



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
Metabolism and the Flow of Genetic Information	4720103199		T=3	P=0	ECTS=4.77	4	July 17, 2024
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator	
			Dr. Amaria, M.Si.	

Learning model	Case Studies
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Program Learning Outcomes (PLO)	PLO study program that is charged to the course																																																																																				
	Program Objectives (PO)																																																																																				
	PO - 1	Able to solve science and technology problems in the general field of chemistry and in simple scopes such as identification, analysis, isolation, transformation and synthesis of micromolecules, through the application of structure, properties, molecular changes, energy and kinetics.																																																																																			
	PO - 2	Able to solve science and technology problems in the field of biochemistry, especially those related to metabolism and processing of genetic information, based on scientific studies and methods of analysis and synthesis, as well as the application of relevant technology.																																																																																			
	PO - 3	Have knowledge about: a) metabolism and regulation of carbohydrate, lipid and protein biomolecules, b) electron transfer processes in photosynthesis and c) genetic information processing processes.																																																																																			
	PLO-PO Matrix																																																																																				
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Short Course Description	Study of catabolism and anabolism and regulation of carbohydrate biomolecules, lipids, proteins, oxidative phosphorylation and electron transfer in photosynthesis, as well as genetic information processing
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References	Main :	
		<ol style="list-style-type: none"> 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's Illustrated Biochemistry , The McGraw-Hill Companies 6. Nelson, D.L. and Cox, M.M. 2003. Lehninger Principle of Biochemistry . 4th edition. Madison: University of Winconsin. 7. Styer, L., 1988. Biochemistry. New York: W.H. Freeman and Company
	Supporters:	

Supporting lecturer		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 Abdurrahman 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 some aspects of metabolism and its role in living cells	1. Explain the CO ₂ and N ₂ cycle 2. Explain the relationship between heterotrophs and autotrophs 3. Explain the difference between catabolism and anabolism 4. Explain the ATP, NADH/NAD, FADH ₂ /FAD cycles	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture, discussion, question and answer 3x50 minutes		Material: Macro and micro aspects of metabolism, energy cycles (Reference: <i>Lehninger. 1988. Basics of Biochemistry (I, II, III). Jakarta: Erlangga.</i>	5%
2	Understanding carbohydrate catabolism: ATP Formation and Glycolysis	1. Analyze 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	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture and case study Student assignment: discuss the stages of glycolysis through EMP Pathway Images		Material: Carbohydrate catabolism: glycolysis, aerobic reactions Reference: <i>Lehninger. 1988. Basics of Biochemistry (I, II, III). Jakarta: Erlangga.</i>	5%
3	Understand the catabolism of disaccharides and polysaccharides and the mechanism of their entry into the glycolysis pathway	1. Explain the enzymatic degradation of disaccharides and polysaccharides 2. Understand the mechanism of entry of disaccharides and polysaccharides in the glycolysis pathway 3. Explain the enzymes that play a role in glycogenolysis in the liver and extra hepatic	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture, discussion and question and answer Student assignment: discuss the stages of catabolism in disaccharides and polysaccharides and the mechanism of entry into the glycolysis pathway		Material: Catabolism of disaccharides and polysaccharides; pathway of entry into glycolysis References: <i>Mathew, CK, van Holde, KE, Ahern, KG 1999. Biochemistry. San Francisco: Addison-Wesley Pub. Co.</i>	5%
4	Understanding the aerobic pathway of carbohydrate catabolism	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 yield of the citric acid cycle 5. Explain the peculiarities of the alternative HMP shunt pathway	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture, discussion and question and answer Student assignment: discuss the differences between aerobic and anaerobic pathways 3 x 50 minutes		Material: - Citric acid cycle (printed book, journal) References: <i>Mathew, CK, van Holde, KE, Ahern, KG 1999. Biochemistry. San Francisco: Addison-Wesley Pub. Co.</i>	7%

5	Understand the process of ATP formation through oxidative phosphorylation		Form of Assessment : Participatory Activities	Form: lecture Method: Lecture, discussion and question and answer Student assignment: discuss the differences between the Glycerolphosphate and MalateAspartate shuttle systems and the amount of ATP produced in both pathways 3x50 minutes		Material: Oxidative phosphorylation, metabolic system, ATP calculation, regulation of carbohydrate catabolism. Reference: <i>Lehninger. 1988. Basics of Biochemistry (I, II, III). Jakarta: Erlangga.</i>	7%
6	Understand the use of ATP in various carbohydrate anabolism pathways, their regulation and relationships	1. Explain the differences between catabolism and anabolism pathways in carbohydrates 2. Explain the stages of gluconeogenesis and glycogenesis reactions 3. Explain the control of carbohydrate anabolism by the hormones insulin and glucagon	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture, discussion and question and answer		Material: Pathways of carbohydrate anabolism, gluconeogenesis, glycogenesis, and control of carbohydrate anabolism. Reference: <i>Nelson, DL and Cox, MM 2003. Lehninger Principle of Biochemistry. 4th edition. Madison: University of Wisconsin.</i>	7%
7	Understand the process of photosynthesis	1. Explain the photochemical reaction system 2. Describe the stages of the light reaction 3. Describe the reaction stages of the Calvin cycle 4. Explain the use of the Hatch-slack cycle 5. Analyze the reaction stages of the Hatch-Slack cycle	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture and PJB Student assignment: make a video about the photosynthesis process as a group		Matter: Dark – light reactions, Calvin Cycle, Hatch – Slack Cycle References: <i>Nelson, DL and Cox, MM 2003. Lehninger Principle of Biochemistry. 4th edition. Madison: University of Wisconsin.</i>	6%
8	UTS		Form of Assessment : Test				10%
9	Understanding amino acid catabolism and its regulation	1. Explain the main function of amino acid catabolism and the role of amino acids as a source of energy. 2. Explain the intermediate pathway for amino acid catabolism. 3. Explain the transaminase reaction in amino acids to form other amino acids. 4. Explain the mechanism for transporting ammonia in the body. 5. Explain the differences in nitrogen secretion pathways in ammonotelic, ureotelic, and uricotelic. 6. Explain the Urea Cycle	Form of Assessment : Participatory Activities	Form: lecture Method: Lecture, discussion and question and answer Student assignment: discuss the differences in nitrogen secretion pathways in ammonotelic, ureotelic, and uricotelic. Explain the Urea Cycle		Material: Intermediate pathways for amino acid catabolism, transaminase reactions, nitrogen secretion pathways in ammonotelic, ureotelic and uricotelic, urea cycle References: <i>Mathew, CK, van Holde, KE, Ahern, KG 1999. Biochemistry. San Francisco: Addison-Wesley Pub. Co.</i>	7%

10	Understanding amino acid anabolism and its regulation	1. Explain the synthesis of amino acids from ammonium through 3 enzymatic reactions: glutamate dehydrogenase, glutamin synthetase and carbamoyl-phosphate synthetase and their regulation 2. Explain the synthesis of amino acids from the reaction of glutamate transaminase with α -keto acid	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture, discussion and question and answer	Material: Synthesis of amino acids from ammonium through 3 enzymatic reactions and their regulation, synthesis of amino acids from the glutamate transaminase reaction with α -keto acid. References: <i>Mathew, CK, van Holde, KE, Ahern, KG 1999. Biochemistry. San Francisco: Addison-Wesley Pub. Co.</i>	7%
11	Understand the series of catabolism processes of various main lipid compounds	1. Briefly describe the stages of \square 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 stages of oxidation of unsaturated fatty acids. 5. Calculate the ATP produced from the oxidation of fatty acids. 6. Describe how ketones are formed and the effects	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture and case study Student assignment: discuss how much ATP is produced from the oxidation of fatty acids	Material: Catabolism of saturated fatty acids, catabolism of unsaturated fatty acids, odd fatty acids and ketogenesis and control. References: <i>Styer, L., 1988. Biochemistry. New York: WH Freeman and Company</i>	7%
12	Understand the series of anabolism processes of various main lipid compounds	1. Describe the anabolism of fatty acids. 2. Explain the difference between the anabolism of saturated and unsaturated fatty acids. 3. Explain the regulation of lipogenesis (everyday cases). 4. Explain the relationship between cholesterol and atherosclerosis.	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture and case study Student assignment: discuss the relationship between cholesterol and atherosclerosis.	Material: Synthesis of saturated, unsaturated and odd fatty acids References: <i>Mathew, CK, van Holde, KE, Ahern, KG 1999. Biochemistry. San Francisco: Addison-Wesley Pub. Co.</i>	10%
13	Understand each stage of genetic information processing and its control	1. Explain the model of replication 2. Explain DNA polymerase 3. Explain the mechanism of replication 4. Explain the difference between replication on the leading strand and the lagging strand	Criteria: Oral test Form of Assessment : Participatory Activities	Form: lecture Method: Lecture and question and answer Student assignment: discuss the differences between replication on the leading strand and the lagging strand	Material: Replication Bibliography: <i>Ayala, FJ and Kieger, JA 1984. Modern Genetics . California: The Benjamin Cummings Publishing Company Inc..</i>	7%

14	1. Understand each stage of genetic information processing and its control 2.1. Explain the meaning of transcription 2. Explain the initiation stage of transcription 3. Explain the elongation stage of transcription 4. Explain the termination stage of transcription 5. Explain the maturation stage of transcription in the Eukaryot group 6. Explain the control of transcription (Lacperon)		Form of Assessment : Project Results Assessment / Product Assessment	Form: lecture Method: Lecture, discussion and question and answer		Material: Transcription Bibliography: <i>Lehninger. 1988. Basics of Biochemistry (I, II, III). Jakarta: Erlangga.</i>	10%
15	Understand each stage of genetic information processing and its control		Criteria: Oral test	Form: lecture Method: Lecture, discussion and question and answer		Material: Translation Bibliography: <i>Lehninger. 1988. Basics of Biochemistry (I, II, III). Jakarta: Erlangga.</i>	10%
16	UAS		Form of Assessment : Test				0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	80%
2.	Project Results Assessment / Product Assessment	10%
3.	Test	10%
		100%

Notes

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Forms of assessment:** test and non-test.
- 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.
- 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.
- Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
- 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%.
- TM=Face to face, PT=Structured assignments, BM=Independent study.

