



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

Document  
Code

**SEMESTER LEARNING PLAN**

<b>Courses</b>	<b>CODE</b>	<b>Course Family</b>	<b>Credit Weight</b>			<b>SEMESTER</b>	<b>Compilation Date</b>																																											
Biochemistry I: Structure & Function	8420402037		T=2	P=0	ECTS=3.18	5	July 18, 2024																																											
<b>AUTHORIZATION</b>		<b>SP Developer</b>		<b>Course Cluster Coordinator</b>		<b>Study Program Coordinator</b>																																												
		.....		.....		Prof. Dr. Utiya Azizah, M.Pd.																																												
<b>Learning model</b>	Case Studies																																																	
<b>Program Learning Outcomes (PLO)</b>	PLO study program which is charged to the course																																																	
	Program Objectives (PO)																																																	
	PLO-PO Matrix																																																	
		<table border="1" style="margin: auto;"> <tr> <td style="width: 10%; text-align: center;">P.O</td> <td colspan="16"></td> </tr> </table>						P.O																																										
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	PO Matrix at the end of each learning stage (Sub-PO)																																																	
	<table border="1" style="margin: auto;"> <tr> <td style="width: 5%; text-align: center;">P.O</td> <td colspan="16" style="text-align: center;">Week</td> </tr> <tr> <td></td> <td style="width: 5%; text-align: center;">1</td> <td style="width: 5%; text-align: center;">2</td> <td style="width: 5%; text-align: center;">3</td> <td style="width: 5%; text-align: center;">4</td> <td style="width: 5%; text-align: center;">5</td> <td style="width: 5%; text-align: center;">6</td> <td style="width: 5%; text-align: center;">7</td> <td style="width: 5%; text-align: center;">8</td> <td style="width: 5%; text-align: center;">9</td> <td style="width: 5%; text-align: center;">10</td> <td style="width: 5%; text-align: center;">11</td> <td style="width: 5%; text-align: center;">12</td> <td style="width: 5%; text-align: center;">13</td> <td style="width: 5%; text-align: center;">14</td> <td style="width: 5%; text-align: center;">15</td> <td style="width: 5%; text-align: center;">16</td> </tr> </table>																P.O	Week																	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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<b>Short Course Description</b>	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.																																																	
<b>References</b>	<b>Main :</b>																																																	
	<ol style="list-style-type: none"> <li>1. Lehninger. 1988. Dasar-dasar Biokimia ,jilid 1, Terjemahan Maggi Thenawidjaya. Penerbit Erlangga, Jakarta</li> <li>2. Color Atlas of Biochemistry, 2005,Koolman, J and Roehm K. H. , 2ndedition. Stutgard New York</li> <li>3. Mathews,C. K and Van Holde K. E, 2000, Biochemistry ,second ed. , The Benjamin Cumming company, Inc.</li> <li>4. Nelson D. L. , and Cox M. M. , 2003, LehningerPrinciple of Biochemistry , 4th edition, University ofWinconsin-Madison</li> <li>5. Stryer, L. , 1988, Biochemistry , thirded. , New York : W. H. Freeman and company</li> </ol>																																																	
	<b>Supporters:</b>																																																	
<b>Supporting lecturer</b>	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.																																																	
<b>Week-</b>	<b>Final abilities of each learning stage (Sub-PO)</b>	<b>Evaluation</b>		<b>Help Learning, Learning methods, Student Assignments, [ Estimated time]</b>		<b>Learning materials [ References ]</b>	<b>Assesment Weight (%)</b>																																											
		<b>Indicator</b>	<b>Criteria &amp; Form</b>	<b>Offline ( offline )</b>	<b>Online ( online )</b>																																													
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)																																											

1	Understand the molecules of living organisms (biomolecules) and their composition	<p>1. Explain the characteristics of living substances.</p> <p>2. Explain the chemical processes in living substances.</p> <p>3. Explain that cells are the smallest part of life.</p> <p>4. Explain the parts of living cells.</p> <p>5. Explain the function of each organelle.</p> <p>6. Explain the organization of molecules in cells.</p> <p>7. Explain the use of energy in living systems to maintain their structure</p>	<p><b>Criteria:</b></p> <p>1. The assessment is carried out on the following aspects:</p> <p>2.1. Participation during lectures is carried out through observation (weight 2)</p> <p>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</p> <p>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</p> <p>5.4. Summative test as UAS score, given weight (3)</p> <p>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</p>	Questions and answers, discussion, reflection 2 X 50			0%
2	Understand the structure and function of Carbohydrates	<p>1. Classify carbohydrates based on the number of constituent monomers, functional groups and constituents.</p> <p>2. Explain asymmetry centers, ring structures, hawort, mutarotation and anomers.</p> <p>3. Explain the functions of monosaccharides, disaccharides and polysaccharides in biological systems.</p>	<p><b>Criteria:</b></p> <p>1. The assessment is carried out on the following aspects:</p> <p>2.1. Participation during lectures is carried out through observation (weight 2)</p> <p>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</p> <p>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</p> <p>5.4. Summative test as UAS score, given weight (3)</p> <p>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</p>	Questions and answers, discussion, reflection 2 X 50			0%

3	Understand the structure and function of Carbohydrates	<p>1. Classify carbohydrates based on the number of constituent monomers, functional groups and constituents.</p> <p>2. Explain asymmetry centers, ring structures, hawort, mutarotation and anomers.</p> <p>3. Explain the functions of monosaccharides, disaccharides and polysaccharides in biological systems.</p>	<p><b>Criteria:</b></p> <p>1.The assessment is carried out on the following aspects:</p> <p>2.1. Participation during lectures is carried out through observation (weight 2)</p> <p>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</p> <p>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</p> <p>5.4. Summative test as UAS score, given weight (3)</p> <p>6.The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</p>	<p>Questions and answers, discussion, reflection</p> <p>2 X 50</p>			0%
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5	Understand the structure and function of Proteins	<p>1. Explain the structure of amino acids and the classification of amino acids</p> <p>2. Explain the nature of acids and bases, amphoteries, isoelectric points, separation of amino acids</p>	<p><b>Criteria:</b></p> <p>1.The assessment is carried out on the following aspects:</p> <p>2.1. Participation during lectures is carried out through</p>	<p>Discussion Presentation</p> <p>2 X 50</p>			0%

(electrophoresis and chromatography), special reactions of amino acids 3. Explain the reaction of peptide bond formation 4. Explain the function of peptides in living systems 5. Explain the separation process by dialysis, gel filtration, electrophoresis 6. Explain the determination of amino acid series by hydrolysis and amino acid reactions with FDNB, dansyl chloride, Edman reagents 7. Explain the definition of homologous proteins 8. Explain fixed residues, non-fixed residues, series homology and examples of the importance of series homology from various species 9. Explain the classification of proteins based on function, constituent elements and shape 10. Explain configuration and conformation 11. Explain the structure of  $\alpha$ -helices, the types of amino acids that make up them, their properties and structure as constituents of keratin 12. Explain the structure of silk fibroin, and the differences in its properties from  $\alpha$ -helices 13. Explain the structure of the helix 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 joints 15. 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

observation (weight 2)  
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		<p>proteins 23. Explain the function of hemoglobin and myoglobin. 24. Explain sickle cell anemia and other disorders caused by gene mutations</p>				
6	Understand the structure and function of Proteins	<p>1. Explain the structure of amino acids and the classification of amino acids 2. Explain the nature of acids and bases, amphoteries, isoelectric points, separation of amino acids (electrophoresis and chromatography), special reactions of amino acids 3. Explain the reaction of peptide bond formation 4. Explain the function of peptides in living systems 5. Explain the separation process by dialysis, gel filtration, electrophoresis 6. Explain the determination of amino acid series by hydrolysis and amino acid reactions with FDNB, dansyl chloride, Edman reagents 7. Explain the definition of homologous proteins 8. Explain fixed residues, non-fixed residues, series homology and examples of the importance of series homology from various species 9. Explain the classification of proteins based on function, constituent elements and shape 10. Explain configuration and conformation 11. Explain the structure of - helices, the types of amino acids that make up them, their properties and structure as constituents of keratin 12. Explain the structure of silk fibroin, and the differences in its properties from - helices 13. Explain the structure of the helix 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 joints 15. Types and functions of globular proteins 16. Characteristics of the tertiary structure of globular proteins</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects: <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> </ol> </li> <li>5.4. Summative test as UAS score, given weight (3)</li> <li>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Discussion Presentation 2 X 50		0%

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7	Understand the structure and function of Proteins	<p>1. Explain the structure of amino acids and the classification of amino acids 2. Explain the nature of acids and bases, amphoteries, isoelectric points, separation of amino acids (electrophoresis and chromatography), special reactions of amino acids 3. Explain the reaction of peptide bond formation 4. Explain the function of peptides in living systems 5. Explain the separation process by dialysis, gel filtration, electrophoresis 6. Explain the determination of amino acid series by hydrolysis and amino acid reactions with FDNB, dansyl chloride, Edman reagents 7. Explain the definition of homologous proteins 8. Explain fixed residues, non-fixed residues, series homology and examples of the importance of series homology from various species 9. Explain the classification of proteins based on function, constituent elements and shape 10. Explain configuration and conformation 11. Explain the structure of - helices, the types of amino acids that make up them, their properties and structure as constituents of keratin 12. Explain the structure of silk fibroin, and the differences in its</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects: <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> </ol> </li> <li>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Discussion Presentation 2 X 50		0%

		<p>properties from - helices 13. Explain the structure of the helix 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 joints 15. 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 proteins 23. Explain the function of hemoglobin and myoglobin. 24. Explain sickle cell anemia and other disorders caused by gene mutations</p>				
8	Midterm exam		<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects:</li> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> <li>6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	<p>Giving a Subsummative written test-1 2 X 50</p>		0%

9	Understand the structure and function of enzymes	<p>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 <math>V_{max}</math> and <math>K_M</math>  9. Explain the Lineweaver-Burk equation  10. Explain the factors that influence enzyme activity  11. Explain the process of enzyme inhibition by inhibitors along with a binding model  12. Explain multi enzyme systems with</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects: <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> </ol> </li> <li>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Study material from mandatory books, ask questions, answer 2 X 50 practice questions			0%
10	Understand the structure and function of enzymes	<p>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 <math>V_{max}</math> and <math>K_M</math>  9. Explain the Lineweaver-Burk equation  10. Explain the factors that influence enzyme activity  11. Explain the process of enzyme inhibition by inhibitors along with a binding model  12. Explain multi enzyme systems with</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects: <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> </ol> </li> <li>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Study material from mandatory books, ask questions, answer 2 X 50 practice questions			0%



11	Understand the structure and function of vitamins and minerals	<p>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. Mention the minerals needed in nutrition, both plants and animals.  7. Explain the role of minerals in enzyme function.</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects: <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> </ol> </li> <li>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Study material from mandatory books, ask questions, answer 2 X 50 practice questions			0%
12	Understand the structure and function of vitamins and minerals	<p>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. Mention the minerals needed in nutrition, both plants and animals.  7. Explain the role of minerals in enzyme function.</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects: <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> </ol> </li> <li>6. The final NA is (participation value x 2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Study material from mandatory books, ask questions, answer 2 X 50 practice questions			0%

13	Understand the structure and function of nucleic acids	<p>1. Explain the components of nucleosides, 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, protein synthesis</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects:             <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> </ol> </li> <li>6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Questions and answers, discussion, reflection 2 X 50			0%
14	Understand the structure and function of lipids and bio-membranes	<p>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 structure of the membrane mosaic 5. Explain the nature of the lipid bilayer in the membrane 6. Explain the function of the membrane</p>	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1. The assessment is carried out on the following aspects:             <ol style="list-style-type: none"> <li>2.1. Participation during lectures is carried out through observation (weight 2)</li> <li>3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2)</li> <li>4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3)</li> <li>5.4. Summative test as UAS score, given weight (3)</li> </ol> </li> <li>6. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10</li> </ol>	Questions and answers, answering 2 X 50 practice questions			0%

15	Understand the structure and function of Hormones	Describe the role of each hormone in primary and secondary target hormones	<b>Criteria:</b> 1.The assessment is carried out on the following aspects: 2.1. Participation during lectures is carried out through observation (weight 2) 3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2) 4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3) 5.4. Summative test as UAS score, given weight (3) 6.The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10	Questions and answers, answering 2 X 50 practice questions			0%
16	UAS		<b>Criteria:</b> 1.The assessment is carried out on the following aspects: 2.1. Participation during lectures is carried out through observation (weight 2) 3.2. Subsummative test, carried out twice assessing all relevant indicators through written exams, averaged and weighted (2) 4.3. Structured assignment assessment from each teacher and the scores are averaged, then given a weight (3) 5.4. Summative test as UAS score, given weight (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
		0%

## 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.