	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	2020103004		T=3	P=0	ECTS=4.77	5	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Lusia Rakhmawati, 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

	P.O

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Short Course Description	Basic concepts; electricity, electric power, power flow, 3 phase system, delta/star connection; representation of electric power systems; electric power system components, in-line diagrams, impedance diagrams, admittance diagrams, quantities per unit (PU), circuit models, Y bus matrix, Z bus matrix, bus classification, calculating power flow.
References	**Main :**

1.
1. Diktat: Analisa Sistem Tenaga Listrik I dan II
2. Gross A., Charless. 1979. *Power System Analisys* . New York: John Wiley & sons
3. Moh. E. El-Hawary. 1986. *Electrical Power System Design and Analisys* . New York: McGraw-Hill Inc. 4. Stevenson Jr., William D. 1984. *Elemen of Power System Analsys* . New York: McGraw-Hill Inc.

Supporters:	
Supporting lecturer	GATOT WIDODO Mahendra Widyartono, S.T., 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	test	test		test 3 X 50			0%

2	1. Describe the electric power system 2. Describe the main parts of the electric power system 3. Describe the characteristics of the electric power system 4. Describe natural energy sources 5. Describe the operation of the electric power system	1. 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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%
3	1. Describe the power system 2. Describe the power system components 3. Describe the power network topology 4. Understand the typical power system load	1. Explain the meaning of a power system 2. Mention the components of a power system 3. Explain the topology of an electric power network 4. Read various typical power system loads on an 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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%
4	1. Understanding 3 phase systems 2. Y relationship between current and voltage 3. D relationship between current and voltage 4. Power in a 3 phase system	1. 3 phase system 2. Y relationship between current and voltage 3. D relationship between current and voltage 4. Power in a 3 phase system	**Criteria:** calculation results	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%

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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Behaviorism/Direct learning/Lectures and discussions 3 X 50			0%
6	1. Understand the use of inline diagram symbols 2. Be able to determine impedance on inline diagrams 3. Be able to convert quantities per unit (pu) for 1 phase and 3 phases	1. Use of in-line diagram symbols in a system 2. Determining impedance in a in-line diagram of a system 3. Quantity per unit for 1 phase 4. Quantity per unit for 3 phases -	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Behaviorism/Direct learning/Lectures and discussions 3 X 50			0%

7	1. Able to create a Ybus matrix 2. Able to create a Zbus matrix	1. Determine the Ybus matrix 2. Determine the Zbus matrix	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%
8	UTS	able to do UTS	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	written test 3 X 50			0%

9	Able to calculate power flow in general form	Calculating power flow with general form	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%
10	Able to calculate power flow in hybrid form	Calculating power flow with hybrid forms	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%

11	1. Able to analyze power flow 2. Able to determine bus classification 3. Able to calculate power flow between buses	1. Determine power flow analysis 2. Determine bus classification 3. Calculate power flow between buses	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%
12	1. Able to calculate the bus load in a system with iteration 2. Able to calculate the bus generator in a system with iteration 3. Able to calculate the power flow between buses	1. Calculating the bus load on a system with iteration 2. Calculating the bus generator on a system with iteration	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%

13	1. Able to calculate the bus load using the Gauss-Seiddel method in the Nth iteration 2. Able to calculate the bus generator using the Gauss-Seiddel method in the Nth iteration	1. Calculating the bus load using the Gauss-Seidel method 2. Calculating the bus generator using the Gauss-Seidel method	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%
14	1. Understand the Taylor series with one variable 2. Be able to apply the Newton Rapson method 3. Understand the Taylor series with two variables 4. Be able to apply the Newton Rapson method	1 Equations/functions with one variable 2. Application of the Newton Rapson method 3. Equations/functions with two variables 4. Application of the Newton Rapson method 5. Creating a jcobian matrix	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%

15	1. Able to calculate the power flow using the Newton Rapson method at the Nth iteration 2. Able to calculate the bus voltage, angle q at the Nth iteration	1. Calculating power flow using the Newton Rapson method with iteration on a system 2. Calculating bus voltage, angle q with iteration on a 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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Direct learning using the pulpit lecture method, exercises and giving 3 X 50 assignments			0%
16	UAS results	able to teach UAS questions	**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)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	Final exam semester 3 X 50			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.