



**Universitas Negeri Surabaya
Vocational Faculty,
D4 Electrical Engineering Study Program**

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date																																	
Electric Power Distribution	2030502031	Compulsory Study Program Subjects	T=2 P=0 ECTS=3.18	4	July 17, 2024																																	
AUTHORIZATION	SP Developer	Course Cluster Coordinator		Study Program Coordinator																																		
		Mahendra Widyartono, S.T., M.T.																																		
Learning model	Project Based Learning																																					
Program Learning Outcomes (PLO)	PLO study program that is charged to the course																																					
	PLO-8	Able to build the performance or quality of a process through testing, measuring work objects, analyzing and interpreting data according to procedures and standards.																																				
	Program Objectives (PO)																																					
	PLO-PO Matrix																																					
		<table border="1" style="margin: auto;"> <tr> <td style="width: 50px;">P.O</td> <td style="width: 50px;">PLO-8</td> </tr> </table>		P.O	PLO-8																																	
P.O	PLO-8																																					
	PO Matrix at the end of each learning stage (Sub-PO)																																					
	<table border="1" style="margin: auto;"> <tr> <td rowspan="2" style="width: 30px;">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				
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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																						
Short Course Description	Understanding and study of: SKKNI for Electrical Power Distribution, Basic Concepts of Distribution Systems, Classification of Distribution Networks, Overhead Lines, Underground Distribution Networks, Direct Current Distribution Networks, Alternating Current Distribution Networks, Voltage Regulation, Applications of Capacitors and Protection for Distribution Networks and Grounding Systems.																																					
References	Main :																																					
	<ol style="list-style-type: none"> 1. ferensi 2. Artono Arismunandar & Sususmu Kuwahara. 1975. Buku Pegangan Teknik Tenaga Listrik Jilid II dan III . Jakarta: PT. Pradnya Paramita. 3. Departemen Energi dan Sumber Daya Mineral. 2004. Sosialisasi Standar Latih Kompetensi (SLK) Tenaga Teknik Ketenagalistrikan Bidang Distribusi Tenaga Listrik . Jakarta: Pusat Diklat Energi dan Ketenagalistrikan. 4. Makmun & Sri Lestari. 2007. Permasalahan Bidang Ketenagalistrikan di Indonesia . Jakarta: Fokus Media. 5. Suhadi dan Tri Wrahatnolo. (2009). Diktat Kuliah Sistem Distribusi Tenaga Listrik . Surabaya : Unesa Press. 6. T.A. Short. (2004). Electrical Distribution- HandBook . London: CRC Press. 7. Yamanaka. Electric Wire & Cable . Sinar Merbabu: Surabaya Jurnal 8. IEEE Transaction on Power Apparatus and System 9. IEEE Transaction on Power Delivery 10. IEEE Spectrum 11. IEEE Power Engineer review. 																																					
	Supporters:																																					
Supporting lecturer	Mahendra Widyartono, S.T., M.T. Aditya Chandra Hermawan, S.ST., 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	Understanding the Development of Electric Power Distribution Systems	<p>1.1. Know, classify and analyze data and communicate ideas and information about electric power distribution systems</p> <p>2.2. Able to analyze problems, consumption and needs for electricity and development prospects</p>	<p>Criteria:</p> <p>1. Assessment of participation in lectures, discussions and question and answer activities through observation sheets, score 0-100</p> <p>2. Assessment of assignments via assessment sheet, score 0-100</p> <p>Form of Assessment : Participatory Activities</p>	Lectures, discussions, questions and answers and assignments. 100 minutes		<p>Material: Electrical Power Distribution System 1. Development of the Electrical Power Distribution System 2. Electricity Consumption and Demand 3. Electrical Power Distribution Process 4. Problems in the Electrical Power Distribution Sector 5. Development of the Rural Electrical Network 6. SKKNI in the Electrical Power Distribution Sector</p> <p>Literature:</p>	2%
2	Understand the Basic Concepts of Electric Power Distribution Systems	<p>1.1. Know, classify and analyze data and communicate ideas and information about the Basic Concepts of Electric Power Distribution Systems</p> <p>2.2. Able to analyze problems and resolve electricity distribution networks</p>	<p>Criteria:</p> <p>1. Observation of participation and enthusiasm in the learning process, using an observation sheet, score 0-100</p> <p>2. Assessment of completion of assignments, using the assignment assessment sheet, score 01-00</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture 2. Discussion 3. Question and Answer 4. Assignment 100 minutes		<p>Material: 1. Basic Concepts of Electric Power Distribution Systems Library: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p> <p>Material: 2. Classification of Electric Power Distribution Networks Reference: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%

3	Understand the Basic Concepts of Direct Current Electric Power Distribution Systems	<p>1.1. Calculate voltage loss, load point voltage, line end voltage, power loss, system efficiency and cross-sectional size</p> <p>2.2. Analyze problems and resolve direct current electricity distribution networks</p>	<p>Criteria:</p> <p>1.Observation of participation and enthusiasm in the learning process, using an observation sheet, score 0-100</p> <p>2.Assessment of completion of assignments, using the assignment assessment sheet, score 01-00</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture 2. Discussion 3. Question and Answer 4. Assignment 100 minutes</p>	<p>Material: Direct Current Electrical Power Distribution System 1. Various forms of distribution system circuits 2. Distribution of two wires supplied by 1 source 3. Distribution of two wires supplied by 2 sources of the same voltage 4. Distribution of two wires supplied by 2 sources of unequal voltage 5. Distribution of three wires supplied by 1 source 6. Three-wire distribution supplied by 2 sources with the same voltage 7. Three-wire distribution supplied by 2 sources with unequal voltages</p> <p>Reference: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%
4	Understand the Basic Concepts of Direct Current Electric Power Distribution Systems	<p>1.1. Calculate voltage loss, load point voltage, line end voltage, power loss, system efficiency and cross-sectional size</p> <p>2.2. Analyze problems and resolve direct current electricity distribution networks</p>	<p>Criteria:</p> <p>1.Observation of participation and enthusiasm in the learning process, using an observation sheet, score 0-100</p> <p>2.Assessment of completion of assignments, using the assignment assessment sheet, score 01-00</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture 2. Discussion 3. Question and Answer 4. Assignment 100 minutes</p>	<p>Material: Direct Current Electrical Power Distribution System 1. Various forms of distribution system circuits 2. Distribution of two wires supplied by 1 source 3. Distribution of two wires supplied by 2 sources of the same voltage 4. Distribution of two wires supplied by 2 sources of unequal voltage 5. Distribution of three wires supplied by 1 source 6. Three-wire distribution supplied by 2 sources with the same voltage 7. Three-wire distribution supplied by 2 sources with unequal voltages</p> <p>Reference: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%

5	Understand the Basic Concepts of Direct Current Electric Power Distribution Systems	<p>1.1. Calculate voltage loss, load point voltage, line end voltage, power loss, system efficiency and cross-sectional size</p> <p>2.2. Analyze problems and resolve direct current electricity distribution networks</p>	<p>Criteria:</p> <p>1.Observation of participation and enthusiasm in the learning process, using an observation sheet, score 0-100</p> <p>2.Assessment of completion of assignments, using the assignment assessment sheet, score 01-00</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture 2. Discussion 3. Question and Answer 4. Assignment 100 minutes</p>	<p>Material: Direct Current Electrical Power Distribution System</p> <p>1. Various forms of distribution system circuits 2. Distribution of two wires supplied by 1 source 3. Distribution of two wires supplied by 2 sources of the same voltage 4. Distribution of two wires supplied by 2 sources of unequal voltage 5. Distribution of three wires supplied by 1 source 6. Three-wire distribution supplied by 2 sources with the same voltage 7. Three-wire distribution supplied by 2 sources with unequal voltages</p> <p>Reference: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%
6	Understand the Basic Concepts of Alternating Current Electric Power Distribution Systems	<p>1.1. Calculate voltage loss, load point voltage, line end voltage, power loss, system efficiency and cross-sectional size</p> <p>2.2. Analyze problems and resolve alternating current electric power distribution networks</p>	<p>Criteria:</p> <p>1.Observations use a checklist, score 0-100</p> <p>2.Performance assessment uses a performance assessment sheet, score 0-100</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture 2. Discussion 3. Question and answer 4. Practice solving questions 5. Giving assignments. 100 minutes</p>	<p>Material: 1. Concept of alternating current distribution system 2. Single phase distribution system 3. Single phase three wire distribution system 4. Three phase three wire distribution system 5. Three phase four wire distribution system 6. Load asymmetry 7. Load diagram vector</p> <p>References: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%

7	Understand the Basic Concepts of Alternating Current Electric Power Distribution Systems	<p>1.1. Calculate voltage loss, load point voltage, line end voltage, power loss, system efficiency and cross-sectional size</p> <p>2.2. Analyze problems and resolve alternating current electric power distribution networks</p>	<p>Criteria:</p> <p>1.Observations use a checklist, score 0-100</p> <p>2.Performance assessment uses a performance assessment sheet, score 0-100</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture 2. Discussion 3. Question and answer 4. Practice solving questions 5. Giving assignments. 100 minutes</p>		<p>Material: 1. Concept of alternating current distribution system 2. Single phase distribution system 3. Single phase three wire distribution system 4. Three phase three wire distribution system 5. Three phase four wire distribution system 6. Load asymmetry 7. Load diagram vector</p> <p>References: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	13%
8			<p>Form of Assessment : Test</p>	UTS 100 Minutes			20%
9		<p>1.1. Calculate voltage loss, load point voltage, line end voltage, power loss, system efficiency and cross-sectional size</p> <p>2.2. Able to analyze problems and solve direct current electric power distribution networks</p> <p>3.3. Understand systems, primary distribution, distribution substations, distribution transformers, transformer banks, consumer services, and load types</p> <p>4.4. Able to analyze problems and resolve direct current electric power distribution networks</p>	<p>Criteria:</p> <p>1.Check list sheet, Score 0-100</p> <p>2.Performance Assessment Sheet, score 0-100</p> <p>3.Assignment Assessment Sheet, score 0-100</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture 2. Discussion 3. Question and answer 4. Demonstration 5. Practice solving questions 6. Giving assignments 100 minutes</p>		<p>Material: Primary Distribution Network System 1. Definition of distribution function 2. Grouping of distribution networks 3. Classification of distribution channels 4. Primary distribution system 5. SUTM Secondary distribution network system 1. Primary distribution system 2. Distribution substation 3. Distribution transformer 4. Transformer bank 5. Customer service 6. Types of library load: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%

10		<p>1.1. Calculate voltage loss, load point voltage, line end voltage, power loss, system efficiency and cross-sectional size</p> <p>2.2. Able to analyze problems and solve direct current electric power distribution networks</p> <p>3.3. Understand systems, primary distribution, distribution substations, distribution transformers, transformer banks, consumer services, and load types</p> <p>4.4. Able to analyze problems and resolve direct current electric power distribution networks</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Check list sheet, Score 0-100 2. Performance Assessment Sheet, score 0-100 3. Assignment Assessment Sheet, score 0-100 <p>Form of Assessment : Participatory Activities</p>	<ol style="list-style-type: none"> 1. Lecture 2. Discussion 3. Question and answer 4. Demonstration 5. Practice solving questions 6. Giving assignments <p>100 minutes</p>		<p>Material: Primary Distribution Network System</p> <ol style="list-style-type: none"> 1. Definition of distribution function 2. Grouping of distribution networks 3. Classification of distribution channels 4. Primary distribution system 5. SUTM Secondary distribution network system <ol style="list-style-type: none"> 1. Primary distribution system 2. Distribution substation 3. Distribution transformer 4. Transformer bank 5. Customer service 6. Types of library load: <p><i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%
11	Understanding above ground distribution networks (SUTM and SUTR)	<ol style="list-style-type: none"> 1.1. Prepare, collect, organize and analyze data and communicate ideas and information about above-ground distribution networks 2.2. Determine the impedance of the distribution network above ground (SUTR and SUTM) 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Observation Sheet, score 0-100 2. Performance Assessment Sheet, score 0-100 3. Assignment Assessment Sheet, score 0-100 <p>Form of Assessment : Participatory Activities</p>	<ol style="list-style-type: none"> 1. Lecture 2. Demonstration 3. Practicum 4. Question and answer 5. Discussion 6. Practice 7. Work on assignments <p>100 Minutes</p>			2%
12	Understanding above ground distribution networks (SUTM and SUTR)	<ol style="list-style-type: none"> 1.1. Prepare, collect, organize and analyze data and communicate ideas and information about above-ground distribution networks 2.2. Determine the impedance of the distribution network above ground (SUTR and SUTM) 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. Observation Sheet, score 0-100 2. Performance Assessment Sheet, score 0-100 3. Assignment Assessment Sheet, score 0-100 <p>Form of Assessment : Participatory Activities</p>	<ol style="list-style-type: none"> 1. Lecture 2. Demonstration 3. Practicum 4. Question and answer 5. Discussion 6. Practice 7. Work on assignments <p>100 Minutes</p>			2%

13	<p>1.1. Understand underground distribution networks</p> <p>2.2. Understanding Power Transformers</p>	<p>1.1. Prepare, collect, organize and analyze data and communicate ideas and information about underground distribution networks</p> <p>2.2. Determine the impedance of the underground distribution network</p> <p>3.3. Identify, differentiate, operate and analyze data and communicate ideas and information about Power Transformers</p> <p>4.4. Calculate the loading and transformer losses.</p> <p>5.5. Assembling the power transformer (GTT), power panel and its components/distribution substation</p>	<p>Criteria:</p> <p>1.Observation sheet, score 0-100</p> <p>2.Performance assessment sheet, score 0-100</p> <p>3.Assignment assessment sheet, score 0-100</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture</p> <p>2. Practicum</p> <p>3. Discussion</p> <p>4. Question and answer</p> <p>5. Practice questions</p> <p>6. Doing assignments 100 minutes</p>		<p>Material: Underground Distribution Network, 1. Conductor/Cable Data 2. Network impedance 3. Cable reliability 4. Primary Distribution Network Disturbances 1. Distribution Transformer 2. Single Phase Transformer 3. Three Phase Transformer 4. Transformer Loading 5 . Transformer Losses 6. Distribution Substation Transformer Circuits</p> <p>Library: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%
14	<p>1.1. Understand underground distribution networks</p> <p>2.2. Understanding Power Transformers</p>	<p>1.1. Prepare, collect, organize and analyze data and communicate ideas and information about underground distribution networks</p> <p>2.2. Determine the impedance of the underground distribution network</p> <p>3.3. Identify, differentiate, operate and analyze data and communicate ideas and information about Power Transformers</p> <p>4.4. Calculate the loading and transformer losses.</p> <p>5.5. Assembling the power transformer (GTT), power panel and its components/distribution substation</p>	<p>Criteria:</p> <p>1.Observation sheet, score 0-100</p> <p>2.Performance assessment sheet, score 0-100</p> <p>3.Assignment assessment sheet, score 0-100</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture</p> <p>2. Practicum</p> <p>3. Discussion</p> <p>4. Question and answer</p> <p>5. Practice questions</p> <p>6. Doing assignments 100 minutes</p>		<p>Material: Underground Distribution Network, 1. Conductor/Cable Data 2. Network impedance 3. Cable reliability 4. Primary Distribution Network Disturbances 1. Distribution Transformer 2. Single Phase Transformer 3. Three Phase Transformer 4. Transformer Loading 5 . Transformer Losses 6. Distribution Substation Transformer Circuits</p> <p>Library: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	2%

15	<p>1.1. Understand underground distribution networks</p> <p>2.2. Understanding Power Transformers</p>	<p>1.1. Prepare, collect, organize and analyze data and communicate ideas and information about underground distribution networks</p> <p>2.2. Determine the impedance of the underground distribution network</p> <p>3.3. Identify, differentiate, operate and analyze data and communicate ideas and information about Power Transformers</p> <p>4.4. Calculate the loading and transformer losses.</p> <p>5.5. Assembling the power transformer (GTT), power panel and its components/distribution substation</p>	<p>Criteria:</p> <p>1. Observation sheet, score 0-100</p> <p>2. Performance assessment sheet, score 0-100</p> <p>3. Assignment assessment sheet, score 0-100</p> <p>Form of Assessment : Participatory Activities</p>	<p>1. Lecture</p> <p>2. Practicum</p> <p>3. Discussion</p> <p>4. Question and answer</p> <p>5. Practice questions</p> <p>6. Doing assignments 100 minutes</p>	<p>Material: Underground Distribution Network, 1. Conductor/Cable Data 2. Network impedance 3. Cable reliability 4. Primary Distribution Network Disturbances 1. Distribution Transformer 2. Single Phase Transformer 3. Three Phase Transformer 4. Transformer Loading 5 . Transformer Losses 6. Distribution Substation Transformer Circuits</p> <p>Library: <i>Suhadi and Tri Wrahatnolo. (2009). Lecture Diktat on Electric Power Distribution Systems. Surabaya: Unesa Press.</i></p>	13%
16			<p>Form of Assessment : Test</p>	UAS		30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Test	50%
		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.