



**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 II: Metabolism	8420403034		T=3 P=0 ECTS=4.77	6	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>	Project Based Learning																
<b>Program Learning Outcomes (PLO)</b>	PLO study program which is charged to the course																
	Program Objectives (PO)																
	PLO-PO Matrix																
		P.O															
	PO Matrix at the end of each learning stage (Sub-PO)																
	P.O	Week															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<b>Short Course Description</b>	Study of catabolism and anabolism and regulation of carbohydrate, lipid, protein biomolecules, oxidative phosphorylation and electron transfer in photosynthesis, as well as genetic information processing																
<b>References</b>	<b>Main :</b>																
	1. Ayala, F. J. and Kieger, J. A. 1984.Modern Genetics. California: The Benyamin Cummings Publishing Company Inc. . 2. Koolman, J. and Roehm, K. H. 2005.Color Atlas of Biochemistry. 2 nd edition. New York: Stutgard. 3. Lehninger. 1988.Dasar-Dasar Biokimia(I,II,III). Jakarta: Erlangga. 4. Mathew,C. K. , van Holde, K. E. , Ahern, K. G. 1999.Biochemistry.San Fransisco: Addison-Wesley Pub. Co. 5. Murray R. K. , Granner R. K. , Mayes P. A. , and Rotwell V. W. 2003.Harper 19s Illustrated Biochemistry, The McGraw-Hill Companies 4. Nelson, D. L. and Cox, M. M. 2003.Lehninger Principle of Biochemistry. 4th edition. Madison: University of Winconsin. 5. Styer, L. , 1988.Biochemistry.New York: W. H. Freeman and Company																
	<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>Assessment 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 some aspects of metabolism and its role in living cells	1. Explain the CO <sub>2</sub> cycle and N <sub>2</sub> cycle 2. Explain the relationship between Autotrophs and Heterotrophs 3. Distinguish between catabolism and anabolism 4. Explain the ATP, NADH/NAD, FADH <sub>2</sub> /FAD cycles	<b>Criteria:</b> Tasks and participation	Questions and answers, discussion, reflection 3 X 50			0%
2	Understand the formation of ATP in various carbohydrate catabolism pathways, their regulation and interrelationships	1. Describe the relationship between the catabolism and anabolism pathways of carbohydrates 2. Understand the sequence of stages of the glycolysis reaction 3. Explain the role of enzymes in each stage of glycolysis 4. Distinguish between the stages of the aerobic and anaerobic pathways 5. Calculate the energy produced by glycolysis 6. Explain the pathway for the entry of other saccharides into glycolysis 7. Explain the regulation of glycolysis	<b>Criteria:</b> Participation and tasks	Questions and answers, discussions and reflections. Assignment 3 X 50			0%
3	Understand the formation of ATP in various carbohydrate catabolism pathways, their regulation and interrelationships	1. Explain the enzymatic degradation of starch, glycogen 2. Define glycogenolysis 3. Explain the enzymes that play a role in glycogenolysis in the liver and extra hepatic	<b>Criteria:</b> Attached	Questions and answers, discussions and reflections. Assignment 3 X 50			0%
4	Understand the formation of ATP in various carbohydrate catabolism pathways, their regulation and interrelationships	1. Explain the role of the citric acid cycle 2. Explain each stage of the citric acid cycle 3. Explain the regulation of the citric acid cycle 4. Calculate the energy produced by the citric acid cycle 5. Explain the characteristics of the alternative HMP shunt pathway	<b>Criteria:</b> Participation and Tasks	Questions and answers, discussions and reflections. Assignment 3 X 50			0%

5	Understand the formation of ATP in various carbohydrate catabolism pathways, their regulation and interrelationships	1. Explain the meaning of phosphorylation, oxidative phosphorylation 2. Determine the direction of electrons based on DG0 3. Explain the ATP and NADPH/NADH cycles 4. Name various inhibitory compounds and the location of the obstacles 5. Distinguish between the glycerophosphate and malate aspartate shuttle systems	<b>Criteria:</b> Tasks and participation	Questions and answers, discussion and reflection on the 3 X 50 Assignment		0%
6	Understand the formation of ATP in various carbohydrate anabolism pathways, their regulation and interrelationships	1. Briefly describe the reactions of gluconeogenesis 2. Name 4 enzymes that differentiate it from glycolysis 3. Explain the precursors of gluconeogenesis 4. Explain the control of gluconeogenesis 5. Differentiate from glycolysis 6. Explain the stages of glycogenesis reactions 7. Explain the enzymes that play a role in glycogenesis 8. Control of carbohydrate catabolism and anabolism by the hormones insulin and glucagon	<b>Criteria:</b> Participation and Tasks	Questions and answers, discussion and reflection, Assignment 3 X 50		0%
7	Understand the process of photosynthesis	1. Explain the photochemical reaction system 2. Mention the stages of the light reaction 3. Mention the reaction stages of the Calvin cycle 4. Explain the use of the Hatch-Slack cycle 5. Mention the reaction stages of the Hatch-Slack cycle	<b>Criteria:</b> Tasks and participation	Questions and answers, discussion and reflection Practice questions 3 X 50		0%
8	UTS		<b>Criteria:</b> UTS value	Giving mid-semester written test 2 X 50		0%

9	Understanding amino acid catabolism and its regulation	<p>1. Explain the main function of amino acid catabolism and the role of amino acids as an energy source</p> <p>2. Explain the intermediate pathway for amino acid catabolism</p> <p>3. Explain the transaminase reaction in amino acids to form other amino acids</p> <p>4. Explain the mechanism for transporting ammonia in the body</p> <p>5. Explain the differences in nitrogen secretion pathways in ammonotelic, ureotelic, and uricotelic.</p> <p>6. Explain the Urea Cycle</p>	<b>Criteria:</b> Participation and tasks	Questions and answers, discussion and reflection 3 X 50			0%
10	Understanding amino acid anabolism and its regulation	<p>1. Explain the synthesis of amino acids from ammonium through 3 enzymatic reactions: glutamate dehydrogenase, glutamine synthetase and carbamoyl-phosphate synthetase and their regulation</p> <p>2. Explain the synthesis of amino acids from the reaction of glutamate transaminase with -keto acid</p> <p>3. Explain purine degradation</p> <p>4. Explain purine catabolism to uric acid</p> <p>5. Explain pyrimidine degradation</p> <p>6. Explain the synthesis of AMP and GMP from IMP</p> <p>7. Explain the role of carbamoyl phosphate and aspartate as precursors of pyrimidine bases</p> <p>8. Explain the multienzyme system in the synthesis of pyrimidine bases</p>	<b>Criteria:</b> Participation and Tasks	Questions and answers, discussion and reflection Practice questions 3 X 50			0%

11	Understand the series of catabolism and anabolism processes of various main lipid compounds	1. Briefly describe the b-stages of oxidation. 2. Calculate the energy produced from the complete oxidation of fatty acids. 3. Explain additional steps for the oxidation of odd fatty acids. 4. Briefly describe the second stage of oxidation of unsaturated fatty acids 5. Explain the difference in oxygen energy with saturated fatty acids 6. Explain the meaning of alpha and beta oxidation 7. Explain how the formation and effects of ketone bodies	<b>Criteria:</b> Participation and tasks	Questions and answers, discussion and reflection Practice questions 3 X 50			0%
12	Understand the series of catabolism and anabolism processes of various main lipid compounds	1. Describe the anabolism of fatty acids starting from mitochondrial acetyl CoA 2. Explain the differences between the anabolism of saturated and unsaturated fatty acids 3. Describe the second stage of TG anabolism 4. Explain the principles of phosphoglyceride anabolism 5. Mention the hormones, enzymes and metabolites that play a role in lipid regulation 6. Explain the regulation of lipolysis and lipogenesis (everyday cases).7. Mention the various main intermediates of squalene biosynthesis, cholesterol 8. Explain the regulatory reactions of biosynthesis 9. Explain the relationship between cholesterol and atherosclerosis.	<b>Criteria:</b> Tasks and participation	Questions and answers, discussion and reflection Practice questions 3 X 50			0%
13	Understand each stage of genetic information processing and its control	1. Explain the replication model 2. Explain DNA polymerase 3. Explain the replication mechanism	<b>Criteria:</b> Participation and tasks	Questions and answers, discussions. 3 X 50			0%
14	Understand each stage of genetic information processing and its control	1. Explain the initiation stage 2. Explain the elongation stage 3. Explain the termination stage 4. Explain negative control (Lacperon)	<b>Criteria:</b> Participation and tasks	Questions and answers, discussion, summarizing 3 X 50			0%
15	Understand each stage of genetic information processing and its control	1. Explain the initiation stage 2. Explain the elongation stage 3. Explain the termination stage	<b>Criteria:</b> Participation and tasks	Questions and answers, discussion, summarizing 3 X 50			0%

16	UAS		Criteria: UAS scores	Giving a written test for the final semester exam 2 X 50			0%
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**Evaluation Percentage Recap: Project Based Learning**

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.**