| | Universitas Negeri Surabaya<br>Faculty of Engineering,<br>Electrical Engineering Undergraduate Study Program | Document Code |
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# SEMESTER LEARNING PLAN

| Courses | CODE | Course Family | Credit Weight | | | SEMESTER | Compilation Date |
|---|---|---|---|---|---|---|---|
| Power System Analysis II | 2020102010 | | T=2 | P=0 | ECTS=3.18 | 6 | July 17, 2024 |

| AUTHORIZATION | SP Developer | Course Cluster Coordinator | Study Program Coordinator |
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| | ..... | ..... | Dr. Lusia Rakhmawati, S.T., M.T. |

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

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

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| **Short Course Description** | Basic concepts of faults/short circuits, classification of short circuit types, symmetric short circuit analysis, determination of safety capacity/circuit breaker, symmetric components, non-symmetric short circuit analysis, determination of positive, negative and zero sequence circuits, system stability analysis. |
| **References** | **Main :** |

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.

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| | **Supporters:** |
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| **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 (%) |
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| | | Indicator | Criteria & Form | Offline ( *offline* ) | Online ( *online* ) | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |

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| **1** | 1. Identify and describe types of short circuits | 1. Mention the types of short circuits in the system 2. Define the types of short circuits in the system | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |
| **2** | 1. Calculating the breaker capacity (CB) in general 2. Calculating the breaker capacity (CB) due to short circuit current | 1. Able to calculate short circuit current on generator without load 2. Able to calculate short circuit current on generator with load | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |

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| **3** | 1. Determine the capacity of a breaker. 2. Calculate the capacity of a breaker due to the flow of short circuit current | 1. Able to calculate the breaker capacity (CB) 2. Able to calculate the size of a breaker due to the flow of short circuit current | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |
| **4** | 1. Understand symmetric components (positive sequence, negative sequence and zero) 2. Understand operator "a" on symmetric components | 1. Apply symmetric components for positive sequence, negative sequence and zero sequence 2. Apply operator "a" to power or function | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |

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| **5** | 1, Able to solve unbalanced 3 f systems 2. Phase shift in star delta connection transformer | 1. Solving the unbalanced 3 f system 2. Solving the Hub transformer phase shift. Star delta | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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 and assignments<br>2 X 50 | | | 0% |
| **6** | Transmission line sequence impedance a) “untransposed” transmission line b) “transposed” transmission line | 1. "untransposed" Transmission channel completion 2. "transposed" Transmission channel completion | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>7. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10. | Behaviorism/Direct learning/Lectures, exercises and discussions<br>2 X 50 | | | 0% |

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| **7** | 1. Sequence impedance of a synchronous machine 2. Sequence impedance of a transformer | 1. Determine the sequence impedance of a synchronous machine. 2. Determine the sequence impedance of a transformer | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |
| **8** | Short circuit 3 Ø: 1. short circuit 3 Ø to ground Directly 2. short circuit 3 Ø to ground through impedance | 1. determine the parameters of the short circuit 3 Ø directly 2. determine the parameters of the short circuit 3 Ø via impedance | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |

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| **9** | Example of a 3 Ø short circuit to ground directly | 1. determine the positive sequence, negative sequence, and zero sequence, in the 3 Ø direct short circuit 2. determine the positive sequence, negative sequence, and zero sequence, in the 3 Ø short circuit via impedance | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |
| **10** | 1. Short circuit 3 Ø to ground 2. Short circuit between phases to ground | Calculating the voltage, phase current at the fault point Calculating the voltage, phase current when the phase is short circuited to ground | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |

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| **11** | Stability problems in electric power systems | 1. steady state stability 2. transient stability 3. dynamic stability | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |
| **12** | Loss of synchronization on the system | 1. Stable system 2. Unstable system | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |

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| **13** | Example of a system stability analysis question | 1 steady state<br>2.transient | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |
| **14** | Swing equation | The area criteria are the same | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |

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| **15** | draw a stability curve | able to describe the stability curve | **Criteria:**<br>1. The assessment criteria are carried out by looking at aspects:<br>2. • Participation: carried out by observing student activities (weight 2)<br>3. • UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4. • UAS: carried out every semester to measure all indicators (weight 3)<br>5. • Task: carried out on each indicator (weight 3)<br>6. Student Final Grade:<br>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<br>2 X 50 assignments | | | 0% |
| **16** | | | | | | | 0% |

**Evaluation Percentage Recap: Project Based Learning**

| No | Evaluation | Percentage |
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| | | 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.