessment	5%
3.	Portfolio Assessment	12.5%
4.	Test	22.5%
		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.