



**Universitas Negeri Surabaya**  
**Faculty of Engineering,**  
**Electrical Engineering Undergraduate Study Program**

Document Code

**SEMESTER LEARNING PLAN**

|  |  |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|--|--|--|-----------------------------------|--|-------------------------------------|--|------------------------------|---|---|----|----|----|----|----|----|----|--|--|--|--|--|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| <b>Courses</b>                           | <b>CODE</b>  | <b>Course Family</b>   | <b>Credit Weight</b>              | <b>SEMESTER</b>  | <b>Compilation Date</b>             |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| Optimum Operation and System Reliability | 2020102095   |  | T=2 P=0 ECTS=3.18                 | 7  | July 17, 2024                       |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| <b>AUTHORIZATION</b>                     | <b>SP Developer</b>  |  | <b>Course Cluster Coordinator</b> |  | <b>Study Program Coordinator</b>    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | .....  |  | .....                             |  | Dr. Lusia Rakhmawati,<br>S.T., M.T. |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| <b>Learning model</b>                    | Case Studies   |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| <b>Program Learning Outcomes (PLO)</b>   | PLO study program which is charged to the course   |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | Program Objectives (PO)  |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | PLO-PO Matrix  |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  |  | <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 100px; height: 30px;">P.O</td> </tr> </table> |                                   |  |                                     |  | P.O                          |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| P.O                                      |  |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | PO Matrix at the end of each learning stage (Sub-PO)   |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td rowspan="2" style="width: 50px; height: 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 |
| P.O                                      | Week   |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | 1  | 2  | 3                                 | 4  | 5                                   | 6  | 7                            | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| <b>Short Course Description</b>          | Interconnected electric power systems, characteristics of power plants, scheduling maintenance and system operations, system reliability calculating LOLP (Loss of Load Probability), load distribution of generating units, hydrothermal optimization, generator constraints, system security, operation control.   |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| <b>References</b>                        | <b>Main :</b>  |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | 1. Bruce F.Wollenberg. 2001. Power System Operation and Control. The Electric Power Engineering Handbook Ed. L.L. Grigsby. CRC Press LLC. Djiteng Marsudi. 2006. Operasi Sistem Tenaga Listrik. Cetakan Pertama. Graha Ilmu. Yogyakarta Leonard L. Grigsby. 2006. Power Systems, Electric Power Engineering Handbook Second Edition. New York: Taylor and Francis Group.   |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  | <b>Supporters:</b>   |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| <b>Supporting lecturer</b>               | Unit Three Kartini, S.T., M.T., Ph.D.<br>Muhamad Syariffuddin Zuhrie, S.Pd., M.T.  |  |                                   |  |                                     |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| <b>Week-</b>                             | <b>Final abilities of each learning stage (Sub-PO)</b>   | <b>Evaluation</b>  |                                   | <b>Help Learning, Learning methods, Student Assignments, [ Estimated time]</b> |                                     | <b>Learning materials [ References ]</b> | <b>Assessment Weight (%)</b> |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|  |  | <b>Indicator</b>   | <b>Criteria &amp; Form</b>        | <b>Offline ( offline )</b>   | <b>Online ( online )</b>            |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
| (1)                                      | (2)  | (3)  | (4)                               | (5)  | (6)                                 | (7)                                      | (8)                          |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |

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|---|---|---|--|---|--|--|----|
| 1 | Able to understand the process of delivering electric power | Explaining the electric power system<br>Explaining the interconnection system and operation management of the electric power system | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | Presentation, group discussion and reflection<br>2 X 50 |  |  | 0% |
| 2 | Able to understand the process of delivering electric power | Explaining the electric power system<br>Explaining the interconnection system and operation management of the electric power system | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | Presentation, group discussion and reflection<br>2 X 50 |  |  | 0% |

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| 3 | Students are able to plan scheduling and constraints of the electric power system. Students understand scheduling and loading methods | - Calculate and analyze system fuel costs Explain loading and methods for calculating LOLP - Explain operation planning and system load analysis - Calculate possible losses LOLP Load Calculate the effect of adding and removing generating units on system reliability | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | Presentation, discussion and practice<br>2 X 50 |  |  | 0% |
| 4 | Students are able to plan scheduling and constraints of the electric power system. Students understand scheduling and loading methods | - Calculate and analyze system fuel costs Explain loading and methods for calculating LOLP - Explain operation planning and system load analysis - Calculate possible losses LOLP Load Calculate the effect of adding and removing generating units on system reliability | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | Presentation, discussion and practice<br>2 X 50 |  |  | 0% |

|   |   |   |  |   |  |  |    |
|---|---|---|--|---|--|--|----|
| 5 | Students are able to plan scheduling and constraints of the electric power system. Students understand scheduling and loading methods | - Calculate and analyze system fuel costs Explain loading and methods for calculating LOLP - Explain operation planning and system load analysis - Calculate possible losses LOLP Load Calculate the effect of adding and removing generating units on system reliability | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | Presentation, discussion and practice<br>2 X 50 |  |  | 0% |
| 6 | Students are able to understand and analyze the characteristics of hydro thermal plants   | - Explain the characteristics of hydro thermal generators - Economic loading of hydro thermal generator units   | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | Discussion, exercises and assignments<br>2 X 50 |  |  | 0% |

|    |   |   |  |   |  |  |    |
|----|---|---|--|---|--|--|----|
| 7  | Students are able to understand and analyze the characteristics of hydro thermal plants | - Explain the characteristics of hydro thermal generators - Economic loading of hydro thermal generator units | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | Discussion, exercises and assignments<br>2 X 50 |  |  | 0% |
| 8  | Midterm exam  |   | <b>Criteria:</b><br>1.The assessment criteria are carried out by looking at aspects:<br>2.1. Participation: carried out by observing student activities (weight 2)<br>3.2. UTS: carried out with an assessment during the middle of the semester (weight 2)<br>4.3. UAS: carried out every semester to measure all indicators (weight 3)<br>5.4. Task: carried out on each indicator (weight 3)<br>6.Student Final Grade:<br>7.Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. | 2 X 50  |  |  | 0% |
| 9  |   |   |  |   |  |  | 0% |
| 10 |   |   |  |   |  |  | 0% |
| 11 |   |   |  |   |  |  | 0% |
| 12 |   |   |  |   |  |  | 0% |

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|----|--|--|--|--|--|--|----|
| 13 |  |  |  |  |  |  | 0% |
| 14 |  |  |  |  |  |  | 0% |
| 15 |  |  |  |  |  |  | 0% |
| 16 |  |  |  |  |  |  | 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** 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.
- 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.**