UNESA	**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 Power System Analysis	8320102004		T=2	P=0	ECTS=3.18	4	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Nur Kholis, 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)
	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	Application and development of system requirements and problems as well as development of electric power system models, Basic Concepts, System Models, Network Calculations, Load Flow Studies, Symmetrical Three-Phase Faults, Symmetrical Components; Asymmetrical disturbances; and power system stability.
References	**Main :**

1. William D. Stevenson Jr. 1990. Element of Power System Anal y s i s 4 th Edition . New York: McGraw-Hill, Inc.
2. Moh. El-Hawary. Electrical Power Systems Design and Anal y s i s . New York: McGraw-Hill, Inc.
3. Gross, A. Charles. (1990). Power System Anal y s i s , New York: John Wiley & Sons.
4. Tri Wrahatnolo. 2018. Hand Out Perkuliahan Analisis Sistem Tenaga Listrik . Surabaya: Fakultas Teknik Unesa.
5. IEEE Transac

Supporters:	
Supporting lecturer	Dr. Tri Rijanto, M.Pd., M.T. Prof.Dr. Tri Wrahatnolo, M.Pd., M.T. Dr. Subuh Isnur Haryudo, S.T., M.T. Unit Three Kartini, S.T., M.T., Ph.D. Fendi Achmad, S.Pd., M.Pd. Roswina Dianawati, S.Pd., M.Ed.

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	Understand the needs and development of electric power systems	1. Able to calculate electricity needs 2. Able to study the characteristics of renewable electricity sources and their feasibility for development in Indonesia 3. Able to study the electricity system in Indonesia and its problems.	**Criteria:** 1. Assessment of participation in lectures, discussions and question and answer activities through observation sheets, score 0-100 2. Assessment of assignments via assessment sheet, score 0-100	Lectures, discussions, questions and answers and assignments. 2 X 50			0%
2	Able to understand the basic concepts of three-phase electric power systems	1. After following the learning process, students will be able to: Be able to understand the basic concepts of electrical power systems; 2. Able to determine power in AC circuits; 3. Able to determine Quantity Per unit; 4. Able to convert Basic quantity per unit.	**Criteria:** Assessment of completion of assignments, using the assignment assessment sheet, score 01-00	1. Lecture2. Discussion3. Questions and Answers4. Giving assignments 2 X 50			0%
3	Understand the three-phase electric power system model	1. Students are able to: Make generator and transformer circuit models in three-phase electric power systems; 2. Making equivalent circuits of electrical machines; 3. Create inline diagrams; 4. Create Impedance Diagrams and Reactance Diagrams; 5. Perform calculations per unit on an electric power system model.	**Criteria:** 1. Assessment of participation and enthusiasm in activities: Lectures, giving examples of problem solving, discussions, questions and answers, and practice questions 2. Meanwhile, the assessment of completing assignments uses the assignment assessment sheet, score 0-100.	1. Lecture2. Providing examples-2 problem solving3. Discussion4. Questions and answers5. Practice questions 6. Giving assignments 2 X 50			0%
4	Understand the three-phase electric power system model	Students are able to determine the model of a three-phase electric power system	**Criteria:** 1. Assessment of participation and enthusiasm in activities: Lectures, giving examples of problem solving, discussions, questions and answers, and practice questions 2. Meanwhile, the assessment of completing assignments uses the assignment assessment sheet, score 0-100.	1. Lecture2. Providing examples-2 problem solving3. Discussion4. Questions and answers5. Practice questions 6. Giving assignments 2 X 50			0%

5	Describe the concept of network calculations in three-phase electric power systems	1. Students are able to: Determine the equality of electricity sources, 2. Create node equations 3. Create matrix partitioning 4. Removing vertices with matrix algebra 5. Determine bus admittance and impedance matrix 6. Determining the Impedance Matrix	**Criteria:** 1. Assessment of participation and enthusiasm in activities: Lectures, giving examples of problem solving, discussions, questions and answers, and practice questions 2. using observation sheet, score 0-100 3. Meanwhile, the assessment of completing assignments uses the assignment assessment sheet, score 0-100.	1. Lecture2. Providing examples-2 problem solving3. Discussion4. Questions and answers5. Practice questions 6. Giving assignments 2 X 50			0%
6	Understand the concept of network calculations in three-phase electric power systems	Students are able to calculate electrical quantities in a three-phase electric power system network	**Criteria:** Performance assessment uses a performance assessment sheet, score 0-100	1. Lecture2. Sidkusi3. Questions and answers4. Practice solving questions 5. Assignment of assignments. 2 X 50			0%
7	Understanding load flow studies in electric power systems	Students are able to determine load flow studies in electric power systems	**Criteria:** Performance assessment uses a performance assessment sheet, score 0-100	1. Lecture2. Discussion3. Questions and answers4. Practice solving questions 5. Assignment of assignments. 2 X 50			0%
8	Able to understand load flow studies in electric power systems	1. Students are able to carry out calculations: Power for load flow studies; 2. Gauss-Seidel Method; 3. Newton Raphson Method; 4. Fast Decouple Method; 5. Load Flow Studies with Digital Computers; 6. Power Settings go into Power System; 7. Power repair with Capacitor Bank; 8. Arrangement with Transformer	**Criteria:** Performance assessment uses a performance assessment sheet, score 0-100	1. Lecture2. Sidkusi3. Questions and answers4. Practice solving questions 5. Assignment of assignments. 2 X 50			0%

9	Able to calculate symmetric three-phase disturbances	1. Students are able to calculate: Transient conditions during disturbances, 2. Short circuit analysis on loaded and unloaded machines in transient conditions, 3. Bus impedance matrix (Zbus),; And 4. Determining the capacity/rating of the breaker (circuit breaker)	**Criteria:** 1. Test Assessment Sheet, score 0-100 2. Assignment Assessment Sheet, score 0-100	1. Lecture2. Discussion3. Q&A4. Demonstration5. Practice solving problems 6. Giving assignments 2 X 50			0%
10	Understand the components of symmetry and order series	1. Students are able to calculate the synthesis of unsymmetrical phasors, symmetric components of unsymmetrical phasors, 2. Determine the phase shift in the DU transformer, 3. Calculating sequence circuits: sequence impedance of transmission lines of synchronous machines, and in transformers; 4. Calculating the relationship between positive, negative and zero sequences, 5. Simulate symmetry disruption and 6. Calculating asymmetric disturbances	**Criteria:** 1. Check list sheet, Score 0-100 2. Performance Assessment Sheet, score 0-100 3. Assignment Assessment Sheet, score 0-100	1. Lecture2. Discussion3. Q&A4. Demonstration5. Practice solving problems 6. Giving assignments 2 X 50			0%
11	Able to determine symmetry components and sequence sequences	1. Students are able to:·Discuss components of symmetry and ordered series 2. Calculates the Y-Delta transformation 3. Determine the equivalent impedance with the Thevenin circuit 4. Carry out calculation simulations using a series of sequences 5. Carry out calculation simulations for symmetric and unsymmetrical disturbances	**Criteria:** 1. Observation Sheet, score 0-100 2. Performance Assessment Sheet, score 0-100 3. Assignment Assessment Sheet, score 0-100	1. Lecture2. Demonstration3. Practicum 4. Questions and answers5. Discussion6. Exercise7. Completion of assignments 2 X 50			0%

12	Able to determine symmetry components and sequence sequences	1. Students are able to: Discuss the components of symmetry and ordered series 2. Calculating the Y-Delta transformation; 3. Determine the equivalent impedance with the Thevenin circuit 4. Carry out calculation simulations using a series of sequences 5. Carry out calculation simulations for symmetric and unsymmetrical disturbances	**Criteria:** 1. Observation Sheet, score 0-100 2. Performance Assessment Sheet, score 0-100 3. Assignment Assessment Sheet, score 0-100	1. Lecture2. Demonstration3. Practicum 4. Questions and answers5. Discussion6. Exercise7. Completion of assignments 2 X 50			0%
13	Able to calculate asymmetric disturbances. Types of asymmetric disturbances: · Single disturbance · Inter-channel disturbance · Double disturbance · Inter-channel disturbance · Network interpretation Sequence of disturbances via impedance	1. Students are able to identify types of asymmetrical disturbances 2. Determines the magnitude of the fault current when a fault occurs 3. Carry out a simulation of asymmetrical fault current calculations	**Criteria:** 1. Observation sheet, score 0-100 2. Performance assessment sheet, score 0-100 3. Assignment assessment sheet, score 0-100	1. Lecture2. Practical 3. Discussion4. Questions and answers5. Practice questions 6. Doing 2 X 50 assignments			0%
14	Understand power system stability	1. Students are able to understand the concepts of steady state, transient and dynamic stability; 2. Understand the concept of loss of synchronization; 3. Determine the main factors of stability; 4. Understand the concept of swing equation and power coefficient; 5. Calculating system stability; 6. Simulating system stability using equal area criteria and step by step methods	**Criteria:** 1. Observation sheet, score 0-100 2. Performance assessment sheet, score 0-100 3. Assignment assessment sheet, score 0-100	1. Lecture2. Practical 3. Discussion4. Questions and answers5. Practice questions 6. Doing 2 X 50 assignments			0%
15							0%
16							0%

Evaluation Percentage Recap: Project Based Learning

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.