



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

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date
Electric motor control	8320103089		T=3 P=0 ECTS=4.77	6	July 18, 2024
AUTHORIZATION	SP Developer		Course Cluster Coordinator		Study Program Coordinator
		Dr. Nur Kholis, S.T., M.T.

Learning model	Case Studies																																	
Program Learning Outcomes (PLO)	PLO study program that is charged to the course																																	
	Program Objectives (PO)																																	
	PLO-PO Matrix																																	
	<table border="1" style="margin: auto;"> <tr> <td style="width: 50px; height: 20px;">P.O</td> </tr> </table>	P.O																																
P.O																																		
	PO Matrix at the end of each learning stage (Sub-PO)																																	
	<table border="1" style="margin: auto;"> <tr> <td rowspan="2" style="width: 30px; height: 20px;">P.O</td> <td colspan="16" style="text-align: center;">Week</td> </tr> <tr> <td style="width: 20px;">1</td> <td style="width: 20px;">2</td> <td style="width: 20px;">3</td> <td style="width: 20px;">4</td> <td style="width: 20px;">5</td> <td style="width: 20px;">6</td> <td style="width: 20px;">7</td> <td style="width: 20px;">8</td> <td style="width: 20px;">9</td> <td style="width: 20px;">10</td> <td style="width: 20px;">11</td> <td style="width: 20px;">12</td> <td style="width: 20px;">13</td> <td style="width: 20px;">14</td> <td style="width: 20px;">15</td> <td style="width: 20px;">16</td> </tr> </table>	P.O	Week																1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
P.O	Week																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																		

Short Course Description Students are able to explain and demonstrate basic knowledge of electric motor control, able to explain and demonstrate concepts of electric motor theory, speed regulation, reversing direction of rotation, starting current and starting and braking coupling; able to plan a solution approach to an electric motor control problem; and able to operate electromagnetic controllers and PLC equipment in accordance with predetermined operating standards and procedures.

References	Main :
	<ol style="list-style-type: none"> 1. Joko, dkk. 2016. Modul Praktik Pengendali Motor Listrik. JTE, FT Unesa 2. Joko, dkk. 2016. Exsperiment Sheet Praktik Pengendali Motor Listrik. JTE, FT Unesa 3. Walter, N. 1975. Electric Motor Control. New York: An Nostrand Reinhold Company. 4. Zuhul. 1990. Dasar Teknik Tenaga Listrik dan Elektronika Daya. Jakarta: Gramedia. 5. Data Sheet PLC
	Supporters:

Supporting lecturer Dr. Tri Rijanto, M.Pd., M.T.
 Prof. Dr. Joko, M.Pd., M.T.
 Aditya Chandra Hermawan, S.ST., M.T.
 Fendi Achmad, S.Pd., M.Pd.

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	Students are able to understand the various types of controllers	<ol style="list-style-type: none"> 1. Describe the various types of electric motor control systems 2. Students can describe the components of manual, semi-automatic and automatic electric motor controllers 3. Students can identify manual, semi-automatic and automatic control components) 4. Students can determine (type, specifications, units and quantity) of electric motor control components based on the results of observations 	Criteria: 1. The cognitive domain consists of 5 items and the max score for each item is 10, so the total max. 50 2. The psychomotor domain consists of 7 items and the maximum score for each item is 5, so the total is max.35 3. The affective domain consists of 10 items and the maximum score for each item is 2, so the total is max. 20 4. The maximum score for the three learning outcomes domains is 100	Direct learning model Presentation Discussion Questions and answers Practice Assignment Reflection 3 X 50			0%

2	Students are able to understand the various types of controllers	<ol style="list-style-type: none"> 1. Describe the various types of electric motor control systems 2. Students can describe the components of manual, semi-automatic and automatic electric motor controllers 3. Students can identify manual, semi-automatic and automatic control components) 4. Students can determine (type, specifications, units and quantity) of electric motor control components based on the results of observations 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 5 items and the max score for each item is 10, so the total max. 50 2. The psychomotor domain consists of 7 items and the maximum score for each item is 5, so the total is max. 35 3. The affective domain consists of 10 items and the maximum score for each item is 2, so the total is max. 20 4. The maximum score for the three learning outcomes domains is 100 	Direct learning model Presentation Discussion Questions and answers Practice Assignment Reflection 3 X 50			0%
3	Understand manual DC motor control	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and DC motor control power to regulate the starting coupling, starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine tool requirements (name, specifications, units and quantity) for DC motor controllers. 4. Assembling DC motor control tools and materials. 5. Carrying out preparatory work, carrying out inspections and repairing DC controller circuits. 6. Operate DC motor controllers, evaluate and improve their performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%

4	Understand manual DC motor control	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and DC motor control power to regulate the starting coupling, starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine tool requirements (name, specifications, units and quantity) for DC motor controllers. 4. Assembling DC motor control tools and materials. 5. Carrying out preparatory work, carrying out inspections and repairing DC controller circuits. 6. Operate DC motor controllers, evaluate and improve their performance 7. Create project results reports and present the results 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
5	Understand manual DC motor control	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and DC motor control power to regulate the starting coupling, starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine tool requirements (name, specifications, units and quantity) for DC motor controllers. 4. Assembling DC motor control tools and materials. 5. Carrying out preparatory work, carrying out inspections and repairing DC controller circuits. 6. Operate DC motor controllers, evaluate and improve their performance 7. Create project results reports and present the results 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%

6	Understand manual DC motor control	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and DC motor control power to regulate the starting coupling, starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine tool requirements (name, specifications, units and quantity) for DC motor controllers. 4. Assembling DC motor control tools and materials. 5. Carrying out preparatory work, carrying out inspections and repairing DC controller circuits. 6. Operate DC motor controllers, evaluate and improve their performance 7. Create project results reports and present the results 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
7	Understand manual control of single phase induction motors	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and power controller for a single phase AC motor to regulate the starting coupler, starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine equipment requirements (name, specifications, units and quantity) for single phase AC motor controllers 4. Assembling tools and materials to control a single phase AC motor 5. Carrying out preparatory work, inspecting and repairing single phase AC motor controller circuits 6. Operate single phase AC motor controllers, evaluate and improve their performance 7. Create project results reports and present the results 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. each item 5, and a total of max. 30 2. The psychomotor domain consists of 6 items, the maximum score for each item is 10, and the total max. 60 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%

8	Understand manual control of 3 phase induction motors	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and power controller for a 3-phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine equipment requirements (name, specifications, units and quantity) for controlling a 3 phase induction motor 4. Assembling tools and materials to control a 3 phase induction motor 5. Carrying out preparatory work, inspecting and repairing 3 phase induction motor controller circuits 6. Operate a 3 phase induction motor controller, evaluate and improve its performance 7. Create project results reports and present the results 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
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9	Understand the electromagnetic control of a 3 phase DOL system induction motor	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a design drawing for the control circuit and electromagnetic control power of the DOL system for a 3 phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine the equipment requirements (name, specifications, units and quantity) for electromagnetic control of the DOL system for a 3 phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 4. Assembling tools and materials for electromagnetic control of the 3 phase DOL induction motor system to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 5. Carrying out preparatory work, carrying out inspections and repairing the electromagnetic control circuit for the DOL 3 phase induction motor system to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 6. Operate the electromagnetic controller of the DOL system for a 3 phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed, evaluate and improve its performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
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10	Understand the electromagnetic control of a 3 phase DOL system induction motor	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a design drawing for the control circuit and electromagnetic control power of the DOL system for a 3 phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 3. Determine the equipment requirements (name, specifications, units and quantity) for electromagnetic control of the DOL system for a 3 phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 4. Assembling tools and materials for electromagnetic control of the 3 phase DOL induction motor system to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 5. Carrying out preparatory work, carrying out inspections and repairing the electromagnetic control circuit for the DOL 3 phase induction motor system to regulate the starting current, regulate the direction of rotation, regulate the rotation speed 6. Operate the electromagnetic controller of the DOL system for a 3 phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed, evaluate and improve its performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
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11	Understanding automatic 3 phase electromagnetic induction motor controllers	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and automatic electromagnetic power control of a 3 phase induction motor to regulate the starting current of the triangular star and regulate the direction of rotation 3. Determine equipment requirements (name, specifications, units and quantity) for automatic electromagnetic controllers for 3 phase induction motors 4. Assembling tools and materials for automatic electromagnetic control of a 3 phase induction motor 5. Carrying out preparatory work, carrying out inspections and repairing automatic electromagnetic control circuits for 3 phase induction motors 6. Operate automatic electromagnetic controllers for 3 phase induction motors, evaluate and improve their performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
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12	Understanding automatic 3 phase electromagnetic induction motor controllers	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and automatic electromagnetic power control of a 3 phase induction motor to regulate the starting current of the triangular star and regulate the direction of rotation 3. Determine equipment requirements (name, specifications, units and quantity) for automatic electromagnetic controllers for 3 phase induction motors 4. Assembling tools and materials for automatic electromagnetic control of a 3 phase induction motor 5. Carrying out preparatory work, carrying out inspections and repairing automatic electromagnetic control circuits for 3 phase induction motors 6. Operate automatic electromagnetic controllers for 3 phase induction motors, evaluate and improve their performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
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13	Understanding automatic 3 phase electromagnetic induction motor controllers	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and automatic electromagnetic power control of a 3 phase induction motor to regulate the starting current of the triangular star and regulate the direction of rotation 3. Determine equipment requirements (name, specifications, units and quantity) for automatic electromagnetic controllers for 3 phase induction motors 4. Assembling tools and materials for automatic electromagnetic control of a 3 phase induction motor 5. Carrying out preparatory work, carrying out inspections and repairing automatic electromagnetic control circuits for 3 phase induction motors 6. Operate automatic electromagnetic controllers for 3 phase induction motors, evaluate and improve their performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
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14	Understand electronic control of 3 phase induction motors	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a drawing design for the control circuit and power controller for a 3-phase induction motor to regulate the starting current, regulate the direction of rotation, regulate the rotation speed automatically. 3. Determine equipment requirements (name, specifications, units and quantity) for electronically controlling a 3-phase induction motor 4. Assembling tools and materials to control a 3 phase induction motor electronically 5. Carrying out preparatory work, carrying out inspections and repairing electronic 3 phase induction motor control circuits 6. Operate a 3 phase induction motor controller electronically, evaluate and improve its performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
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15	Understand the control of a 3 phase induction motor with a PLC	<ol style="list-style-type: none"> 1. Formulate project objectives, problems, problem solving 2. Create a design for a control circuit (leader diagram) and control power for a 3-phase induction motor to regulate the starting current, regulate the direction of rotation, and regulate the rotation speed 3. Determine equipment requirements (name, specifications, units and quantity) for controlling a 3 phase induction motor with PLC 4. Assembling tools and materials to control a 3 phase induction motor with a PLC 5. Carrying out preparatory work, inspecting and repairing 3 phase induction motor controller circuits with PLC 6. Operate a 3 phase induction motor controller with a PLC, evaluate and improve its performance 7. Create project results reports and present the results 	Criteria: <ol style="list-style-type: none"> 1. The cognitive domain consists of 6 items, max score. 10 items per item, and a total of max. 60 2. The psychomotor domain consists of 6 items, the maximum score for each item is 5, and the total max. 30 3. The affective domain consists of 10 items, the max score for each item is 1, and the max score. 10 4. Max score total. all three domains of learning outcomes 100 	Project-based learning Presentation Discussion Assignment Practical Reflection 3 X 50			0%
16							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.