



**Universitas Negeri Surabaya
Faculty of Engineering,
Electrical Engineering Undergraduate Study Program**

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date																																																	
Electric Motor Control System	2020102420		T=2	P=0	ECTS=3.18	5	August 4, 2023																																																	
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator																																																		
	Prof. Dr. Joko, M.Pd. MT.				Dr. Lusia Rakhmawati, S.T., M.T.																																																		
Learning model	Project Based Learning																																																							
Program Learning Outcomes (PLO)	PLO study program that is charged to the course																																																							
	Program Objectives (PO)																																																							
	PO - 1	Analyze, evaluate, select and use electric motors according to electric motor load characteristics and electric motor characteristics, starting and braking of electric motors, regulation of electric motor rotation speed, DC motor control hardware, solid state motor control-speed of induction motors, selecting motors for industry, and choose an electric motor economically																																																						
	PLO-PO Matrix																																																							
		<table border="1" style="margin: auto;"> <tr><td style="padding: 5px;">P.O</td></tr> <tr><td style="padding: 5px;">PO-1</td></tr> </table>						P.O	PO-1																																															
P.O																																																								
PO-1																																																								
PO Matrix at the end of each learning stage (Sub-PO)																																																								
	<table border="1" style="margin: auto;"> <tr> <td rowspan="2" style="padding: 5px;">P.O</td> <td colspan="16" style="text-align: center;">Week</td> </tr> <tr> <td style="padding: 5px;">1</td><td style="padding: 5px;">2</td><td style="padding: 5px;">3</td><td style="padding: 5px;">4</td><td style="padding: 5px;">5</td><td style="padding: 5px;">6</td><td style="padding: 5px;">7</td><td style="padding: 5px;">8</td><td style="padding: 5px;">9</td><td style="padding: 5px;">10</td><td style="padding: 5px;">11</td><td style="padding: 5px;">12</td><td style="padding: 5px;">13</td><td style="padding: 5px;">14</td><td style="padding: 5px;">15</td><td style="padding: 5px;">16</td> </tr> <tr> <td style="padding: 5px;">PO-1</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>						P.O	Week																1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PO-1																
P.O	Week																																																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																																								
PO-1																																																								
Short Course Description	Students have the ability to analyze, evaluate, select and use electric motors according to the load characteristics of electric motors and characteristics of electric motors, starting and braking of electric motors, regulation of rotational speed of electric motors, DC motor control hardware, solid state motor control-speed of induction motors, choosing motors for industry, and choosing electric motors economically																																																							
References	Main :																																																							
	<ol style="list-style-type: none"> 1. Austin Hughes, 2006. Electric Motors and Drives. Fundamentals, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved. 2. Fang Qi, Daniel Scharfenstein, Claude Weis, 2019. Motor Handbook. Institute for Power Electronics and Electrical Drives. RWTH Aachen University 3. Joko, 2015. Mesin Arus Searah. University Press Universitas Negeri Surabaya 4. Joko, 2018. Mesin Arus Bolak Balik. Surabaya: University Press Universitas Negeri Surabaya 5. O'Kelly, Denis. 1992. Performance and Control of Electrical Machines . London: McGraw-Hill 																																																							
	Supporters:																																																							
	<ol style="list-style-type: none"> 1. Baharuddin, Deny Haryanto S., Olnes Y.H., 2021. Penggunaan dan pengaturan motor listrik. CV Pena Persada, Purwokerto. 2. Joko, Agus Budi S, Parama D.W., Alfredo A. P.P. 2022. Pemeliharaan dan perbaikan motor listrik berbasis model pembelajaran berbasis proyek. Unesa University Press. 																																																							
Supporting lecturer	Prof. Dr. Joko, M.Pd., M.T.																																																							
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	Able to understand the various load characteristics of electric motors	Searching for sources of information, group discussions, summarizing material, and group presentations using PPT	<p>Criteria:</p> <ol style="list-style-type: none"> 1.Accuracy of information sources, group discussions, summarizing material, and group presentations using PPT, max score 50 2.Participative, min score 50 <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Presentations, lecture contracts, discussions and questions and answers, assignments to explore sources of information, group discussions, summarizing material, group presentations using PPT, and reflection 2 X 50		<p>Material: Electric motor load characteristics</p> <p>Reference: <i>Austin Hughes, 2006. Electric Motors and Drives. Foundations, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved. http://www.emic-bg.org/...</i></p>	5%
2	Able to understand the various load characteristics of electric motors	<ol style="list-style-type: none"> 1.Summarize and present the basic content of motor selection, load types, basic drive system equations, load torque, load moment of inertia, torque vs load speed curve, speed vs time curve, and motor working environment 2.Presentation, expressing ideas, answering and defending ideas, punctuality, and cooperation 	<p>Criteria:</p> <ol style="list-style-type: none"> 1.Accuracy of summary and PPT material, max score 40 2.Accuracy of presentation, expressing ideas, answering and defending ideas, punctuality and cooperation, max score 10 3.Participation, min score 50 <p>Form of Assessment : Participatory Activities</p>		Lecturer's short presentation, question and answer, tracing sources of information, discussion, summarizing, group presentation, discussion and reflection 2 X 50	<p>Material: Electric motor load characteristics</p> <p>Reference: <i>Austin Hughes, 2006. Electric Motors and Drives. Foundations, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved.</i></p>	5%
3	Able to understand the various characteristics of electric motors	Searching for information sources, summarizing, creating PPTs and group presentations	<p>Criteria:</p> <ol style="list-style-type: none"> 1.Accuracy in summarizing, making PPT and group presentations, max score 50 2.Participation, min score 50 <p>Form of Assessment : Participatory Activities</p>		Short lecturer presentations, questions and answers, assignments to search for sources of information, summarizing, making PPTs and group presentations, and reflections 2 X 50	<p>Material: Characteristics of electric motors</p> <p>Reference: <i>Austin Hughes, 2006. Electric Motors and Drives. Foundations, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved.</i></p>	5%
4	Able to understand the characteristics of electric motors	<ol style="list-style-type: none"> 1.PPT Content, PPT Appearance, Presentation, Putting forward ideas, Defending ideas, Answering, and Participation 2.Participative 	<p>Criteria:</p> <ol style="list-style-type: none"> 1.Accuracy of PPT content, PPT appearance, Presentation, Expressing ideas and ideas, Defending ideas, Answering, max score 50 2.Participative, min score 50 <p>Form of Assessment : Participatory Activities</p>	Group presentations, discussions, questions and answers, and reflections 2X50		<p>Material: Characteristics of electric motors</p> <p>References: <i>Fang Qi, Daniel Scharfenstein, Claude Weis, 2019. Motor Handbook. Institute for Power Electronics and Electrical Drives. RWTH Aachen University</i></p>	5%

5	Starting and Braking Electric Motorcycles	Fill in the summary, fill in the ppt, presentation	<p>Criteria: Accuracy of summary content, ppt content, presentation, expressing ideas, answering, and defending ideas. Max score 50</p> <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Short lecturer presentations, discussions, questions and answers, assignments to summarize and create a powerpoint on starting and braking of a 2X50 electric motorbike		<p>Material: Starting and braking of DC motors Reference: Joko, 2015. <i>Direct Current Machines.</i> University Press Surabaya State University</p> <hr/> <p>Material: Starting and braking of AC motors Reference: Joko, 2018. <i>Alternating Current Machines.</i> Surabaya: University Press, Surabaya State University</p>	5%
6	Starting and Braking Electric Motorcycles	Fill in the summary, fill in the ppt, presentation	<p>Criteria: Accuracy of summary content, ppt content, presentation, expressing ideas, answering, and defending ideas. Max score 50</p> <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Short lecturer presentations, discussions, questions and answers, assignments to summarize and create a powerpoint on starting and braking of a 2X50 electric motorbike		<p>Material: Starting and braking of DC motors Reference: Joko, 2015. <i>Direct Current Machines.</i> University Press Surabaya State University</p> <hr/> <p>Material: Starting and braking of AC motors Reference: Joko, 2018. <i>Alternating Current Machines.</i> Surabaya: University Press, Surabaya State University</p>	5%
7	Able to regulate the rotation speed of the electric motor	<p>1.Fill in summaries, fill in ppt, presentations, put forward ideas, defend ideas, answer questions</p> <p>2.Participative</p>	<p>Criteria: 1.Accuracy of summary content, ppt content, presentation, expressing ideas, defending ideas, answering questions, max score 60</p> <p>2.Participative, min score 50</p> <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Short lecture presentations, discussions, questions and answers, assignments to trace sources of information, summarize and create PPTs and presentations 2 X 50	Fill in summaries, fill in ppt, presentations, put forward ideas, defend ideas, answer questions	<p>Material: Regulation of electric motor rotation speed. Reference: Austin Hughes, 2006. <i>Electric Motors and Drives. Foundations, Types, And Applications. Third Edition.</i> Published by Elsevier Ltd. All rights reserved.</p> <hr/> <p>Material: DC motor speed regulation Reference: Joko, 2015. <i>Direct Current Machines.</i> University Press Surabaya State University</p>	5%
8	UTS	Accuracy of answers and time	<p>Form of Assessment : Test</p>	UTS-1st elementary school meeting material. 7th meeting 2 X 50			10%

9	Able to understand DC motor control hardware	1.Fill in summaries, fill in ppt, presentations, put forward ideas, defend ideas, answer questions 2.Participative	Criteria: 1.Fill in the summary, fill in the ppt, presentation, put forward ideas, defend ideas, answer questions, max score 50 2.Participative, min score 60 Form of Assessment : Participatory Activities		Lecturer short presentations, discussions, assignments to explore sources of information, summarize, create a PPT and present the 2 X 50 DC motor controller hardware	Material: DC motor rotation speed control hardware Reference: <i>Fang Qi, Daniel Scharfenstein, Claude Weis, 2019. Motor Handbook. Institute for Power Electronics and Electrical Drives. RWTH Aachen University</i>	5%
10	Able to understand DC motor control hardware	1.Fill in summaries, fill in ppt, presentations, put forward ideas, defend ideas, answer questions 2.Participative	Criteria: 1.Fill in the summary, fill in the ppt, presentation, put forward ideas, defend ideas, answer questions, max score 50 2.Participative, min score 60 Form of Assessment : Participatory Activities		Lecturer short presentations, discussions, assignments to explore sources of information, summarize, create a PPT and present the 2 X 50 DC motor controller hardware	Material: DC motor rotation speed control hardware Reference: <i>Fang Qi, Daniel Scharfenstein, Claude Weis, 2019. Motor Handbook. Institute for Power Electronics and Electrical Drives. RWTH Aachen University</i>	5%
11	Able to understand solid state motor control-induction motor rotation speed	1.Fill in summaries, ppts and presentations 2.Participative	Criteria: 1.Accuracy of summary, ppt and presentation content, max score 50 2.Participatory, min score 50 Form of Assessment : Participatory Activities		Lecturer short presentations, discussions, questions and answers, assignments to search for sources of information, summarizing, making PPTs and group presentations 2 X 50	Material: Solid state motor control-induction motor rotation speed. Reference: <i>Austin Hughes, 2006. Electric Motors and Drives. Foundations, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved.</i> Material: Solid state motor control-induction motor rotation speed Reference: <i>O&rsquoKelly, Denis. 1992. Performance and Control of Electrical Machines. London: McGraw-Hill</i>	5%

12	Able to understand solid state motor control-induction motor rotation speed	1.Fill in summaries, ppts and presentations 2.Participative	Criteria: 1.Accuracy of summary, ppt and presentation content, max score 50 2.Participatory, min score 50 Form of Assessment : Participatory Activities		Lecturer short presentations, discussions, questions and answers, assignments to search for sources of information, summarizing, making PPTs and group presentations 2 X 50	Material: Solid state motor control-induction motor rotation speed. Reference: Austin Hughes, 2006. <i>Electric Motors and Drives. Foundations, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved.</i> Material: Solid state motor control-induction motor rotation speed Reference: O&rsquoKelly, Denis. 1992. <i>Performance and Control of Electrical Machines. London: McGraw-Hill</i>	5%
13	Able to understand how to choose electric motors for industry	1.Searching for information sources, summarizing, making PPTs and presenting 2.Participative	Criteria: 1.Accuracy in tracing information sources, summarizing, creating PPT and presenting, max score 50 2.Participative, min score 50 Form of Assessment : Participatory Activities, Portfolio Assessment		Short lecturer presentations, discussions, questions and answers, assignments to search for information sources, summarize, make PPTs and present 2 X 50	Material: Selection of motors for industry Reference: Austin Hughes, 2006. <i>Electric Motors and Drives. Foundations, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved.</i> Material: Maintenance and repair of electric motors References: Joko, Agus Budi S, Parama DW, Alfredo APP 2022. <i>Maintenance and repair of electric motors based on a project-based learning model. Unesa University Press.</i>	5%

14	Able to understand how to choose electric motors for industry	1. Searching for information sources, summarizing, making PPTs and presenting 2. Participative	Criteria: 1. Accuracy in tracing information sources, summarizing, creating PPT and presenting, max score 50 2. Participative, min score 50 Form of Assessment : Participatory Activities, Portfolio Assessment		Short lecturer presentations, discussions, questions and answers, assignments to search for information sources, summarize, make PPTs and present 2 X 50	Material: Selection of motors for industry Reference: <i>Austin Hughes, 2006. Electric Motors and Drives. Foundations, Types, And Applications. Third Edition. Published by Elsevier Ltd. All rights reserved.</i> Material: Maintenance and repair of electric motors References: <i>Joko, Agus Budi S, Parama DW, Alfredo APP 2022. Maintenance and repair of electric motors based on a project-based learning model. Unesa University Press.</i>	5%
15	Able to choose an electric motorbike from an economic perspective	1. Searching for sources of information, summarizing, group presentations, and reflection 2. Participative	Criteria: 1. Accuracy in tracing sources of information, summarizing, group presentations and reflection, max score 50 2. Participative, min score 50 Form of Assessment : Participatory Activities		Lecturer short presentations, discussions, questions and answers, assignments to explore sources of information, summarizing, group presentations, and reflections 2 X 50	Material: Choosing a motorbike from an economic perspective. Reference: <i>O&rsquo;Kelly, Denis. 1992. Performance and Control of Electrical Machines. London: McGraw-Hill</i>	5%
16	UAS		Form of Assessment : Test	UAS 2 X 50			20%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	55%
2.	Portfolio Assessment	15%
3.	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.

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.