



**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																																																			
Power System Analysis I	2020102009	Compulsory Study Program Subjects	T=2	P=0	ECTS=3.18	5	May 1, 2023																																																			
AUTHORIZATION		SP Developer	Course Cluster Coordinator			Study Program Coordinator																																																				
		Unit Three Kartini, S.T., M.T., Ph.D.	Prof. Dr. I Gusti Putu Asto B., M.T.			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	Able to apply knowledge of mathematics, natural sciences, information technology, and electrical engineering to gain a thorough understanding of engineering principles																																																								
	PLO-PO Matrix																																																									
		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">P.O</td> <td colspan="6"></td> </tr> <tr> <td style="text-align: center;">PO-1</td> <td colspan="6"></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-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">P.O</td> <td colspan="16" style="text-align: center;">Week</td> </tr> <tr> <td></td> <td style="text-align: center;">1</td><td style="text-align: center;">2</td><td style="text-align: center;">3</td><td style="text-align: center;">4</td><td style="text-align: center;">5</td><td style="text-align: center;">6</td><td style="text-align: center;">7</td><td style="text-align: center;">8</td><td style="text-align: center;">9</td><td style="text-align: center;">10</td><td style="text-align: center;">11</td><td style="text-align: center;">12</td><td style="text-align: center;">13</td><td style="text-align: center;">14</td><td style="text-align: center;">15</td><td style="text-align: center;">16</td> </tr> <tr> <td style="text-align: center;">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><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	Basic concepts of electricity, electric power, power flow, 3 phase system, star delta connection; system representation of electric power systems; electric power system components, in-line diagram, impedance diagram, admittance diagram, size per unit (pu); circuit model; Ybus matrix, Zbus matrix; bus classification; calculate power flow.																																																									
References	Main :																																																									
	<ol style="list-style-type: none"> 1. Diktat: Analisa Sistem Tenaga Listrik I 2. Gross A., Charless. 1979. Power System Analysis . New York: John Wiley & sons 3. Moh. E. El-Hawary. 1986. Electrical Power System Design and Analysis . New York: McGraw-Hill Inc. 																																																									
	Supporters:																																																									
	<ol style="list-style-type: none"> 1. Stevenson Jr., William D. 1984. Elemen of Power System Analysis . New York: McGraw-Hill Inc. 																																																									
Supporting lecturer	Unit Three Kartini, S.T., M.T., Ph.D.																																																									
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	Describe the power system Describe the power system components Describe the power network topology Understand the typical power system load	Explain the meaning of a power system 2. Mention the components of a power system 3. Explain the topology of the electric power network 4. Read various typical power system loads	Criteria: 1. The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	Direct learning using the pulpit lecture method, exercises and giving 2 X 50 assignments		Material: Meeting material 1 References: Diktat: Electrical Power System Analysis I	5%
2	electric power system operation 5. Describe natural energy sources 4. Describe electric power system characteristics 3. Describe electric power main parts of the system 2. Describe electric power systems Describe	Explain the meaning of an electric power system 2. Mention the main parts of an electric power system 3. Explain the characteristics of a power system 4. Mention natural energy sources 5. Explain the operation of an electric power system	Criteria: 1. The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities	Direct learning using the pulpit lecture method, exercises and giving 2 X 50 assignments		Material: Meeting material 2 References: Gross A., Charless. 1979. Power System Analysis. New York: John Wiley & sons	0%

3	electricity	<p>Calculating electrical power 1 f 2. Calculating voltage and current in complex form 3. Calculating electrical power in complex form 4. Calculating active and reactive power flow</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. <p>Form of Assessment : Participatory Activities</p>	Direct learning using the pulpit lecture method, exercises and giving 2 X 50 assignments		<p>Material: Meeting material 3 Reader: <i>Moh. E. El-Hawary. 1986. Electrical Power System Design and Analysis. New York: McGraw-Hill Inc.</i></p>	5%
4	<p>1. Understanding the 3f system 2. U relationship between current and voltage 3. D relationship between current and voltage 4. Power in the 3f system</p>	<p>1. Calculating phase current, line current of system Y 2. Calculating phase current, line current of system D 3. Calculating power 3 f system Y 4. Calculating power 3 f system D</p>	<p>Criteria:</p> <ol style="list-style-type: none"> 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. <p>Form of Assessment : Participatory Activities</p>	Direct learning using the pulpit lecture method, exercises and giving 2 X 50 assignments		<p>Material: Meeting material 4 References: <i>Stevenson Jr., William D. 1984. Elements of Power System Analysis. New York: McGraw-Hill Inc.</i></p>	5%

5	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities	Behaviorism/Direct learning/Lectures and discussions 2 X 50		Material: Meeting material 5 References: <i>Stevenson Jr., William D. 1984. Elements of Power System Analysis. New York: McGraw-Hill Inc.</i>	5%
6	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	PBL 2 X 50		Material: Meeting material 5 References: <i>Stevenson Jr., William D. 1984. Elements of Power System Analysis. New York: McGraw-Hill Inc.</i>	10%

7	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	5%
8	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	5%

9	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	5%
10	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10.	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	10%

11	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	10%
12	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	10%

13	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	5%
14	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1.The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	PBL 2 X 50		Material: Meeting material 5 References: Stevenson Jr., William D. 1984. <i>Elements of Power System Analysis</i> . New York: McGraw-Hill Inc.	10%

15	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1. The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10.	PBL 2 X 50		Material: Meeting material 5 References: <i>Stevenson Jr., William D. 1984. Elements of Power System Analysis. New York: McGraw-Hill Inc.</i>	10%
16	Able to describe the replacement circuit for transmission line generators, transformers, loads and their parameters	1. Describe the simultaneous generator replacement circuit and its parameters 2. Describe the transmission line replacement circuit and its parameters 3. Describe the transformer replacement circuit and its parameters 4. Describe the load replacement circuit	Criteria: 1. The assessment criteria are carried out by looking at aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10.	PBL 2 X 50		Material: Meeting material 5 References: <i>Stevenson Jr., William D. 1984. Elements of Power System Analysis. New York: McGraw-Hill Inc.</i>	10%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	57.5%
2.	Project Results Assessment / Product Assessment	22.5%
		80%

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.