



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

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date
Bioprocess	1234502006	Compulsory Study Program Subjects	T=2 P=0 ECTS=4.48	1	April 28, 2023
AUTHORIZATION	SP Developer		Course Cluster Coordinator	Study Program Coordinator	
	Prof.Dr.Yuliani,M.Si		Prof.Dr.Yuliani,M.Si	Prof. Dr. Yuliani, M.Si.	

Learning model	Case Studies
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Program Learning Outcomes (PLO)	PLO study program that is charged to the course																																																																																																																							
	PLO-6	Able to show a responsible attitude towards work in their field of expertise by paying attention to academic ethics in carrying out their professional duties, and able to embody the character of faith, intelligence, independence, honesty, caring and toughness in daily behavior.																																																																																																																						
	PLO-7	Applying the concept of eduecopreneurship based on local wisdom and having a leadership spirit to support community independence in the era of the Industrial Revolution.																																																																																																																						
	Program Objectives (PO)																																																																																																																							
	PO - 1	Able to develop knowledge and technology in the field of bioprocesses based on local wisdom through research to produce innovative work (Knowledge)																																																																																																																						
	PO - 2	Applying the concept of Bioprocess and education based on local wisdom and having a leadership spirit to support community independence in the era of the Industrial Revolution. (Special skills)																																																																																																																						
	PO - 3	Able to develop logical and critical thinking and be able to apply it in the fields of biology and bioprocesses (General skills)																																																																																																																						
	PO - 4	Able to organize ideas, thoughts and scientific arguments in the field of biology and bioprocesses and communicate them to the public (General Skills)																																																																																																																						
	PO - 5	Able to demonstrate a responsible attitude in completing Bioprocess tasks that are relevant to the local wisdom of the Indonesian nation (attitude)																																																																																																																						
	PLO-PO Matrix																																																																																																																							
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	PO Matrix at the end of each learning stage (Sub-PO)																																																																																																																							
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Short Course Description	Studies on Bioprocesses study Bioprocesses in Plants, Animals and Microorganisms, Cell Biomass, Bioenzymes, Metabolites, Bioconversion and timelines of developments in bioprocess engineering, breakthroughs in bioprocesses, new trends in bioprocess engineering, advances in materials and nano, and bioprocesses in in producing chemical and biological products, which supports strengthening the concept of utilizing natural resources based on local wisdom to improve life skills as a basis for establishing the spirit of Bioecopreneurship. This course is presented in theory and assignments, using the case study method.
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References	Main :
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1. Clarke, K.B. 2014. Bioproses Engineering. Woodlead Publishing
2. Seraano-Ruiz, Juan Carlos. 2015. New Microbial Technologies: Toward More Sustainable Production Methods. Canada: Apple Academic press, Inc.
3. Ragauskas, Arthur J. 2014. "Materials for Biofuels" Materials and Energy, Volume 4. New Jersey: World Scientific Publishing, Inc
4. Pogaku Ravindra. 2015. Advances in Bioprocess Technology. Springer. p. 484. ISBN 9783319179155
5. D. Voet and Voet J.G., 2011. Biochemistry 4th. edition. John Wiley and Son, INC.
6. Morris, C; J.A. Heinemann and L.M. Hunt. 2009. Assessing Plant Biopharming in New Zealand: Knowledge from the arable sector. Constructive Conservation. Karero Whakaaetanga. New Zealand
7. Yuliani, Nur Kuswanti, Yuni Sri rahayu, 2021. Bioproses. Surabaya: University Press Unesa.

Supporters:

1. Henrikson, R. 2009 Earth Food Spirulina. Ronore Enterprises. Inc. Hawai
2. Farrell, J. and V.S. Reed 2010: National algal Biofuel Technology Roadmap. US Dipertement of Energy. USA.

Supporting lecturer Dr. Nur Kuswanti, M.Sc.St.
Prof. Dr. Yuliani, M.Si.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (offline)	Online (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Understand the meaning of bioprocess and its role in producing biological products	<ol style="list-style-type: none"> 1. Describe the meaning of bioprocess and the scope of bioprocess. 2. Provide examples of the role of organisms in bioprocesses by utilizing biodiversity and local Indonesian wisdom 3. Analyze the role of Bioprocess in producing Biological products 	<p>Criteria: Form: Written Test and Assignment. Criteria: Indicators achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Case method</p> <p>1. Pre existing Material. The lecturer asks students to individually read references regarding bioprocesses and their role in producing biological products. Supported by the LKM contained in the Bioprocess Book (Yuliani, et al).</p> <p>2. Activities in groups. The lecturer provides problem cases regarding the role of organisms in bioprocesses by utilizing biodiversity and local Indonesian wisdom. Students explore the references obtained to answer the various roles of bioprocesses in biological products. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions</p> <p>3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups, and classically conclusions are obtained from the discussions carried out. Students are asked to read further references...</p> <p>2 X 50</p>		<p>Material: Bioprocess Technology and its Role in Biological Products</p> <p>References: Yuliani, Nur Kuswanti, Yuni Sri Rahayu, 2021. Bioprocess. Surabaya: University Press Unesa.</p>	5%

2	Analyze the role of plants, animals and other organisms and their metabolites in bioprocesses to produce industrial and medicinal products	<p>1. Analyzing the role of plant, animal and other organism metabolites in industrial and pharmaceutical bioprocesses</p> <p>2. Provide examples of various organisms that play a role in industrial and medicinal bioprocesses by utilizing Indonesia's biodiversity and local wisdom</p> <p>3. Summarizes the various stages of bioprocesses in industry and medicine involving plant, animal and other organism metabolites</p>	<p>Criteria: Performance reports/assessments are assessed as ASSIGNMENTS with a weight of 30%, UTS with a weight of 20%, Student activities and responses during learning activities are assessed as participation, a weight of 20%, UAS with a weight of 30%</p> <p>Form of Assessment : Participatory Activities</p>	<p>Case method 1. Pre-existing Material. The lecturer asks students to individually read references regarding the role of plant, animal and other organism metabolites in industrial bioprocesses and pharmaceuticals. Searching for references was assigned by the lecturer at the previous meeting, and was emphasized at the 2nd meeting. 2. Activities in groups. The lecturer provides problem cases regarding the analysis of various organisms that play a role in industrial and medicinal bioprocesses and their mechanisms by utilizing biodiversity and local Indonesian wisdom. Students are asked to conduct a literature review. This activity is supported by Bioprocess teaching materials. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups, and classically obtained problem solving and conclusions from the activities carried out. 2 X 50</p>		<p>Material: metabolites of plants, animals and other organisms in industrial bioprocesses and pharmaceuticals. Reference: Pogaku Ravindra. 2015. <i>Advances in Bioprocess Technology</i>. Springer. p. 484. ISBN 9783319179155</p>	5%
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3	Analyzing the role of plants and their metabolites in bioprocesses to produce food products	<ol style="list-style-type: none"> 1. Analyzing the role of plants in the bioprocess of producing food 2. Provide examples of various plants that play a role in food bioprocessing by utilizing biodiversity and local Indonesian wisdom 3. Summarize the various stages of bioprocessing in food processing 	<p>Criteria: Form: Written Test and Assignment. Criteria: Indicators achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Case method</p> <ol style="list-style-type: none"> 1. Pre-existing Material. The lecturer asks students to individually read references from books and journals regarding the role of plants and their metabolites in the bioprocess to produce food products. This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in groups. The lecturer provided problem cases regarding various organisms that play a role in food bioprocessing technology by utilizing biodiversity and local Indonesian wisdom. Students are asked to provide their ideas and opinions based on the references they read. In this activity, students can develop ideas to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups, and classically obtained problem solving and conclusions from the activities carried out. Students are asked to make a report on the results of the discussion and read references for the next meeting <p>2 X 50</p>	<p>Material: Plants and their metabolites in bioprocesses to produce food products</p> <p>References: Morris, C; JA Heinemann and LM Hunt .2009. <i>Assessing Plant Biopharming in New Zealand: Knowledge from the arable sector. Constructive Conservation.</i> Karero Whakaaetanga. New Zealand</p>	5%
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4	Analyzing the role of plants and their metabolites in bioprocesses to produce bioenergy/biofuel products	<ol style="list-style-type: none"> Analyzing the role of plants in the bioprocess of producing bioenergy Provide examples of plants that produce bioenergy/biofuel by utilizing Indonesia's biodiversity and local wisdom Explain the stages of the bioprocess mechanism in making bioenergy/biofuel 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Presentation discussion The lecturer facilitates student-centered learning through group discussions and is responsible for finding concepts (based on literature reviews from textbooks and journals) regarding the role of plants and their metabolites in bioprocesses to produce bioenergy/biofuel products based on local Indonesian wisdom. Students then present the results of the group's work. Lecturer and students conclude the results of the discussion. Students are asked to visit the website and look for various products from bioprocess technology based on local wisdom that will be used for the next meeting 2 X 50</p>		<p>Material: Bioprocess Technology in Biofuel/Bioenergy Reference: <i>Ragauskas, Arthur J. 2014. "Materials for Biofuels" Materials and Energy, Volume 4. New Jersey: World Scientific Publishing, Inc</i></p>	5%
5	Communicate the role of plants and their metabolites in bioprocesses to produce products	Communicating the various roles of plants in bioprocesses based on local wisdom	<p>Criteria: Performance reports/assessments are assessed as ASSIGNMENTS with a weight of 30%, UTS with a weight of 20%, Student activities and responses during learning activities are assessed as participation, a weight of 20%, UAS with a weight of 30%</p> <p>Form of Assessment : Participatory Activities</p>	<p>Discussions, article analysis, presentations Lecturers facilitate student-centered learning through group discussions and are responsible for discovering various concepts (based on literature reviews from textbooks and journals) regarding the role of plants and their metabolites in bioprocess technology to produce various products based on local wisdom. Students then present the results of their group work. Lecturer and students conclude the results of the discussion. Students are asked to read the references for the next meeting 2 X 50</p>		<p>Material: Bioprocess Technology and Plants that produce Biological Products Bibliography: <i>Clarke, KB 2014. Bioprocess Engineering. Woodlead Publishing</i></p>	5%

6	Analyzing Bioprocess mechanisms in cell Biomass	<ol style="list-style-type: none"> 1. Describe the mechanism of cell growth/biomass 2. Analyze cell growth over a certain period of time 3. Provide an example of the role of cell biomass by utilizing biodiversity and local wisdom 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Case method</p> <ol style="list-style-type: none"> 1. Pre-existing Material. The lecturer asks students to individually read references regarding Bioprocess mechanisms in cell biomass logically and critically for application in Biological products. This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in groups. The lecturer provides problem cases regarding the role of cell biomass in bioprocess products by utilizing biodiversity and local wisdom. Students are asked to discuss based on the references they have read. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups, and classically obtained problem solving and conclusions from the activities carried out. <p>2 X 50</p>	<p>Material: Cell Biomass Bioprocess Reference: <i>Seraano-Ruiz, Juan Carlos. 2015. New Microbial Technologies: Toward More Sustainable Production Methods. Canada: Apple Academic press, Inc.</i></p>	5%
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7	Analyzing Bioprocess mechanisms in cell Biomass	<ol style="list-style-type: none"> Analyze the role of organisms in cell growth/biomass mechanisms Explain the factors that influence cell growth and biomass 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Discussion, analysis of presentation articles. Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature reviews from textbooks and journals) regarding analysis of the role of organisms in cell growth/biomass mechanisms. Students then present the results of their group work. Lecturer and students conclude the results of the discussion. Students are asked to read the references for the next meeting 2 X 50</p>		<p>Material: Bioprocess technology and mechanisms of cell biomass as a biological product. Reference: <i>Henrikson, R. 2009 Earth Food Spirulina. Ronore Enterprises. Inc. Hawaii</i></p>	5%
8	Midterm exam	<p>Performance reports/assessments are assessed as ASSIGNMENTS with a weight of 30%, UTS with a weight of 20%, Student activities and responses during learning activities are assessed as participation, a weight of 20%, UAS with a weight of 30%</p>	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Test</p>	<p>Written Test 2 X 50</p>		<p>Material: Materials 1 to 7 References: <i>Clarke, KB 2014. Bioprocess Engineering. Woodhead Publishing</i></p>	10%
9	Analyzing the use of microorganisms and other organisms in producing fermentation products, harvesting and purifying fermentation products	<ol style="list-style-type: none"> Describe fermentation k Provide examples of the use of organisms in the bioprocess of fermented products by utilizing Indonesia's biodiversity Explain the stages of the harvesting and purification mechanism of the product 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Presentation discussion Lecturers facilitate student-centred learning through group discussions and are responsible for finding concepts (based on literature review) regarding the use of microorganisms and other organisms in producing fermentation products, systematic harvesting and purification of fermentation products. Students then present the results of their group work. Lecturer and students conclude the results of the discussion. Students are asked to read references that will be used for the next meeting 2 X 50</p>		<p>Material: Bioprocess Fermentation Products Reference: <i>Pogaku Ravindra. 2015. Advances in Bioprocess Technology. Springer. p. 484. ISBN 9783319179155</i></p>	5%

10	Communicate the role of organisms in bioprocesses for various Biological products related to cell biomass and fermentation	Communicate the role of organisms in bioprocesses for various Biological products related to cell biomass and fermentation	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Case method 1. Pre existing Material. The lecturer asks students to individually read references regarding the role of organisms in bioprocesses for various Biological products related to cell biomass and fermentation. This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in groups. The lecturer provides problem cases regarding the role of organisms in bioprocesses for various biological products related to cell biomass and fermentation based on local wisdom. Students are asked to solve problems based on the references they read. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups. and classically obtained problem solving and conclusions from the discussions carried out. Students make reports in independent assignments. 2 X 50</p>		<p>Material: Cell Biomass and Fermentation References: Yuliani, Nur Kuswanti, Yuni Sri Rahayu, 2021. <i>Bioprocess</i>. Surabaya: University Press Unesa.</p>	5%
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11	Analyze the role of animals, plants and other organisms in bioconversion	<ol style="list-style-type: none"> 1. Analyze the role of organisms in bioconversion mechanisms 2. Provide examples of the use of organisms in bioconversion by utilizing Indonesia's biodiversity 3. Explain the factors that influence the bioconversion process in various products 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Case method 1. Pre-existing Material. The lecturer asks students to individually read references regarding the role of animals, plants and other organisms in bioconversion. This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in the group. The lecturer provides cases of problems regarding the role of animals, plants and other organisms in bioconversion. Students are asked to conduct discussions to solve problems. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups, and classically obtained problem solving and conclusions from class discussions. 2 X 50</p>		<p>Material: Bioprocess Bioconversion technology Library: Pogaku Ravindra .2015. <i>Advances in Bioprocess Technology</i>. Springer. p. 484. ISBN 9783319179155</p>	5%
12	Understand the application of enzymes and enzyme mobilization in bioprocesses	<ol style="list-style-type: none"> 1. Analyzing the role of enzymes in bioprocess technology 2. Explain the stages of enzyme immobilization 3. Analyzing the role of animals and other organisms in bioprocesses to produce enzyme technology 4. Provide examples of various products resulting from animal bioprocessing by utilizing local Indonesian wisdom 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <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 enzymes, mobilizing enzymes in bioprocesses and applying enzymes. Students then present the results of their group work. Lecturer and students conclude the concept of enzyme technology in bioprocesses. Students are asked to read references that will be used for the next meeting 2 X 50</p>		<p>Material: Enzyme Bioprocess Technology and enzyme mobilization Reference: D. Voet and Voet JG, 2011. <i>Biochemistry 4th edition</i>. John Wiley and Son, INC.</p>	5%

13	Understand the application of the hormonal system in making synthetic hormones	<ol style="list-style-type: none"> 1. Analyzing the role of animals in the bioprocess of producing synthetic hormones 2. Provide examples of various components from animals that play a role in making synthetic hormones by utilizing Indonesia's biodiversity 3. Summarize the bioprocess stages in making synthetic hormones 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>Case method 1. Pre-existing Material. The lecturer asks students to individually read references regarding the role of animals in the bioprocess of producing synthetic hormones. This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in the group. The lecturer provides problem cases of various animal components that play a role in making synthetic hormones by utilizing Indonesia's biodiversity. Students are asked to discuss to solve the problem. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups, and classically obtained problem solving and conclusions from the discussions carried out. 2 X 50</p>		<p>Material: Bioprocess Technology in Making Synthetic Hormones Reference: Clarke, KB 2014. <i>Bioprocess Engineering</i>. Woodhead Publishing</p>	5%
14	Analyzing the role of animals in bioprocesses for the vaccine industry	<ol style="list-style-type: none"> 1. Analyzing the role of animals in the bioprocess of producing vaccines 2. Explain the various components that play a role in making vaccines 3. Summarize the bioprocess stages in making vaccines 4. Summarize the various factors that influence vaccine production 	<p>Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks</p> <p>Form of Assessment : Participatory Activities</p>	<p>The lecturer facilitates student-centered learning through group discussions and is responsible for finding concepts (based on a literature review) regarding the role of animals in the bioprocess of producing vaccines. Students then present the results of their group work. Lecturer and students conclude the results of the discussion. Students are asked to read the references that will be used for the next meeting 2 X 50</p>		<p>Material: Vaccine Bioprocess Technology References: Yuliani, Nur Kuswanti, Yuni Sri Rahayu, 2021. <i>Bioprocess</i>. Surabaya: University Press Unesa.</p>	5%

15	Communicate the role of animals, plants and their metabolites in bioprocesses for various Biological products	Communicate the role of animals, plants and their metabolites in bioprocesses to produce biological products	Criteria: Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks Form of Assessment : Participatory Activities	Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature reviews) regarding the role of animals, plants and their metabolites in bioprocesses to produce biological products. Students then present the results of their group work. The lecturer and students concluded the role of animals, plants and their metabolites in the bioprocess to produce 2 X 50 biological products	Material: The role of animals, plants and their metabolites in bioprocess technology to produce biological products. Reference: Yuliani, Nur Kuswanti, Yuni Sri Rahayu, 2021. <i>Bioprocess. Surabaya: University Press Unesa.</i>	5%
16	Final exams	Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks	Criteria: Performance reports/assessments are assessed as ASSIGNMENTS with a weight of 30%, UTS with a weight of 20%, Student activities and responses during learning activities are assessed as participation, a weight of 20%, UAS with a weight of 30% Form of Assessment : Test	Written Test 2 X 50	Material: Material 9 to 10 Reference: Clarke, KB 2014. <i>Bioprocess Engineering. Woodlead Publishing</i>	20%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	70%
2.	Test	30%
		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** 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.
- 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.