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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
BIOMOLECULE STRUCTURE AND FUNCTION	4720102190	Biochemistry	T=2	P=0	ECTS=3.18	3	June 20, 2022

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

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	Program Objectives (PO)	
	PO - 1	Students have knowledge of the structure of macro molecules: carbohydrates, proteins, fats, nucleic acids; function or role of macromolecules and vitamins, minerals, hormones in organisms
	PO - 2	Students master the concept of structure and function of macromolecules of carbohydrates, proteins, fats, nucleic acids; as well as vitamins, minerals and hormones in the organism
	PO - 3	Students have the ability to utilize learning resources and ICT to support mastery of Biochemical concepts and theories
	PO - 4	Students have the ability to solve science and technology problems in biochemistry and within a simple scope through the application of knowledge of the structure and function of macromolecules, and relevant technology.
	PO - 5	Students have responsibility and an independent attitude in their field of expertise
	PLO-PO Matrix	

P.O
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 structure and function of protein macromolecules, enzymes, carbohydrates, lipids, nucleic acids, and membranes; as well as studies on the function of vitamins and minerals carried out through lecture, discussion and presentation methods	
References	**Main :**	

	1. Nelson, L.D., Cox, M.M. 2021. Lehninger Principle of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin 2. Color Atlas of Biochemistry, 2005,Koolman, J and Roehm K. H. , 2ndedition. Stutgard New York 3. Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer, 2015, Biochemistry, New York, W.H. Freeman 4. Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. 2008. Campbell Biology. .Pearson Benjamin Cummings 5. Rodwell, V.W., Bender, D.A., Botham, K.M., Kennelly, P.J., Weil, P.A. 2018. 31st Edition Harper's Illustrated Biochemistry. McGraw Hill Education
	Supporters:
Supporting lecturer	Prof. Dr. Leny Yuanita, M.Kes. Prof. Dr. Hj. Rudiana Agustini, M.Pd. Dr. Prima Retno Wikandari, M.Si. Prof. Dr. Nuniek Herdyastuti, M.Si. Mirwa Adiprahara Anggarani, S.Si., M.Si. Muhammad Nurrohman Sidiq, S.Si., M.Sc., Ph.D. dr. Shod Abdurrachman Dzulkarnain, M.Biomed

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 molecules of living organisms (biomolecules) and their composition	1.1. Explain the characteristics of living substances 2.2. Explain the chemical processes in living substances 3.3. Explain that cells are the smallest part of life. 4.4. Explain the parts of a living cell. 5.5. Explain the function of each organelle 6.6. Explain the organization of molecules in cells 7.7. Explain the use of energy in living systems to maintain their structure	**Criteria:** 1.The assessment is carried out on the following aspects: 2.1. Participation during lectures is carried out through observation (weight 2) 3.2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4.3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5.4. Summative tests as UAS scores are weighted (3) 6.The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Question and answer discussion reflection 2 X 50		**Material:** Characteristics of living substances, Biochemistry in living substances, Cells as the smallest unit of life, Basic structure of cells and their functions, Molecular organization in cells, Energy for living systems **Bibliography:** *Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer, 2015, Biochemistry, New York, WH Freeman*	5%

2	Understand the structure and function of Carbohydrates	1. Classify carbohydrates based on the number of monomers that make up their functional groups and components. 2. Explain the center of asymmetry of the hawort ring structure, mutarotation and anomer. 3. Explain the functions of monosaccharides, disaccharides and polysaccharides in biological systems.	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Question and answer discussion reflection 2 X 50		**Material:** 1. Structure of carbohydrates 2. Function of carbohydrates in biological systems **References:** *Nelson, LD, Cox, MM 2021. Lehninger Principle of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	5%
3	Understand the structure and function of Carbohydrates	1. Classify carbohydrates based on the number of monomers that make up their functional groups and components. 2. Explain the center of asymmetry of the hawort ring structure, mutarotation and anomer. 3. Explain the functions of monosaccharides, disaccharides and polysaccharides in biological systems.	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Question and answer discussion reflection 2 X 50		**Material:** 1. Structure of carbohydrates 2. Function of carbohydrates in biological systems **References:** *Nelson, LD, Cox, MM 2021. Lehninger Principle of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	10%

4	Understand the structure and function of Carbohydrates	1. Classify carbohydrates based on the number of monomers that make up their functional groups and components. 2. Explain the center of asymmetry of the hawort ring structure, mutarotation and anomer. 3. Explain the functions of monosaccharides, disaccharides and polysaccharides in biological systems.	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Question and answer discussion reflection 2 X 50		**Material:** 1. Structure of carbohydrates 2. Function of carbohydrates in biological systems **References:** *Lehninger, 1988, Basics of Biochemistry, volume 1, Translated by Maggi Thenawidjaya, Erlangga Publishers, Jakarta* **Material:** 1. Structure of carbohydrates 2. Function of carbohydrates in biological systems **References:** *Nelson, LD, Cox, MM 2021. Lehninger Principle of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	10%
5	Understand the structure and function of Proteins	1. Explain the structure of amino acids and the classification of amino acids 2. Explain the nature of amphoteric acid base isoelectric point separation of amino acids (electrophoresis and chromatography) special reactions of amino acids 3. Explain the reactions for the formation of peptide bonds 4. Explain the function of peptides in living systems 5. Explaining the separation using gel electrophoresis filtration dialysis process 6. Explaining the determination of amino acid series by hydrolysis and amino acid reactions with Edman's FDNB dansyl chloride reagent 7. Explaining the definition of homologous proteins 8. Explaining about fixed residues, non-fixed residues, homology series and examples of the importance of homology series of various species 9. Explain the classification of proteins based on	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion Presentation 2 X 50		**Material:** Structure and properties of amino acids, peptide bonds and their function in living systems, separation and purification of amino acids and understanding homologous proteins, covalent structure and function of proteins (primary, secondary, tertiary proteins), characteristics of fiber and globular proteins, quaternary proteins and disorders protein genetics **Bibliography:** *Nelson, LD, Cox, MM 2021. Lehninger Principles of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	5%

		the function of the constituent elements and their shape 10. Explain configuration and conformation 11. Explain the structure - helix, type of amino acid that makes up its nature and structure as a constituent of keratin 12. Explain the structure of silk fibroin and the differences in its properties with - helix 13. Explain the helical structure that makes up collagen, the properties of collagen in tendons and bone matrix 14. Explain the helical structure that makes up elastin and the properties of elastin in joints15. Types and functions of globular proteins 16. Characteristics of the tertiary structure of globular proteins in myoglobin 17. Types of amino acids that make up globular proteins 18. tertiary structures in myoglobin 19. Differences in tertiary structures in several globular proteins 20. Types of bonds that stabilize tertiary structures 21. Definition of oligomeric proteins and examples of oligomeric proteins 22. Quaternary structures make up oligomeric proteins23. Explain the function of hemoglobin and myoglobin. 24. Explain sickle cell anemia and other disorders caused by gene mutations. 25 Proteomic structural analysis using a bioinformatics approach and its applications.					
6	Understand the structure and function of Proteins	1. Explain the structure of amino acids and the classification of amino acids 2. Explain the nature of amphoteric acid base isoelectric point separation of amino acids (electrophoresis and chromatography) special reactions of amino acids 3. Explain the reactions for the formation of peptide bonds 4. Explain the function of peptides in living systems 5. Explaining the separation using gel electrophoresis filtration dialysis	**Criteria:** 1.The assessment is carried out on the following aspects: 2.1. Participation during lectures is carried out through observation (weight 2) 3.2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4.3. Structured task assessment from	Discussion Presentation 2 X 50		**Material:** Structure and properties of amino acids, peptide bonds and their function in living systems, separation and purification of amino acids and understanding homologous proteins, covalent structure and function of proteins (primary, secondary, tertiary proteins), characteristics of fiber and	10%

		process 6. Explaining the determination of amino acid series by hydrolysis and amino acid reactions with Edman's FDNB dansyl chloride reagent 7. Explaining the definition of homologous proteins 8. Explaining about fixed residues, non-fixed residues, homology series and examples of the importance of homology series of various species 9. Explain the classification of proteins based on the function of the constituent elements and their shape 10. Explain configuration and conformation 11. Explain the structure - helix, type of amino acid that makes up its nature and structure as a constituent of keratin 12. Explain the structure of silk fibroin and the differences in its properties with - helix 13. Explain the helical structure that makes up collagen, the properties of collagen in tendons and bone matrix 14. Explain the helical structure that makes up elastin and the properties of elastin in joints15. Types and functions of globular proteins 16. Characteristics of the tertiary structure of globular proteins in myoglobin 17. Types of amino acids that make up globular proteins 18. tertiary structures in myoglobin 19. Differences in tertiary structures in several globular proteins 20. Types of bonds that stabilize tertiary structures 21. Definition of oligomeric proteins and examples of oligomeric proteins 22. Quaternary structures make up oligomeric proteins23. Explain the function of hemoglobin and myoglobin. 24. Explain sickle cell anemia and other disorders caused by gene mutations. 25 Proteomic structural analysis using a bioinformatics approach and its applications.	each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities			globular proteins, quaternary proteins and disorders protein genetics **Bibliography:** *Nelson, LD, Cox, MM 2021. Lehninger Principles of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	
7	Understand the	1. Explain the	**Criteria:**	Discussion		**Material:**	10%

	structure and function of Proteins	structure of amino acids and the classification of amino acids 2. Explain the nature of amphoteric acid base isoelectric point separation of amino acids (electrophoresis and chromatography) special reactions of amino acids 3. Explain the reactions for the formation of peptide bonds 4. Explain the function of peptides in living systems 5. Explaining the separation using gel electrophoresis filtration dialysis process 6. Explaining the determination of amino acid series by hydrolysis and amino acid reactions with Edman's FDNB dansyl chloride reagent 7. Explaining the definition of homologous proteins 8. Explaining about fixed residues, non-fixed residues, homology series and examples of the importance of homology series of various species 9. Explain the classification of proteins based on the function of the constituent elements and their shape 10. Explain configuration and conformation 11. Explain the structure - helix, type of amino acid that makes up its nature and structure as a constituent of keratin 12. Explain the structure of silk fibroin and the differences in its properties with - helix 13. Explain the helical structure that makes up collagen, the properties of collagen in tendons and bone matrix 14. Explain the helical structure that makes up elastin and the properties of elastin in joints15. Types and functions of globular proteins 16. Characteristics of the tertiary structure of globular proteins in myoglobin 17. Types of amino acids that make up globular proteins 18. tertiary structures in myoglobin 19. Differences in tertiary structures in several globular proteins 20. Types of bonds that stabilize tertiary structures	1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Presentation 2 X 50		Structure and properties of amino acids, peptide bonds and their function in living systems, separation and purification of amino acids and understanding homologous proteins, covalent structure and function of proteins (primary, secondary, tertiary proteins), characteristics of fiber and globular proteins, quaternary proteins and disorders protein genetics **Bibliography:** *Nelson, LD, Cox, MM 2021. Lehninger Principles of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	

		21. Definition of oligomeric proteins and examples of oligomeric proteins 22. Quaternary structures make up oligomeric proteins23. Explain the function of hemoglobin and myoglobin. 24. Explain sickle cell anemia and other disorders caused by gene mutations. 25 Proteomic structural analysis using a bioinformatics approach and its applications.					
8	Midterm exam		**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10	Giving a Subsummative written test-1 2 X 50			0%

9	Understand the structure and function of enzymes	1. Explain the structure of enzymes 2. Explain the properties of enzymes 3. Explain the function of enzymes 4. Explain the difference between trivial and systematic naming of enzymes 5. Name the six groups of enzymes along with the groups they attack 6. Explain the mechanism of enzymatic reactions 7. Explain the Michaelis-Menten equation 8. Determine the values of Vmax and KM. 9. Explain the Lineweaver-Burk equation10. Explain the factors that influence enzyme activity11. Explain the process of enzyme inhibition by inhibitors along with a binding model12. Explain multi enzyme systems with	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Studying material from the book requires questions and answers to 2 X 50 practice questions		**Material:** Structure, properties and function of enzymes, Procedures for naming enzymes, Mechanisms of enzymatic reactions, Kinetics of enzymatic reactions, Factors that influence enzyme activity, Enzyme inhibition, Multi-enzyme systems. **References:** *Nelson DL, and Cox MM, 2003, Lehninger Principle of Biochemistry, 4th edition, University of Wisconsin-Madison* **Material:** Structure, properties and function of enzymes, Procedure for naming enzymes, Mechanism of enzymatic reactions, Kinetics of enzymatic reactions, Factors that influence enzyme activity, Enzyme inhibition, Multi-enzyme systems **References:** *Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer, 2015, Biochemistry, New York, W.H. Freeman*	5%

10	Understand the structure and function of enzymes	1. Explain the structure of enzymes 2. Explain the properties of enzymes 3. Explain the function of enzymes 4. Explain the difference between trivial and systematic naming of enzymes 5. Name the six groups of enzymes along with the groups they attack 6. Explain the mechanism of enzymatic reactions 7. Explain the Michaelis-Menten equation 8. Determine the values of Vmax and KM. 9. Explain the Lineweaver-Burk equation10. Explain the factors that influence enzyme activity11. Explain the process of enzyme inhibition by inhibitors along with a binding model12. Explain multi enzyme systems with	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Studying material from the book requires questions and answers to 2 X 50 practice questions		**Material:** Structure, properties and function of enzymes, Procedures for naming enzymes, Mechanisms of enzymatic reactions, Kinetics of enzymatic reactions, Factors that influence enzyme activity, Enzyme inhibition, Multi-enzyme systems. **Reference:** *Color Atlas of Biochemistry, 2005, Koolman, J and Roehm KH, 2nd edition. Stutgard New York* **Material:** Structure, properties and function of enzymes, Procedure for naming enzymes, Mechanism of enzymatic reactions, Kinetics of enzymatic reactions, Factors that influence enzyme activity, Enzyme inhibition, Multi-enzyme systems **References:** *Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer, 2015, Biochemistry, New York, W.H. Freeman*	10%

11	Understand the structure and function of vitamins and minerals	1. Name water-soluble vitamins 2. Name fat-soluble vitamins 3. Describe the structure of water-soluble vitamins 4. Describe the structure of fat-soluble vitamins. 5. Explain the role of vitamins in biological systems. 6. Name the minerals needed in the nutrition of both plants and animals. 7. Explain the role of minerals in enzyme function.	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Studying material from the book requires questions and answers to 2 X 50 practice questions		**Material:** 1. Types of vitamins, their structure and role in enzyme function. 2. Inorganic elements (minerals) required in nutrition and their role in enzyme function. **References:** *Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer, 2015, Biochemistry, New York, WH Freeman*	5%
12	Understand the structure and function of vitamins and minerals	1. Name water-soluble vitamins 2. Name fat-soluble vitamins 3. Describe the structure of water-soluble vitamins 4. Describe the structure of fat-soluble vitamins. 5. Explain the role of vitamins in biological systems. 6. Name the minerals needed in the nutrition of both plants and animals. 7. Explain the role of minerals in enzyme function.	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Studying material from the book requires questions and answers to 2 X 50 practice questions		**Material:** 1. Types of vitamins, their structure and role in enzyme function. 2. Inorganic elements (minerals) required in nutrition and their role in enzyme function **References:** *Nelson, LD, Cox, MM 2021. Lehninger Principle of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	5%

13	Understand the structure and function of nucleic acids	1. Explain the nucleoside components of nucleotides. 2. Explain the main components of DNA and RNA nucleic acids; free nucleotides 3. Describe the structure of DNA and RNA nucleic acids; free nucleotides 4. Explain the nature of nucleic acids DNA RNA 5. Explain the nature of tRNA rRNA mRNA 6. Explain the relationship between transcription translation translation protein synthesis	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Question and answer discussion reflection 2 X 50		**Material:** Nucleoside components, nucletides, nucleic acids, structure of nucleic acids, free nucleotides, role of nucleic acids in protein synthesis **References:** *Nelson, LD, Cox, MM 2021. Lehninger Principle of Biochemistry 8th Edition. Mac Millan Learning University of Wisconsin*	10%
14	Understand the structure and function of lipids and bio-membranes	1. Explain the structure of lipids. 2. Explain the function of lipids in biological systems. 3. Explain the main components of membranes. 4. Describe the fluid mosaic structure of membranes. 5. Explain the nature of the lipid bilayer in membranes. 6. Explain the function of membranes.	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Questions and answers answering 2 X 50 practice questions		**Material:** Structure and Function of Lipids **Reference:** *Lehninger, 1988, Basics of Biochemistry, volume 1, Translated by Maggi Thenawidjaya, Erlangga Publishers, Jakarta* **Material:** Structure and Function of Lipids **References:** *Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer, 2015, Biochemistry, New York, WH Freeman*	5%

15	Understand the structure and function of Hormones	Describe the role of each hormone in primary and secondary target hormones	**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Questions and answers answering 2 X 50 practice questions		**Material:** Types of hormones, Mechanism of action of hormones, Function of hormones in metabolism **References:** *Rodwell, VW, Bender, DA, Botham, KM, Kennelly, PJ, Weil, PA 2018. 31st Edition Harper's Illustrated Biochemistry. McGraw Hill Education*	5%
16	UAS		**Criteria:** 1. The assessment is carried out on the following aspects: 2. 1. Participation during lectures is carried out through observation (weight 2) 3. 2. The subsummative test is carried out twice, assessing all relevant indicators through a written exam, averaging them and giving them a weight (2) 4. 3. Structured task assessment from each teacher and the scores are averaged then given a weight (3) 5. 4. Summative tests as UAS scores are weighted (3) 6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10	2 X 50			0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage

1.	Participatory Activities	100%
		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.