



**Universitas Negeri Surabaya  
Vocational Faculty,  
D4 Electrical Engineering 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>            |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Power Quality                          | 2030502041   |  | 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>   |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | .....  |  | .....                             |  | Mahendra Widyartono,<br>S.T., M.T. |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Learning model</b>                  | Project Based Learning   |  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Program Learning Outcomes (PLO)</b> | PLO study program that is charged to the course  |  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | Program Objectives (PO)  |  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | PLO-PO Matrix  |  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  |  | P.O  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Short Course Description</b>        | PO Matrix at the end of each learning stage (Sub-PO)   |  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  |  | <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td rowspan="2" style="padding: 5px;">P.O</td> <td colspan="16" style="text-align: center; padding: 5px;">Week</td> </tr> <tr> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;">4</td> <td style="padding: 5px;">5</td> <td style="padding: 5px;">6</td> <td style="padding: 5px;">7</td> <td style="padding: 5px;">8</td> <td style="padding: 5px;">9</td> <td style="padding: 5px;">10</td> <td style="padding: 5px;">11</td> <td style="padding: 5px;">12</td> <td style="padding: 5px;">13</td> <td style="padding: 5px;">14</td> <td style="padding: 5px;">15</td> <td style="padding: 5px;">16</td> </tr> </table> |                                   |  |                                    | P.O                                      | Week                         |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| P.O                                    | Week   |  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | 1  | 2  | 3                                 | 4  | 5                                  | 6  | 7                            | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>References</b>                      | <b>Main :</b><br>1. Pustaka Utama : Surajit Chattopadhyay. 2010. Electric Power Quality. Springer.<br><br><b>Supporters:</b> |  |                                   |  |                                    |  |                              |   |   |    |    |    |    |    |    |    |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Supporting lecturer</b>             | Widi Aribowo, S.T., M.T.<br>Ayusta Lukita Wardani, S.ST., 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 | Students are able to understand and explain power semiconductor components, power diodes, thyristo   | <input type="checkbox"/> Accuracy in defining Power Diode Characteristics and Thyristor Characteristics<br><input type="checkbox"/> Sharpness and clarity in distinguishing di/dt and dv/dt Protection  |  | <input type="checkbox"/> Lectures <input type="checkbox"/> Brainstorming, <input type="checkbox"/> group discussions [TM: 2%2 (3x50'')] Task 1: Literature Review Carrying out a resume from the literature review [BT BM:4 x (3x50'')] 4 X 50 |  |  | 0% |
| 2 | Students are able to understand and explain power semiconductor components, power diodes, thyristo   | <input type="checkbox"/> Accuracy in defining Power Diode Characteristics and Thyristor Characteristics<br><input type="checkbox"/> Sharpness and clarity in distinguishing di/dt and dv/dt Protection  |  | <input type="checkbox"/> Lectures <input type="checkbox"/> Brainstorming, <input type="checkbox"/> group discussions [TM: 2%2 (3x50'')] Task 1: Literature Review Carrying out a resume from the literature review [BT BM:4 x (3x50'')] 4 X 50 |  |  | 0% |
| 3 | Students are able to formulate the basic theory of rectifiers and, Single Phase Diode - Bridge Rectifiers, Voltage Doubler Rectifiers (Single Phase), Three Phase Full Bridge Rectifiers, Students are able to formulate and compare Single Phase and Three Phase Rectifiers | <input type="checkbox"/> Clarity of written and verbal explanations about the basics of rectification. <input type="checkbox"/> Ability to apply freewheeling diodes. <input type="checkbox"/> Ability to compare single phase and three phase rectifiers |  | Lecture Group discussion Presentation [TM: 2%2 (3x50'')] Assignment 2: Literature Review Carrying out a resume from the literature review Practicing questions [BT BM:4%2 (3x50'')] 4 X 50   |  |  | 0% |
| 4 | Students are able to formulate the basic theory of rectifiers and, Single Phase Diode - Bridge Rectifiers, Voltage Doubler Rectifiers (Single Phase), Three Phase Full Bridge Rectifiers, Students are able to formulate and compare Single Phase and Three Phase Rectifiers | <input type="checkbox"/> Clarity of written and verbal explanations about the basics of rectification. <input type="checkbox"/> Ability to apply freewheeling diodes. <input type="checkbox"/> Ability to compare single phase and three phase rectifiers |  | Lecture Group discussion Presentation [TM: 2%2 (3x50'')] Assignment 2: Literature Review Carrying out a resume from the literature review Practicing questions [BT BM:4%2 (3x50'')] 4 X 50   |  |  | 0% |
| 5 | Students are able to formulate controllers for controlled rectifiers and frequency inverters, Three-Phase Converter Analysis, AC Inductance Effects, Current Effects, Discontinuity, Inverting Operations, AC Waveforms, and other Three-Phase Converters.                   | <input type="checkbox"/> Clarity of explanation of controlled rectifier <input type="checkbox"/> Clarity of analyzing converter circuit <input type="checkbox"/> Ability to read waveforms  |  | Lecture Group discussion Presentation [TM: 2%2 (3x50'')] Task 3: Literature Review Carrying out a resume from the literature review Practice questions [BT BM:4 x (3x50'')] 2 X 50   |  |  | 0% |

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| 6  | Students are able to understand and explain commutation techniques  | <input type="checkbox"/> Clarity of written and verbal explanations about commutation techniques<br><input type="checkbox"/> Ability to apply the thyristor extinction process   |  | Lecture Group discussion<br>Presentation [TM: 2%2 (3x50")]<br>Assignment 4: Literature Review<br>Carrying out a resume from the literature review<br>Practice questions [BT BM:4 x (3x50")]<br>2 X 50   |  |  | 0% |
| 7  | Students are able to analyze and design Chopper circuits, switching converter models, various types of chopper circuits, Chopper circuit configurations | <input type="checkbox"/> Clarity of written and verbal explanations about the switching converter model.<br><input type="checkbox"/> Ability to apply various converters.<br><input type="checkbox"/> Ability to assemble converter circuits<br><input type="checkbox"/> Accuracy of developing models with Simulink<br><input type="checkbox"/> Ability to simulate, converter circuits |  | Lecture Group discussion<br>Presentation [TM: 2%2 (3x50")]<br>Assignment 5: Literature Review<br>Carrying out a resume from the literature review<br>Practicing questions [BT BM:4%2 (3x50")]<br>Developing a Converter model with Matlab simulink [PS BM : (2 2)x (3x50")]<br>2 X 50 |  |  | 0% |
| 8  | Sub Summative Evaluation: To determine the achievement of competency in the Power Electronics course [1%2 (2%2 50")]                                    |  |  | 2 X 50  |  |  | 0% |
| 9  | Students can understand and explain the basics of AC voltage regulator circuits, DC voltage regulators  | <input type="checkbox"/> Clarity of explanation of AC/DC voltage regulators<br><input type="checkbox"/> Clarity of basic explanation of voltage regulator circuits<br><input type="checkbox"/> Ability to simulate AC/DC voltage regulators  |  | Lecture Group discussion<br>Presentation [TM: 2%2 (3x50")]<br>Task 5: Literature Review<br>Carrying out a resume from the literature review<br>Practicing questions [BT BM:4 x (3x50")]<br>4 X 50   |  |  | 0% |
| 10 | Students can understand and explain the basics of AC voltage regulator circuits, DC voltage regulators  | <input type="checkbox"/> Clarity of explanation of AC/DC voltage regulators<br><input type="checkbox"/> Clarity of basic explanation of voltage regulator circuits<br><input type="checkbox"/> Ability to simulate AC/DC voltage regulators  |  | Lecture Group discussion<br>Presentation [TM: 2%2 (3x50")]<br>Task 5: Literature Review<br>Carrying out a resume from the literature review<br>Practicing questions [BT BM:4 x (3x50")]<br>4 X 50   |  |  | 0% |

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|----|---|--|--|---|--|--|----|
| 11 | Students are able to analyze and design inverter circuits and the basic concepts of Inverting Model Switches, Single Phase Inverters, Three Phase Inverters, other inverting switch schemes, rectifier operating models | <input type="checkbox"/> Clarity of written and verbal explanations about basic switch concepts<br><input type="checkbox"/> Ability to formulate inverters<br><input type="checkbox"/> Accuracy in developing models with Simulink<br><input type="checkbox"/> Ability to simulate inverter circuits |  | Lecture Group discussion<br>Presentation [TM: 2%2 (3x50")]<br>Assignment 6: Literature Review<br>Carrying out a resume from the literature review<br>Practicing questions [BT BM:4%2 (3x50")]<br>Developing an inverter model with Matlab simulink [PS BM : (2 2)x (3x50")]<br>4 X 50 |  |  | 0% |
| 12 | Students are able to analyze and design inverter circuits and the basic concepts of Inverting Model Switches, Single Phase Inverters, Three Phase Inverters, other inverting switch schemes, rectifier operating models | <input type="checkbox"/> Clarity of written and verbal explanations about basic switch concepts<br><input type="checkbox"/> Ability to formulate inverters<br><input type="checkbox"/> Accuracy in developing models with Simulink<br><input type="checkbox"/> Ability to simulate inverter circuits |  | Lecture Group discussion<br>Presentation [TM: 2%2 (3x50")]<br>Assignment 6: Literature Review<br>Carrying out a resume from the literature review<br>Practicing questions [BT BM:4%2 (3x50")]<br>Developing an inverter model with Matlab simulink [PS BM : (2 2)x (3x50")]<br>4 X 50 |  |  | 0% |
| 13 | Students are able to present about power supply applications, motor drive applications, applications  | <input type="checkbox"/> Sharpness in differentiating power supply, motor drive, residential and industrial applications<br><input type="checkbox"/> Ability to simulate, industrial applications  |  | Lecture Group discussion<br>Each group examines a certain theme<br>Presentation and discussion [TM: 2%2 (3x50")]<br>Preparing papers and presentation slides [BT BM: 4%2 (3x50")]<br>4 X 50   |  |  | 0% |
| 14 | Students are able to present about power supply applications, motor drive applications, applications  | <input type="checkbox"/> Sharpness in differentiating power supply, motor drive, residential and industrial applications<br><input type="checkbox"/> Ability to simulate, industrial applications  |  | Lecture Group discussion<br>Each group examines a certain theme<br>Presentation and discussion [TM: 2%2 (3x50")]<br>Preparing papers and presentation slides [BT BM: 4%2 (3x50")]<br>4 X 50   |  |  | 0% |
| 15 | Summative Evaluation: To determine the achievement of competency in the Power Electronics course [1%2 (2%2 50")]  |  |  | UAS<br>2 X 50   |  |  | 0% |

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| 16 |  |  |  |  |  |  | 0% |
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**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.