



Universitas Negeri Surabaya
Faculty of Mathematics and Natural Sciences
Biology Education Undergraduate Study Program

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Biochemistry	8420502047	Supporting Tools	T=2	P=0	ECTS=3.18	2	April 27, 2023
AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator				
	Dr.sc.agr. Yuni Sri Rahayu, M.Si	Dr.sc.agr. Yuni Sri Rahayu, M.Si	Dr. Rinie Pratiwi Puspitawati, 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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PLO-12	Able to demonstrate the ability to apply biological concepts and environmental issues with relevant technology in natural resource management
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Program Objectives (PO)	
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PO - 1	Increasing devotion to God Almighty through Biochemistry studies.
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PO - 2	Communicate understanding of Biochemistry concepts
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PO - 3	Skilled in applying Biochemical concepts in overcoming problems in everyday life based on identifying and recognizing the symptoms of certain diseases
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PO - 4	Able to make the right decisions based on information and data analysis, and able to provide guidance in choosing various alternative solutions independently and in groups in the field of Biochemistry
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PLO-PO Matrix	
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P.O	PLO-12										
PO-1											
PO-2											
PO-3											
PO-4											

PO Matrix at the end of each learning stage (Sub-PO)	
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Short Course Description	Biochemistry studies four organic compounds that are very important for organisms which include carbohydrates, proteins, lipids and nucleic acids. Each organic material will be discussed in detail regarding its structure and function, anabolism, catabolism and diseases related to the metabolism of these four organic materials. This course also examines the application of the biochemical concepts of these four organic compounds to solve related problems in everyday life. Biochemistry also studies enzymes that work in organisms, factors that influence their work and enzyme-related diseases, their prevention and treatment. Biochemistry also studies important compounds/molecules such as water, vitamins and minerals which play a role in the metabolic processes of organisms. Hormones as part of the organism's body coordination system are also studied in this course, mainly related to their constituent compounds, their work organization, hormonal system disorders/diseases, how to prevent and treat them. Learning activities are carried out through face-to-face lectures, assignments and practicums.
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References	<p>Main :</p> <ol style="list-style-type: none"> 1. Leninger,AL. 1992, Biochemistry . New York: Worth Publishing Inc. 2. Strayer, I. 1973, Biochemistry . New York: John Wiley & Sons. 3. Eubanks, PL., Middlecamp, HC., Pienta, JN., Heltzel, EC., Weaver, CG., 2006, Chemistry in Context . New York: McGrawhill publisher <p>Supporters:</p> <ol style="list-style-type: none"> 1. Isnawati, 2010. Biokimia, Surabaya: Unesa Unipress 2. Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry, Surabaya: Unesa Press.
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Supporting lecturer	Dra. Evie Ratnasari, M.Si. Prof.Dr. Yuni Sri Rahayu, M.Si. Dr. Isnawati, M.Si. Ahmad Fudhaili, S.Si., M.Sc., Ph.D.
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Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assesment Weight (%)
		Indicator	Criteria & Form	Offline (offline)	Online (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

1	Describe the structure and function of carbohydrates	<ol style="list-style-type: none"> 1.Explain the structure of various types of monosaccharides, disaccharides, polysaccharides 2.Explain the function of different types of carbohydrates 3.Demonstrate the polymerization of various types of polysaccharides from their constituent monomers 	<p>Criteria:</p> <ol style="list-style-type: none"> 1.Presentations are assessed as assignments with a weight of 10% 2.Practicum/Report is assessed as an assignment with a weight of 30% 3.UTS weight 20% 4.Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5.UAS weight 30% <p>Form of Assessment : Participatory Activities</p>	<p>Lecturers facilitate student-centered learning through group discussions and are responsible for discovering concepts (based on literature review) regarding the structure and function of various types of carbohydrates. Through case study explanations in everyday life, students are invited to think critically to find solutions to problems.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and underline important concepts related to the structure and function of carbohydrates. Demonstrate the polymerization process of types of carbohydrates based on their constituent monomers</p> <p>Identify various types of carbohydrates in various types of food ingredients</p> <p>Structured: 2x60 minutes Make a practical report 2x50 minutes</p>	-	<p>Material: Structure of various types of monosaccharides and polysaccharides, Function of various types of carbohydrates References: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: Structure of various types of monosaccharides and polysaccharides, Functions of various types of carbohydrates Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p>	5%
2	Describe carbohydrate anabolism	<ol style="list-style-type: none"> 1.Explain the process of photosynthesis 2.Explains the process of forming one type of carbohydrate from another type of carbohydrate or from a compound other than carbohydrates 	<p>Criteria:</p> <ol style="list-style-type: none"> 1.Presentations are assessed as assignments with a weight of 10% 2.Practicum/Report is assessed as an assignment with a weight of 30% 3.UTS weight 20% 4.Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5.UAS weight 30% <p>Form of Assessment : Participatory Activities</p>	<p>Lecturers facilitate student-centered learning through:</p> <ol style="list-style-type: none"> 1. Animations and videos of the photosynthesis process 2. Schemes for the formation of types of carbohydrates from other carbohydrate or non-carbohydrate compounds. Through case studies explaining carbohydrate anabolism in everyday life, students are invited to think critically to find solutions to problems. Continue present the results of their group work. <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Studying carbohydrate anabolism in various sources.</p> <p>Structured: 2x60 minutes Make a PPT and present the results of independent learning related to carbohydrate anabolism 2x50 minutes</p>	-	<p>Material: a. Photosynthesis b. Formation of certain types of carbohydrates from other carbohydrates or non-carbohydrates Reference: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: a. Photosynthesis b. Formation of certain types of carbohydrates from other carbohydrates or non-carbohydrates References: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p>	5%

3	Describe carbohydrate catabolism, related diseases and apply these concepts to solve problems related to carbohydrate metabolism in everyday life	<p>1.a. Explain the process of glycolysis and its regulation</p> <p>2.b. Explain the Krebs's cycle and its organization</p> <p>3.c. Explain the electron transfer chain and its regulation</p> <p>4.d. Give examples of diseases related to carbohydrate metabolism, how to prevent and treat them</p> <p>5.d. Give examples of diseases related to carbohydrate metabolism, how to prevent and treat them</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities, Practical Assessment</p>	<p>Lecturers facilitate student-centered learning through case studies and active student discussions about carbohydrate catabolism and related diseases, as well as prevention and treatment, followed by presenting the results of their group work.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and rediscover the concept of carbohydrate catabolism and the calculation of the ATP it produces.</p> <p>Structured: 2x60 minutes Create a resume in the form of a table of ATP calculation results at each stage of cellular respiration</p>	-	<p>Material: a. Glycolysis b. Krebs's cycle c. Electron transfer chain d. Diseases related to carbohydrate metabolism, prevention and treatment</p> <p>Reference: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <hr/> <p>Material: a. Glycolysis b. Krebs's cycle c. Electron transfer chain d. Diseases related to carbohydrate metabolism, prevention and treatment</p> <p>Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <hr/> <p>Material: a. Glycolysis b. Krebs's cycle c. Electron transfer chain d. Diseases related to carbohydrate metabolism, prevention and treatment</p> <p>References: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p>	6%
4	Describe the structure and function of proteins	<p>1.a. Explain the structure of various types of amino acids and proteins</p> <p>2.b. Explain the function of various types of protein in the body</p> <p>3.c. Demonstrate the polymerization of various types of proteins from their constituent amino acid monomers</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities, Practical Assessment</p>	<p>Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature reviews) regarding the structure and function of various types of proteins and strengthening them in the form of case studies of problems in everyday life, followed by presentations of solutions to problems that arise</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and underline important concepts related to protein structure and function. Demonstrate the polymerization process of various types of proteins based on their constituent amino acid monomers</p> <p>Identify various types of proteins in various types of food ingredients</p> <p>Structured: 2x60 minutes Make a practical report</p>	-	<p>Material: a. Amino acid structure b. Various types of protein structures c. Functions of various types of proteins</p> <p>Reference: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <hr/> <p>Material: a. Amino acid structure b. Various types of protein structures c. Functions of various types of protein</p> <p>Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <hr/> <p>Material: a. Amino acid structure b. Various types of protein structures c. Functions of various types of proteins</p> <p>Bibliography: <i>Strayer, I. 1973, Biochemistry . New York: John Wiley & Sons.</i></p>	5%

5	Describe the process of protein synthesis	<p>1.a. Explain the process of gene expression (transcription and translation) in the process of protein formation</p> <p>2.b. Explain the process of forming non-essential amino acids from essential amino acids</p> <p>3.c. Explain the process of synthesizing amino acids from carbohydrate materials/compounds between carbohydrate catabolism</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities, Practical Assessment</p>	<p>Lecturers facilitate student-centered learning through:</p> <ol style="list-style-type: none"> 1. Animations and videos of the gene expression process in protein biosynthesis 2. Schemes for the formation of types of amino acids from intermediate compounds in the carbohydrate catabolism pathway. <p>Through case studies explaining protein synthesis in everyday life, students are invited to think critically and discover solutions to problems related to protein synthesis followed by presenting the results of his group's work.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Studying protein anabolism in various sources.</p> <p>Structured: 2x60 minutes Make a PPT and present the results of independent learning related to protein anabolism 2x50 minutes</p>	-	<p>Material: a. Transcription and translation b. Formation of non-essential amino acids c. Synthesis of amino acids from intermediate compounds in the carbohydrate catabolism pathway. Reference: <i>Leninger, AL. 1992. Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: a. Transcription and translation b. Formation of non-essential amino acids c. Synthesis of amino acids from intermediate compounds in the carbohydrate catabolism pathway. Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <p>Material: a. Transcription and translation b. Formation of non-essential amino acids c. Synthesis of amino acids from intermediate compounds in the carbohydrate catabolism pathway. References: <i>Rahayu, YS, Ratnasari, E., Isnawati, 2016. Biochemistry, Surabaya: Unesa Press.</i></p>	6%
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6	Describe protein catabolism, related diseases and apply these concepts to solve problems related to protein metabolism in everyday life	<ol style="list-style-type: none"> 1.a. Explain the process of protein catabolism 2.b. Give examples of diseases related to protein metabolism, prevention and treatment 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities</p>	<p>Lecturers facilitate student-centered learning through case studies and active student discussions about protein catabolism and related diseases, as well as prevention and treatment, followed by presenting the results of their group work regarding solutions offered from the results of reviewing the case studies that emerged.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and rediscover the concept of protein catabolism and its relationship to carbohydrate catabolism.</p> <p>Structured: 2 x 60 minutes Create a resume in the form of a scheme of the relationship between protein catabolism and carbohydrate catabolism 3 x 50 minutes</p>	-	<p>Material: Protein catabolism, Relationship between protein catabolism and carbohydrate catabolism, Diseases related to protein catabolism, prevention and treatment</p> <p>References: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: Protein catabolism, Relationship between protein catabolism and carbohydrate catabolism, Diseases related to protein catabolism, prevention and treatment.</p> <p>Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <p>Material: Protein catabolism, Relationship between protein catabolism and carbohydrate catabolism, Diseases related to protein catabolism, prevention and treatment</p> <p>References: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p>	5%
7	Describe the role of water, vitamins and minerals for organisms, related diseases and apply these concepts to solve problems related to water, vitamins and minerals in everyday life	<ol style="list-style-type: none"> 1.a. Explain the function of water in the metabolism of organisms 2.b. Explain the structure, properties, sources of obtaining various types of vitamins and their functions for organisms 3.c. Explain the function, properties, sources of obtaining various types of minerals 4.d. Give examples of diseases caused by vitamin and mineral deficiencies, their prevention and cure 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities, Practical Assessment</p>	<p>Lecturers facilitate student-centered learning through group discussions and are responsible for based on case studies in daily life related to vitamins and minerals to find concepts and solutions (based on literature review) regarding the structure, properties, functions, sources of water, vitamins and minerals and Deficiency diseases, prevention and treatment.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and underline important concepts related to structure, properties, function, sources of water, vitamins and minerals and deficiency diseases, prevention and treatment.</p> <p>Structured: 2x60 minutes Create a resume of 2x50 minutes of reading results</p>	-	<p>Material: a. Water (molecular structure, properties, role and deficiency disorders) b. Vitamins (types, molecular structures, properties, roles and deficiency disorders) c. Minerals (types, properties, roles and deficiency disorders)</p> <p>References: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: a. Water (molecular structure, properties, role and deficiency disorders) b. Vitamins (types, molecular structures, properties, roles and deficiency disorders) c. Minerals (types, properties, roles and deficiency disorders)</p> <p>References: <i>Eubanks, PL., Middlecamp, HC., Pienta, JN., Heltzel, EC., Weaver, CG., 2006, Chemistry in Context. New York: McGrawhill publishers</i></p>	5%

8	UTS (Mid Semester Exam)	<ol style="list-style-type: none"> 1. Describe the structure and function of carbohydrates 2. Describe carbohydrate catabolism and carbohydrate anabolism 3. Describe the structure and function of proteins 4. Describe the events of protein metabolism 5. Describe irreversible barriers to enzyme action and solutions to the problems they cause 6. Comparing the mechanism of action of two groups of hormones based on their constituent compounds 	<p>Criteria: UTS 20%</p> <p>Form of Assessment : Test</p>			<p>Material: Carbohydrate Function Structure, Carbohydrate Metabolism, Protein Function Structure, Protein Metabolism, water, minerals, vitamins</p> <p>References: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p> <hr/> <p>Material: Structure and Function of Carbohydrates, Carbohydrate Metabolism, Structure and Function of Proteins, Protein Metabolism, water, minerals, vitamins</p> <p>Reader: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <hr/> <p>Material: Structure and Function of Carbohydrates, Carbohydrate Metabolism, Structure and Function of Proteins, Protein Metabolism, water, minerals, vitamins</p> <p>References: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p>	10%
9	Describe the structure and function of nucleic acids	<ol style="list-style-type: none"> 1.a. Describe the structure of DNA 2.b. Describe the structure of RNA 3.c. Identify the differences between DNA and RNA 4.d. Explain the function of DNA and RNA 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% <p>Form of Assessment : Participatory Activities, Practical Assessment</p>	<p>Lecturers facilitate student-centered learning through group discussions and are responsible for discovering concepts (based on literature review) regarding the structure and function of various types of nucleic acids.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and underline important concepts related to the structure and function of DNA and RNA. Demonstrate the polymerization process of DNA and RNA of its constituent nucleotide monomers</p> <p>Structured: 2x60 minutes Create a resume of your own reading/study results 2x50 minutes</p>		<p>Material: a. DNA b. RNA c. Functions of DNA and RNA</p> <p>Library: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <hr/> <p>Material: a. DNA b. RNA c. Functions of DNA and RNA</p> <p>Library: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <hr/> <p>Material: a. DNA b. RNA c. Functions of DNA and RNA</p> <p>Library: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p>	5%

10	Describe nucleic acid metabolism, related diseases and apply these concepts to solve problems related to nucleic acids and everyday life	<p>1.a. Explain the anabolism of nucleic acids</p> <p>2.b. Explain the catabolism of nucleic acids</p> <p>3.c. Give examples of diseases related to nucleic acid metabolism, prevention and treatment</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities, Practical Assessment</p>	<p>Lecturers facilitate student-centered learning through group discussions and are responsible for discovering concepts (based on literature review) regarding the structure and function of various types of nucleic acids.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and underline important concepts related to the structure and function of DNA and RNA. Demonstrate the polymerization process of DNA and RNA of its constituent nucleotide monomers</p> <p>Structured: 2x60 minutes Create a resume of your own reading/study results 2x50 minutes</p>	-	<p>Material: a. nucleic acid anabolism b. nucleic acid catabolism c. diseases related to nucleic acid metabolism, prevention and treatment</p> <p>References: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <hr/> <p>Material: a. nucleic acid anabolism b. nucleic acid catabolism c. diseases related to nucleic acid metabolism, prevention and treatment</p> <p>References: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p> <hr/> <p>Material: a. nucleic acid anabolism b. nucleic acid catabolism c. diseases related to nucleic acid metabolism, prevention and treatment</p> <p>Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p>	5%
11	Describe the structure and function of lipids	<p>1.a. Explain the structure of various types of fatty acids and lipids</p> <p>2.b. Explain the function of various types of lipids in organisms</p> <p>3.c. Demonstrate the preparation of various types of lipids from their constituent components</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities</p>	<p>Lecturers facilitate student-centered learning through case studies so that group discussions occur and are responsible for finding concepts (based on literature review) regarding the structure and function of various types of lipids including finding related solutions.</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes Read and underline important concepts related to the structure and function of lipids. Demonstrate the process of preparing various types of lipids from their constituent components.</p> <p>Identify various types of fats in various types of food.</p> <p>Structured: 2x60 minutes Make a practical report 2x50 minutes</p>	-	<p>Material: a. Fatty acids b. Types of lipids and their functions</p> <p>Reference: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: a. Fatty acids b. Types of lipids and their functions</p> <p>References: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p> <p>Material: a. Fatty acids b. Types of lipids and their functions</p> <p>Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p>	5%

12	Describe lipid anabolism	<p>1.a. Explain the process of formation of saturated fatty acids and unsaturated fatty acids</p> <p>2.b. Explain the formation of fatty acids from carbohydrates</p> <p>3.c. Inventory and calculate the compounds produced and needed in the fatty acid formation process</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Bentuk Penilaian : Aktifitas Partisipatif, Praktik / Unjuk Kerja</p>	<p>Dosen memfasilitasi pembelajaran berpusat pada siswa melalui:</p> <ol style="list-style-type: none"> 1. Animasi dan video proses ekspresi gen pada biosintesis asam lemak 2. Skema pembentukan jenis asam lemak dari bahan karbohidrat <p>Melalui case study peneraan dalam kehidupan sehari-hari terkait anabolisme lipid, mahasiswa diajak untuk berfikir kritis menemukan solusi terhadap masalah terkait dilanjutkan mempresentasikan hasil kerja kelompoknya.</p> <p>Tatap muka: 2x50 menit</p> <p>Mandiri: 2x60 menit</p> <p>Mempelajari anabolisme asam lemak dan berbagai jenis lipid pada berbagai sumber.</p> <p>Terstruktur: 2x60 menit</p> <p>Membuat PPT dan mempresentasikan hasil belajar mandiri terkait anabolisme lipid 2x50 menit</p>	-	<p>Materi: a. Biosintesis asam lemak jenuh dan tidak jenuh b. Biosintesis berbagai jenis lipid dari asam lemak dan bahan karbohidrat</p> <p>Pustaka: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Materi: a. Biosintesis asam lemak jenuh dan tidak jenuh b. Biosintesis berbagai jenis lipid dari asam lemak dan bahan karbohidrat</p> <p>Pustaka: <i>Isnawati, 2010. Biokimia, Surabaya: Unesa Unipress</i></p> <p>Materi: a. Biosintesis asam lemak jenuh dan tidak jenuh b. Biosintesis berbagai jenis lipid dari asam lemak dan bahan karbohidrat</p> <p>Pustaka: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p>	5%
13	Mendeskripsikan katabolisme lipida, penyakit yang berkaitan dan menerapkan konsep tersebut untuk menyelesaikan masalah terkait metabolisme lipida dalam kehidupan sehari-hari	<ol style="list-style-type: none"> 1.a. Menjelaskan proses katabolisme lipida 2.b. Menginventarisasi dan menghitung jumlah ATP yang dihasilkan dari proses katabolisme berbagai jenis lipida 3.c. Mengaitkan metabolisme lipida dengan metabolisme protein dan karbohidrat 4.d. Memberi contoh penyakit terkait metabolisme lipida, pencegahan dan pengobatannya 	<p>Kriteria:</p> <ol style="list-style-type: none"> 1. Presentasi dinilai sebagai tugas dengan bobot 10% 2. Praktikum/Laporan dinilai sebagai tugas dengan bobot 30% 3. UTS bobot 20% 4. Aktivitas dan respon mahasiswa selama kegiatan pembelajaran terutama pd waktu keg presentasi/praktikum/penugasan dinilai sebagai partisipasi dengan bobot 10% 5. UAS bobot 30% <p>Bentuk Penilaian : Aktifitas Partisipatif, Penilaian Praktikum</p>	<p>Lecturers facilitate student-centered learning through case studies that are presented so that an active discussion process is formed by students about lipid metabolism and related diseases, as well as prevention and treatment, followed by presenting the results of their group work</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 2x60 minutes</p> <p>Reading and rediscovering the concept of catabolism lipids and their relationship to protein and carbohydrate metabolism.</p> <p>Structured: 2x60 minutes</p> <p>Create a resume in the form of a schematic of the relationship between lipid, protein and carbohydrate metabolism 2x50 minutes</p>	-	<p>Material: Beta oxidation cycle, related diseases, prevention and treatment</p> <p>References: <i>Eubanks, PL., Middlecamp, HC., Pienta, JN., Heltzel, EC., Weaver, CG., 2006, Chemistry in Contentx. New York: McGrawhill publishers</i></p> <p>Material: Beta oxidation cycle, related diseases, prevention and treatment</p> <p>Reference: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <p>Material: Beta oxidation cycle, related diseases, prevention and treatment</p> <p>References: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry. Surabaya: Unesa Press.</i></p>	5%

14	Describe concepts related to enzymes, factors that influence enzyme work, enzyme-related diseases and apply these concepts to solve problems in everyday life related to the work of enzymes in the body	<ol style="list-style-type: none"> 1.a. Explain the meaning, structure, function and properties of enzymes 2.b. Determine the classification of enzymes 3.c. Explain the mechanism of action of enzymes 4.d. Explain the factors that influence the work of enzymes 5.e. Describe the obstacles to enzyme action 6.f. Create a schematic of enzyme systems in various metabolic pathways 7.g. Give examples of isoenzymes 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities</p>	<p>Lecturers facilitate student-centered learning, through case studies and active discussions related to enzymes and enzyme-related diseases in everyday life to find concepts and solutions related to the concept of enzymes and their role in metabolism</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 3x60 minutes Reading and in groups and write the results of a journal review of research results on enzymes and their role</p> <p>Structured: 2x60 minutes Make a report on the results of a literature review on enzymes and their role 2x50 minutes</p>	-	<p>Material: a. Definition, structure, function and properties of enzymes b. Enzyme classification. c. Enzyme mechanism of action d. Factors that influence enzyme work e. Barriers to enzyme action f. Enzyme system g. Isoenzyme Library: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p>	6%
15	Describe concepts related to hormones, hormonal diseases, how to prevent and treat them based on the application of the biochemical concept of hormones	<ol style="list-style-type: none"> 1.a. Explain the meaning, properties, functions and compounds that make up various types of hormone groups 2.b. Explain the organization of hormone action in the human body 3.c. Explain the types of hormones and their functions 4.d. Explain the mechanism of action of hormones 5.e. Describe hormonal deficiency, symptoms, prevention and treatment 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Presentations are assessed as assignments with a weight of 10% 2. Practicum/Report is assessed as an assignment with a weight of 30% 3. UTS weight 20% 4. Student activities and responses during learning activities, especially during presentations/practicum/assignments, are assessed as participation with a weight of 10% 5. UAS weight 30% <p>Form of Assessment : Participatory Activities, Practical Assessment</p>	<p>Lecturers facilitate student-centered learning, through case studies and active discussions to find concepts and solutions related to hormones, hormonal diseases, ways of preventing and treating them based on the application of biochemical concepts of hormones</p> <p>Face to face: 2x50 minutes</p> <p>Independent: 3x60 minutes Reading and writing in groups journal review results of research results on hormones and their role</p> <p>Structured: 2x60 minutes Make a report on the results of a literature review on hormones and their role 2x50 minutes</p>	-	<p>Material: a. Definition of properties, functions and compounds that make up various types of hormone groups b. Organization of hormone action in the human body cc Types of hormones and their functions d. Mechanism of action of hormone e. Hormonal disorders. prevention and treatment References: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: a. Definition of properties, functions and compounds that make up various types of hormone groups b. Organization of hormone action in the human body cc Types of hormones and their functions d. Mechanism of action of hormone e. Hormonal disorders. prevention and treatment References: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p>	6%

16	Final Semester Evaluation / Final Semester Examination	<ol style="list-style-type: none"> 1. Based on a study of articles on the website provided, students can explain the role of cortisol in our bodies 2. Based on the study of articles on the website provided, students are able to make conclusions regarding the data/graphs presented 3. Based on a study of articles on the website provided, students describe actions that can reduce cortisol levels 4. Based on a study of articles on the website provided, students describe the implementation of research results in everyday life 5. Describe the structure and function of nucleic acids 6. Describe the process of protein synthesis 7. Describe the abnormalities that arise related to abnormalities in the protein synthesis process 	<p>Criteria: UAS 30%</p> <p>Form of Assessment : Test</p>	-	-	<p>Material: Hormone Structure, Function and Metabolism; Structure and Function of Nucleic Acids; Synthesis of Proteins, Lipids Library: <i>Leninger, AL. 1992, Biochemistry . New York: Worth Publishing Inc.</i></p> <p>Material: Hormone Structure, Function and Metabolism; Structure and Function of Nucleic Acids; Protein Synthesis, Lipids Library: <i>Isnawati, 2010. Biochemistry, Surabaya: Unesa Unipress</i></p> <p>Material: Hormone Structure, Function and Metabolism; Structure and Function of Nucleic Acids; Protein Synthesis, Lipids Library: <i>Rahayu, YS, Ratnasari, E., Isnawati. 2016. Biochemistry, Surabaya: Unesa Press.</i></p>	16%
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Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Practical Assessment	21.5%
3.	Practice / Performance	2.5%
4.	Test	26%
		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.