



**Universitas Negeri Surabaya**  
**Faculty of Engineering**  
**, Electrical Engineering Education 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>																																												
Electrical Instrumentation and Measurement	8320102039	Compulsory Study Program Subjects	T=2 P=0 ECTS=3.18	3	July 17, 2024																																												
<b>AUTHORIZATION</b>		<b>SP Developer</b>	<b>Course Cluster Coordinator</b>	<b>Study Program Coordinator</b>																																													
		.....	.....	Dr. Nur Kholis, S.T., M.T.																																													
<b>Learning model</b>	Project Based Learning																																																
<b>Program Learning Outcomes (PLO)</b>	<b>PLO study program that is charged to the course</b>																																																
	<b>PLO-10</b>	Have a responsible character and be committed to professional ethics (General/SSC4.6).																																															
	<b>PLO-13</b>	Able to design circuits, devices and products in the electrical and electronics engineering expertise program (SSC3.1).																																															
	<b>PLO-14</b>	Able to become a practitioner who can apply his knowledge and skills to develop products in a comprehensive electrical engineering and electronics engineering skills program (SSC4.1)																																															
	<b>Program Objectives (PO)</b>																																																
	<b>PLO-PO Matrix</b>																																																
		<table border="1" style="margin: auto;"> <tr> <td style="width: 20%;">P.O</td> <td style="width: 20%;">PLO-10</td> <td style="width: 20%;">PLO-13</td> <td style="width: 20%;">PLO-14</td> </tr> </table>				P.O	PLO-10	PLO-13	PLO-14																																								
P.O	PLO-10	PLO-13	PLO-14																																														
<b>PO Matrix at the end of each learning stage (Sub-PO)</b>																																																	
	<table border="1" style="margin: auto;"> <tr> <td rowspan="2" style="width: 5%;">P.O</td> <td colspan="16" style="text-align: center;">Week</td> </tr> <tr> <td style="width: 5%;">1</td> <td style="width: 5%;">2</td> <td style="width: 5%;">3</td> <td style="width: 5%;">4</td> <td style="width: 5%;">5</td> <td style="width: 5%;">6</td> <td style="width: 5%;">7</td> <td style="width: 5%;">8</td> <td style="width: 5%;">9</td> <td style="width: 5%;">10</td> <td style="width: 5%;">11</td> <td style="width: 5%;">12</td> <td style="width: 5%;">13</td> <td style="width: 5%;">14</td> <td style="width: 5%;">15</td> <td style="width: 5%;">16</td> </tr> </table>																P.O	Week																1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																																	
<b>Short Course Description</b>	This Electrical Measurement course will study various types of electrical measuring instruments and their use, taking measurements correctly according to measurement units and standards.																																																
<b>References</b>	<b>Main :</b>																																																
	<ol style="list-style-type: none"> <li>1. Cooper W D. 1999. Instrumentasi Elektronik dan Teknik Pengukuran, Edisi Ke-2 . Jakarta: Penerbit Erlangga.</li> <li>2. Soedjana S dan Nishino O. 2000. Pengukuran dan Alat-Alat Ukur Listrik . Jakarta: Paradnya Paramita.</li> <li>3. Rudy Setiabudi. 2007. Pengukuran Besaran Listrik. Jakarta: Lembaga Penerbit FEUI (LP-FEUI).</li> <li>4. Sapiie S dan Nishino. 2005. Pengukuran dan Alat-Alat Ukur Listrik . Jakarta: Pradnya Paramita.</li> </ol>																																																
	<b>Supporters:</b>																																																
	<ol style="list-style-type: none"> <li>1. 1. Johnson, David E.; Hilburn, John L.; Johnson, Johnny R.; Scot, Peter D.; 2002, "Basic Circuit Analysis", John Wiley &amp; Son (Asia) Pte. Ltd.</li> <li>2. 2. Witte, Robert A. 2002, "Electronic Test Instrument : Analog and Digital Measurements", 2<sup>nd</sup> ed., PrenticeHall</li> </ol>																																																
<b>Supporting lecturer</b>	Dr. Subuh Isnur Haryudo, S.T., 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)																																										

1	<p>1. Able to explain the system of units and electrical quantities according to measurement standards</p> <p>2. Able to use a system of units and electrical quantities according to measurement standards</p>	<p>1. Able to explain electrical units and quantities;</p> <p>2. Able to explain measurement standardization;</p> <p>3. Able to identify and convert various units of electrical quantities into basic quantities and derived quantities;</p> <p>4. Able to explain the symbols of electrical measuring instruments.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B -=66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Lectures, discussions and questions and answers 2 X 50</p>		<p><b>Material:</b> Units and Quantities <b>Library:</b> Rudy Setiabudi. 2007. <i>Measurement of Electrical Quantities</i>. Jakarta: FEUI Publishing Institute (LP-FEUI).</p>	3%
2	<p>Able to describe the working principles and characteristics of electrical measuring instruments</p>	<p>1. Can identify the concepts of electromotive force and electromagnetic force as sources of electric current in an electrical circuit;</p> <p>2. Can explain the working principles and characteristics of electrical measuring instruments;</p> <p>3. Can explain the characteristics and types of electrical measuring instruments;</p> <p>4. Use of various electrical measuring instruments.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B -=66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Lectures, discussions and performances 2 X 50</p>		<p><b>Material:</b> Characteristics of measuring instruments <b>Reference:</b> Rudy Setiabudi. 2007. <i>Measurement of Electrical Quantities</i>. Jakarta: FEUI Publishing Institute (LP-FEUI).</p>	3%
3	<p>Able to describe the working principles and characteristics of electrical measuring instruments</p>	<p>1. Can identify the concepts of electromotive force and electromagnetic force as sources of electric current in an electrical circuit;</p> <p>2. Can explain the working principles and characteristics of electrical measuring instruments;</p> <p>3. Can explain the characteristics and types of electrical measuring instruments;</p> <p>4. Use of various electrical measuring instruments.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B -=66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Discussion, and practice 2 X 50</p>		<p><b>Material:</b> Characteristics of measuring instruments <b>Reference:</b> Cooper W D. 1999. <i>Electronic Instrumentation and Measurement Techniques, 2nd Edition</i>. Jakarta: Erlangga Publishers.</p>	4%

4	<p>1. Able to explain the basics of electricity about electric current</p> <p>2. Able to use Ammeter measuring instruments in measurements</p>	<p>1. Can explain the basic concepts of electric current;</p> <p>2. Can explain the various sources of electric current;</p> <p>3. Can explain the working principles and characteristics of electric current measuring instruments;</p> <p>4. Can carry out electric current measurements.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B -=66-70.9; C =61-65.9; C =56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Lectures, discussions and practice 2 X 50</p>		<p><b>Material:</b> Electric Current</p> <p><b>Literature:</b> <i>Sapiie S and Nishino. 2005. Measurements and Electrical Measuring Instruments. Jakarta: Pradnya Paramita.</i></p> <hr/> <p><b>Material:</b> Electric current measurement</p> <p><b>Reference:</b> <i>Rudy Setiabudi. 2007. Measurement of Electrical Quantities. Jakarta: FEUI Publishing Institute (LP-FEUI).</i></p>	3%
5	<p>1. Able to explain the basics of electricity about electric current</p> <p>2. Able to use Ammeter measuring instruments in measurements</p>	<p>1. Can explain the basic concepts of electric current;</p> <p>2. Can explain the various sources of electric current;</p> <p>3. Can explain the working principles and characteristics of electric current measuring instruments;</p> <p>4. Can carry out electric current measurements.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B -=66-70.9; C =61-65.9; C =56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Discussion, and practice 2 X 50</p>		<p><b>Material:</b> Electric Current</p> <p><b>Literature:</b> <i>Sapiie S and Nishino. 2005. Measurements and Electrical Measuring Instruments. Jakarta: Pradnya Paramita.</i></p> <hr/> <p><b>Material:</b> Electric current measurement</p> <p><b>Reference:</b> <i>Rudy Setiabudi. 2007. Measurement of Electrical Quantities. Jakarta: FEUI Publishing Institute (LP-FEUI).</i></p>	4%
6	<p>1. Able to explain the basics of electricity regarding electric voltage</p> <p>2. Able to use a Voltmeter measuring instrument in measurements</p>	<p>1. Can explain the basic concepts of electric voltage;</p> <p>2. Can explain the various types of electrical voltage;</p> <p>3. Can explain the working principles and characteristics of electric voltage measuring instruments;</p> <p>4. Can carry out electrical voltage measurements.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B -=66-70.9; C =61-65.9; C =56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Lectures, discussions and performances 2 X 50</p>		<p><b>Material:</b> Electrical Measuring Instruments</p> <p><b>Library:</b> <i>Rudy Setiabudi. 2007. Measurement of Electrical Quantities. Jakarta: FEUI Publishing Institute (LP-FEUI).</i></p> <hr/> <p><b>Material:</b> Voltage measuring instrument (Voltmeter)</p> <p><b>References:</b> <i>Sapiie S and Nishino. 2005. Measurements and Electrical Measuring Instruments. Jakarta: Pradnya Paramita.</i></p>	3%

7	<p>1. Able to explain the basics of electricity regarding electric voltage</p> <p>2. Able to use a Voltmeter measuring instrument in measurements</p>	<p>1. Can explain the basic concepts of electric voltage;</p> <p>2. Can explain the various types of electrical voltage;</p> <p>3. Can explain the working principles and characteristics of electric voltage measuring instruments;</p> <p>4. Can carry out electrical voltage measurements.</p>	<p><b>Criteria:</b> A=86-100; A=81-85.9; B =76-80.9; B=71-75.9; B =-66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Discussion, and performance 2 X 50</p>		<p><b>Material:</b> Electrical Measuring Instruments <b>Library:</b> Rudy Setiabudi. 2007. <i>Measurement of Electrical Quantities</i>. Jakarta: FEUI Publishing Institute (LP-FEUI).</p> <p><b>Material:</b> Voltage measuring instrument (Voltmeter) <b>References:</b> Sapiie S and Nishino. 2005. <i>Measurements and Electrical Measuring Instruments</i>. Jakarta: Pradnya Paramita.</p>	4%
8	<p>Midterm Exam (UTS)</p>	<p>Able to complete learning in the form of a portfolio from meetings 1-7</p>	<p><b>Criteria:</b> A=86-100; A=81-85.9; B =76-80.9; B=71-75.9; B =-66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Tests</p>	<p>Individual Project 2 X 50</p>			20%
9	<p>Be able to explain electrical elements as voltage sources</p>	<p>1. Can explain various electrical elements as voltage sources;</p> <p>2. Can explain the working principles and characteristics of electrical elements;</p> <p>3. Can carry out measurements of electrical elements.</p>	<p><b>Criteria:</b> A=86-100; A=81-85.9; B =76-80.9; B=71-75.9; B =-66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Lectures, discussions and performance performances 2 X 50</p>		<p><b>Material:</b> Electrical elements <b>References:</b> 1. Johnson, David E.; Hilburn, John L.; Johnson, Johnny R.; Scott, Peter D.; 2002, "Basic Circuit Analysis", John Wiley &amp; Son (Asia) Pte. Ltd.</p>	3%
10	<p>1. Able to describe the basics of electricity regarding power and electrical energy</p> <p>2. Able to use a Wattmeter measuring instrument in measurements</p>	<p>1. Can explain the concept of power and electrical energy</p> <p>2. Can explain the relationship between current, voltage, power and electrical energy</p> <p>3. Can explain the working principles of power and electrical energy measuring instruments</p> <p>4. Can apply the use of power and electrical energy in daily life and calculate it based on the numbers printed on the kWh meter</p>	<p><b>Criteria:</b> A=86-100; A=81-85.9; B =76-80.9; B=71-75.9; B =-66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Forms of Assessment :</b> Participatory Activities, Practice/Performance, Tests</p>	<p>Lectures, discussions and performance performances 2 X 50</p>		<p><b>Material:</b> Power and Energy <b>Reader:</b> Rudy Setiabudi. 2007. <i>Measurement of Electrical Quantities</i>. Jakarta: FEUI Publishing Institute (LP-FEUI).</p> <p><b>Material:</b> Characteristics of measuring instruments <b>References:</b> 1. Johnson, David E.; Hilburn, John L.; Johnson, Johnny R.; Scott, Peter D.; 2002, "Basic Circuit Analysis", John Wiley &amp; Son (Asia) Pte. Ltd.</p>	3%

11	<p>1. Able to describe the basics of electricity regarding power and electrical energy</p> <p>2. Able to use a Wattmeter measuring instrument in measurements</p>	<p>1. Can explain the concept of power and electrical energy</p> <p>2. Can explain the relationship between current, voltage, power and electrical energy</p> <p>3. Can explain the working principles of power and electrical energy measuring instruments</p> <p>4. Can apply the use of power and electrical energy in daily life and calculate it based on the numbers printed on the kWh meter</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B-=66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practice / Performance</p>	<p>Discussion, and performance demonstration 2 X 50</p>		<p><b>Material:</b> Power and Energy <b>Reader:</b> Rudy Setiabudi. 2007. <i>Measurement of Electrical Quantities</i>. Jakarta: FEUI Publishing Institute (LP-FEUI).</p> <p><b>Material:</b> Characteristics of measuring instruments <b>References:</b> 1. Johnson, David E.; Hilburn, John L.; Johnson, Johnny R.; Scott, Peter D.; 2002, "Basic Circuit Analysis", John Wiley &amp; Son (Asia) Pte. Ltd.</p>	5%
12	<p>1. Able to describe the working principles and characteristics of an Oscilloscope</p> <p>2. Able to operate an Oscilloscope</p>	<p>1. Can explain the working principles and characteristics of an Oscilloscope;</p> <p>2. Can use Oscilloscope in measuring electrical circuits;</p> <p>3. Can analyze the data obtained.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B-=66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Lectures, discussions, and practice/performance 2 X 50</p>		<p><b>Material:</b> Power and Energy <b>References:</b> Soedjana S and Nishino O. 2000. <i>Electrical Measurements and Measuring Instruments</i>. Jakarta: Paradnya Paramita.</p> <p><b>Material:</b> Oscilloscope <b>Reader:</b> Sapiie S and Nishino. 2005. <i>Measurements and Electrical Measuring Instruments</i>. Jakarta: Pradnya Paramita.</p>	3%
13	<p>1. Able to describe the working principles and characteristics of an Oscilloscope</p> <p>2. Able to operate an Oscilloscope</p>	<p>1. Can explain the working principles and characteristics of an Oscilloscope;</p> <p>2. Can use Oscilloscope in measuring electrical circuits;</p> <p>3. Can analyze the data obtained.</p>	<p><b>Criteria:</b> A=86-100; A-=81-85.9; B =76-80.9; B=71-75.9; B-=66-70.9; C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9</p> <p><b>Form of Assessment :</b> Participatory Activities, Practice/Performance</p>	<p>Discussion, and practice/performance 2 X 50</p>		<p><b>Material:</b> Power and Energy <b>References:</b> Soedjana S and Nishino O. 2000. <i>Electrical Measurements and Measuring Instruments</i>. Jakarta: Paradnya Paramita.</p> <p><b>Material:</b> Oscilloscope <b>Reader:</b> Sapiie S and Nishino. 2005. <i>Measurements and Electrical Measuring Instruments</i>. Jakarta: Pradnya Paramita.</p>	5%

14	Able to use various electrical measuring instruments and take measurements	1.Can use various kinds of electrical measuring instruments based on various electrical loads and can analyze the data obtained; 2.Can analyze the data obtained;	<b>Criteria:</b> A=86-100; A-=81-85.9;B =76-80.9;B=71-75.9; B-=66-70.9;C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9  <b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practice / Performance	Discussion and Practicum 2 X 50		<b>Material:</b> Electrical Measuring Instruments <b>Library:</b> Rudy Setiabudi. 2007. <i>Measurement of Electrical Quantities.</i> Jakarta: FEUI Publishing Institute (LP-FEUI).	3%
15	Able to use various electrical measuring instruments and take measurements	1.Can use various kinds of electrical measuring instruments based on various electrical loads and can analyze the data obtained; 2.Can analyze the data obtained;	<b>Criteria:</b> A=86-100; A-=81-85.9;B =76-80.9;B=71-75.9; B-=66-70.9;C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9  <b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practice / Performance	Discussion and Practicum 2 X 50		<b>Material:</b> Electrical Measuring Instruments <b>Library:</b> Rudy Setiabudi. 2007. <i>Measurement of Electrical Quantities.</i> Jakarta: FEUI Publishing Institute (LP-FEUI).	3%
16	Final Semester Examination (UAT)	Able to complete learning in the form of a portfolio from meetings 8-15	<b>Criteria:</b> A=86-100; A-=81-85.9;B =76-80.9;B=71-75.9; B-=66-70.9;C =61-65.9; C=56-60.9; D=41-55.9; E=0-40.9  <b>Form of Assessment :</b> Test	Practice and Test 2 X 50			30%

#### Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	28.84%
2.	Portfolio Assessment	10.34%
3.	Practice / Performance	22.17%
4.	Test	37.67%
		99.02%

#### Notes

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Forms of assessment:** test and non-test.
- 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.
- 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.
- Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
- 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%.
- TM=Face to face, PT=Structured assignments, BM=Independent study.