


## Semester Learning Plan

	<b>Universitas Negeri Surabaya</b> <b>Faculty of Mathematics and Natural Sciences</b> <b>Physics Education Study Program</b>					<b>Document Code</b>
<b>SEMESTER LEARNING PLAN</b>						
<b>COURSE</b>	<b>CODE</b>	<b>Group of Course</b>	<b>Credit Points</b>		<b>Semester</b>	<b>Date of arrangement</b>
Physics Measurement System		Mandatory Course	T=2	P=0	1	30 Nov. 2019
<b>Authorization</b> <b>Department of Physics</b>	<b>Semester Learning Plan Developer</b>		<b>Group of Course Coordinator</b>		<b>Head of Study Program</b>	
	<b>Abu Zainuddin, S.Pd, M.Pd.</b>		<b>Setyo Admoko, M.Pd</b>		<b>Nadi Suprpto, Ph.D</b>	
<b>Learning Outcome (LO)</b>	<b>PLO in course</b>					
	PLO-1	Able to demonstrate their knowledge of classical physics and modern physics.				
	PLO-6	Design and conduct experiments in learning physics by applying the scientific method				
	PLO-7	Improve their knowledge and be able to continue their study in a higher degree program				
	PLO-9	Make a decision based on the data or information in order to fulfil and evaluate the tasks responsibility				
	<b>Course Learning Outcome (CLO)</b>					
	CLO1	Have the ability to utilize learning source and learning media based on ICT in analyzing physics measurement system.				
	CLO2	Have the knowledge of physics measurement system and master its concepts.				
	CLO3	Have the skills for analyzing physics measurement system including its application in measuring instruments.				
	CLO4	Have a responsible attitude which is reflected in the results of the critical and thorough analysis of the physical measurement system material.				
	<b>Final competencies for each learning stage (Sub-CLO)</b>					
	Sub-CLO1	Have the ability to choose learning source and media based on ICT to find the presentation material. Have the ability to choose learning source and media based on ICT to find the example of electrical measuring instrument application.				

	Sub-CLO2	<p>Have the ability to select a measuring instrument according to the type of quantity to be measured in order to create high-precision and accurate measurement.</p> <p>Have the ability to select appropriate measurement technique based on the type of quantity to be measured in order to create high-precision and accurate measurement.</p> <p>Have the ability to analyze measurement error and uncertainty sources.</p> <p>Have the ability to plan measurement by giving attention to the work safety principle.</p>
	Sub-CLO3	<p>Have the ability to carry out measurement of physical quantities using proper measuring instruments and measurement technique in order to create high-precision and accurate measurement.</p> <p>Have the ability to carry out measurement by giving attention to work safety principle.</p> <p>Have the ability to present measurement results and uncertainty error according to the rules correctly.</p>
	Sub-CLO4	<p>Have responsibility to keep measuring instruments in order to function properly by carrying out proper procedure for use and maintenance.</p>
<b>Short description about the course</b>	<p>This course describes the application of measurement technique and measurement error analysis, the application of direct current indicating instruments for solving various electrical problems, the applications of inductance and capacitance measurement concept also the explanation of CRO (<i>Cathode Ray Oscilloscope</i>) and its application in daily life. Lecturing is undertaken using group discussion, presentation, questions and answers, and also assignment.</p>	
<b>Course Content: Learning Material</b>	<p>The followings are the course content that should be studied by students:</p> <ol style="list-style-type: none"> <li>1. Responsible and committed as physics practitioner Bertanggungjawab dan memiliki komitmen sebagai praktisi fisika.</li> <li>2. Have the ability to use physics concept and suitable mathematical/computation method for solving quantitative physics problems.</li> <li>3. Use demonstration tools, measuring instruments, and computer software/hardware to increase the precision and accuracy of physical phenomena measurement by taking into account the work safety principle.</li> <li>4. Use symbolic and numeric language creatively to describe natural phenomena both qualitatively and quantitatively.</li> <li>5. Design and implement the experimental research, analyze data with precise explanation about error and uncertainty, and draw conclusion based on data and guided/independent analysis for learning and research.</li> <li>6. Have the ability to collect and analyze data also to arrange coherent report on its findings.</li> </ol>	
<b>References</b>	<b>Main references:</b>	
	<ol style="list-style-type: none"> <li>1. Bell, D. A. 2004. <i>Electronics Instrumentation and Measurement</i>. USA: Springer.</li> <li>2. Fornasini, P. 2008. <i>The Uncertainty in Physical Measurements an Introduction to Data Analysis in The Physics Laboratory</i>. New York: Springer.</li> <li>3. Gupta, S.V. 2012. <i>Measurement Uncertainties Physical Parameters and Calibrations of Instruments</i>. New York: Springer.</li> </ol>	
	<b>Supporting references:</b>	

	4. Keithley. 2004. <i>Low Level Measurement Handbook Precision DC Current, Voltage, and Resistance Measurements</i> . USA: Keithley Instruments Inc. 5. Moris, A. S. 2001. <i>Measurement and Instrumentation Principles</i> , Third Edition. Butterworth Heinemann 6. <a href="http://www.eee.metu.edu.tr/~ee231/documents/NotesOnOscilloscopes.pdf">www.eee.metu.edu.tr/~ee231/documents/NotesOnOscilloscopes.pdf</a>						
<b>Lecturers</b>	Setyo Admoko, S.Pd, M.Pd Abu Zainuddin, M.Pd Nurita Apridiana Lestari, M.Pd.						
<b>Requirement course</b>	-						
<b>Week</b>	<b>Final competencies for each learning stage (Sub-CLO)</b>	<b>Assessment</b>		<b>Learning Type, Learning Method, Student Tasks, [Time Estimation]</b>		<b>Learning Material [References]</b>	<b>Assessment Percentage (%)</b>
		<b>Indicator</b>	<b>Criteria &amp; Type</b>	<b>Offline</b>	<b>Online</b>		
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>	<b>(7)</b>	<b>(8)</b>
1	Students are able to explain the fundamentals of measurement system	<ul style="list-style-type: none"> <li>❖ Explain the definition of measurement</li> <li>❖ Write the measurement results based on its unit and the instrument characteristics</li> <li>❖ Apply the measurement skills in laboratory activities</li> </ul>	Criteria: quantitative Types: presentation and written/oral test	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion, and presentation</li> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>		[1, 2, 3, 4 and 5]	Sub-CLO1-4: 5%
2	Students are able to explain the fundamentals of measurement system	<ul style="list-style-type: none"> <li>❖ Explain the definition of measurement</li> <li>❖ Write the measurement results based on its unit and the</li> </ul>	Criteria: quantitative Types: presentation and written/oral test	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion,</li> </ul>		[1, 2, 3, 4 and 5]	Sub-CLO1-4: 5%

		<p>instrument characteristics</p> <ul style="list-style-type: none"> <li>❖ Apply the measurement skills in laboratory activities</li> </ul>		<p>and presentation</p> <ul style="list-style-type: none"> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>			
3	Students are able to explain the characteristics, performance and type of measuring instruments	<ul style="list-style-type: none"> <li>❖ Explain the static characteristics of measuring instruments</li> <li>❖ Explain the dynamic characteristics of measuring instruments</li> </ul>	<p>Criteria: quantitative</p> <p>Types: presentation and written/oral test</p>	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion, and presentation</li> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>		[1, 2, 3, 4 and 6]	Sub-CLO1-4: 5%
4	Students are able to explain the characteristics, performance and type of measuring instruments	<ul style="list-style-type: none"> <li>❖ Explain the static characteristics of measuring instruments</li> <li>❖ Explain the dynamic characteristics of measuring instruments</li> </ul>	<p>Criteria: quantitative</p> <p>Types: presentation and written/oral test</p>	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion, and presentation</li> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>		[1, 2, 3, 4 and 5]	Sub-CPMK1-4: 5%
5-6	Students are able to explain the characteristics of single and repeated measurement	<ul style="list-style-type: none"> <li>❖ Explain the differences of single and repeated</li> </ul>	<p>Criteria: quantitative</p> <p>Types: presentation</p>	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods:</li> </ul>		[1, 2, 3, 4 and 5]	Sub-CPMK1-4: 5%

		<p>measurement technique</p> <ul style="list-style-type: none"> <li>❖ Analyze the data of single and repeated measurement results</li> </ul>	<p>and written/oral test</p>	<p>questions and answers, discussion, and presentation</p> <ul style="list-style-type: none"> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>			
7	<p>Students are able to explain the concept of uncertainty and relative error in measurement</p>	<ul style="list-style-type: none"> <li>❖ Explain the concept of measurement uncertainty</li> <li>❖ Apply the concept of error propagation for determining the accuracy level of measurement results</li> </ul>	<p>Criteria: quantitative Types: presentation and written/oral test</p>	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion, and presentation</li> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>		[1, 2, 3, 4 and 5]	<p>Sub-CPMK1-4: 5%</p>
8	<b>Midterm Semester Evaluation/Midterm Exam</b>						<p>Midterm Exam sub-CLO1-4: 50%</p>
9-10	<p>Students are able to identify the electrical measuring instruments</p>	<ul style="list-style-type: none"> <li>❖ Mention the types of electrical measuring instruments</li> <li>❖ Explain the working principle of electrical measuring instruments</li> </ul>	<p>Criteria: quantitative Types: presentation and written/oral test</p>	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion, and presentation</li> <li>❖ Students assignment:</li> </ul>		[1, 2, 3, 4 and 5]	<p>Sub-CLO1-4: 5%</p>

				individual and groups tasks ❖ 6x 50 minutes			
11-12	Students are able to explain and apply the direct current indicating instrument for solving various electrical problems	<ul style="list-style-type: none"> <li>❖ Explain the function, working principle and sensitivity of galvanometer</li> <li>❖ Explain the working principle of amperemeter</li> <li>❖ Explain the working principle of voltmeter</li> <li>❖ Explain the working principle of ohmmeter</li> <li>❖ Carry out the measurement of electric quantity using measuring instrument</li> <li>❖ Apply the error propagation theory to the measurement results of electric quantities</li> </ul>	Criteria: quantitative Types: presentation and written/oral test	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion, and presentation</li> <li>❖ Students assignment: individual and groups tasks 6x 50 minutes</li> </ul>		[1, 2, 3, 4, 5 and 6]	Sub-CLO1-4: 5%
13-14	Students are able to explain and apply the measurement principles of inductance and capacitance measurement	<ul style="list-style-type: none"> <li>❖ Explain the equivalent circuits of RL and RC.</li> </ul>	Criteria: quantitative Types: presentation and	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers,</li> </ul>		[1, 2, 3, 4, 5 and 6]	Sub-CLO1-4: 5%

		<ul style="list-style-type: none"> <li>❖ Explain the impedance bridge theory</li> <li>❖ Determine the values of R, L and C in a measurement activity</li> </ul>	written/oral test	<ul style="list-style-type: none"> <li>discussion, and presentation</li> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>			
15	Students are able to explain and use CRO to determine electric quantities	<ul style="list-style-type: none"> <li>❖ Explain the working principle of CRO tube.</li> <li>❖ Know CRO parts</li> <li>❖ Use CRO to measure electric quantities</li> </ul>	Criteria: quantitative Types: presentation and written/oral test	<ul style="list-style-type: none"> <li>❖ Learning type: Course</li> <li>❖ Learning methods: questions and answers, discussion, and presentation</li> <li>❖ Students assignment: individual and groups tasks</li> <li>❖ 6x 50 minutes</li> </ul>		[1, 2, 3, 4, 5 and 6]	Sub-CLO1-4: 5%
16	<b>Final Semester Evaluation / Final Exam</b>						Final Exam sub-CLO1-4: 50%

**Notes:**

1. **Program Learning Outcome (PLO)** is the ability possessed by each study program graduate which is the internalization of attitudes, mastery of knowledge and skills according to the level of study program obtained through the learning process.
2. **PLO in course** is some learning outcomes of study program graduate (PLO) to form/develop a course which consists of attitudes, public skills, particular skills and knowledge.
3. **Course learning outcome (CLO)** is the ability which described specifically from PLO in course and is specific to the course content or learning material.
4. **Sub-course learning outcome (Sub-CLO)** is the ability described specifically from CLO that can be measured or observed and is the final ability planned at each learning stage, also is specific to the learning material of the course.

5. **Indicator of ability assessment** in the students learning process and learning outcome is specific and measurable statement that identifying the capability or performance of students learning outcome accompanied by evidence.
6. **Assessment criteria** is the standard used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria is guidelines for assessor so as the assessment is consistent and unbiased. The criteria can be quantitative or qualitative.
7. **Assessment types:** test and non-test.
8. **Learning types:** Lecture, Response, Tutorial, Seminar or else, Practicum, Studio Activity, Workshop Activity, Field Study, Research, Community Services and/or other equivalent learning types.
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 method.
10. **Learning Material** is details or descriptions from course content that can be presented in the form of several subjects and sub-topics.
11. **Assessment percentage** is the percentage of assessment toward every sub-CLO achievement which is proportional to the difficulty level of sub-CLO achievement and its total is 100%.