



**Universitas Negeri Surabaya**  
**Faculty of Engineering,**  
**Mechanical Engineering Education Undergraduate Study Program**

Document Code

**SEMESTER LEARNING PLAN**

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
CAR AC PRACTICE	8320302136	Study Program Elective Courses	T=0	P=2	ECTS=3.18	4	January 17, 2023
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator	
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Learning model	Case Studies
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Program Learning Outcomes (PLO)	<b>PLO study program that is charged to the course</b>	
	PLO-5	Have social competence and personality competence in mechanical engineering education
	PLO-7	Have an understanding of technopreneurship in the field of automotive/production technology
	PLO-8	Able to carry out maintenance and repairs in the automotive engineering field (automotive concentration) or able to operate various production equipment and machines in the manufacturing sector (production concentration)
	PLO-10	Have an understanding of mathematics and basic mechanical engineering
	<b>Program Objectives (PO)</b>	
	PO - 1	Students have knowledge about Car AC components and their working principles
	PO - 2	Students have the skills to analyze disturbances in car AC systems
	PO - 3	Students have the skills to Overhaul, Measure and Reassemble Car AC
	PO - 4	Students have the skills to charge refrigerant (Freon) in car AC

<b>PLO-PO Matrix</b>					
	P.O	PLO-5	PLO-7	PLO-8	PLO-10
	PO-1				
	PO-2				
	PO-3				
	PO-4				

<b>PO Matrix at the end of each learning stage (Sub-PO)</b>																	
	P.O	Week															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	PO-1																
	PO-2																
	PO-3																
	PO-4																

Short Course Description	Practice regarding the introduction of Car AC Equipment, Introduction to Car AC Components, Ability to explain how a Car AC works, Ability to explain and resolve damage to the Car AC electrical system, ability to explain and carry out compressor overhauls and reassemble them correctly and ability to carry out Freon filling procedures
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References	Main :
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<p>1. VEDC. 1987. Dasar-dasar AC Mobil untuk Otomotif . Malang: VEDC.  2. I Made Muliatna. 2010 . Materi Ajar AC Mobil. Surabaya: Jurusan PTM, FT Unesa</p>							
<p><b>Supporters:</b></p>							
<p>1. Abdillah, Margiono. 2017. Perawatan dan Perbaikan Sistem AC Mobil. Pontianak : Yayasan Kemajuan Teknik  2. Toyota. 1995. New Step 1. Training Manual. Jakarta: Toyota Motor  3. Toyota . 1989 . Toyota Air Conditioner . Jakarta: Toyota Motor</p>							
<b>Supporting lecturer</b>		<p>Dr. A. Grummy Wailanduw, M.Pd., M.T.  Prof. Dr. I Made Arsana, S.Pd., M.T.  Heru Arizal, S.Pd., M.M., M.Pd.</p>					
Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [ Estimated time]		Learning materials [ References ]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline ( offline )	Online ( online )		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Students are able to understand the components of car air conditioning and their working principles	<p>1. Students are able to describe the components of a car AC</p> <p>2. Students are able to explain the working principles of car AC components</p>	<p><b>Criteria:</b>  REPORT FORMAT: Title, Objectives, Tools and Materials, Theory Study, Work Safety (K-3), Work Steps and Results Data</p> <p><b>Form of Assessment :</b>  Participatory Activities</p>	<p>Lectures, Discussions, Questions and Answers and Demonstrations  4 X 50</p>		<p><b>Material:</b>  Basics of Car Air Conditioning  <b>Library:</b> / Made Muliatna. 2010 . Car AC Teaching Materials. Surabaya: PTM Department, FT Unesa</p> <p><b>Material:</b>  Basics of Car Air Conditioning  <b>Library:</b>  VEDC. 1987. Basics of Car Air Conditioning for Automotive. Malang: VEDC.</p>	5%
2	Students are able to understand the working system of car AC	<p>Students are able to skillfully explain the working system of car AC</p>	<p><b>Criteria:</b>  Report format: Title, objectives, tools and materials, theoretical study, work safety, work steps, practicum results data, data analysis, conclusions</p> <p><b>Form of Assessment :</b>  Participatory Activities</p>	<p>Lectures, discussions, questions and answers, exercises and  4 X 50 demonstrations</p>		<p><b>Material:</b>  AC working system  <b>Reference:</b>  VEDC. 1987. Basics of Car Air Conditioning for Automotive. Malang: VEDC.</p> <p><b>Material:</b>  AC Working System  <b>Library:</b>  Toyota. 1989 . Toyota Air Conditioner. Jakarta: Toyota Motor</p>	5%

3	Students are able to understand the types of equipment used for Car AC Service	Students are able to understand the types of equipment used for Car AC Service	<p><b>Criteria:</b> Report format: Title, objectives, tools and materials, theoretical study, work safety, work steps, practicum results data, data analysis, conclusions</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Car AC Equipment <b>Library:</b> Toyota. 1995. <i>New Step 1. Training Manual.</i> Jakarta: Toyota Motor</p> <hr/> <p><b>Material:</b> Car AC Equipment <b>Reference:</b> Abdillah, Margiono. 2017. <i>Car AC System Maintenance and Repair.</i> Pontianak: <i>Engineering Progress Foundation</i></p>	5%
4	Students are able to disassemble, install and inspect the Crank type AC Compressor	Students are able to disassemble, install and inspect the Crank type AC Compressor	<p><b>Criteria:</b> Create a practicum results report according to the report structure and data obtained</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Compressor <b>Literature: I</b> Made Muliatna. 2010 . <i>Car AC Teaching Materials.</i> Surabaya: PTM Department, FT Unesa</p>	5%
5	Students are able to disassemble, install and inspect a Swash Plate type AC Compressor	Students are able to disassemble, install and inspect a Swash Plate type AC Compressor	<p><b>Criteria:</b> Create a practicum results report according to the report structure and data obtained</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Compressor <b>Literature: I</b> Made Muliatna. 2010 . <i>Car AC Teaching Materials.</i> Surabaya: PTM Department, FT Unesa</p>	5%
6	Students are able to disassemble, install and inspect the Wobble Plate type AC Compressor	Students are able to disassemble, install and inspect the Wobble Plate type AC Compressor	<p><b>Criteria:</b> Create a practicum results report according to the report structure and data obtained</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Compressor <b>Literature: I</b> Made Muliatna. 2010 . <i>Car AC Teaching Materials.</i> Surabaya: PTM Department, FT Unesa</p>	5%
7	Students are able to disassemble, install and inspect the Scroll type AC Compressor	Students are able to disassemble, install and inspect the Scroll type AC Compressor	<p><b>Criteria:</b> Create a practicum results report according to the report structure and data obtained</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Compressor <b>Literature: I</b> Made Muliatna. 2010 . <i>Car AC Teaching Materials.</i> Surabaya: PTM Department, FT Unesa</p>	5%

8	Students are able to analyze car AC components	<ol style="list-style-type: none"> <li>1.Students are able to analyze condensers</li> <li>2.Students are able to analyze dryers</li> <li>3.Students are able to analyze expansion valves</li> </ol>	<p><b>Criteria:</b> Report format: Title, objectives, tools and materials, theoretical study, work safety, work steps, practical results data, data analysis, conclusions</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Car AC components <b>Reference:</b> <i>I Made Muliatna. 2010 . Car AC Teaching Materials. Surabaya: PTM Department, FT Unesa</i></p> <hr/> <p><b>Material:</b> Inspecting car AC components <b>References:</b> <i>Abdillah, Margiono. 2017. Car AC System Maintenance and Repair. Pontianak: Engineering Progress Foundation</i></p>	5%
9	Students are able to analyze Car AC Components (Continued)	<ol style="list-style-type: none"> <li>1.Students are able to analyze Evaporators</li> <li>2.Students are able to analyze Blower</li> <li>3.Students are able to analyze extra fans</li> </ol>	<p><b>Criteria:</b> Report format: Title, objectives, tools and materials, theoretical study, work safety, work steps, practical results data, data analysis, conclusions</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Car AC components <b>Reference:</b> <i>I Made Muliatna. 2010 . Car AC Teaching Materials. Surabaya: PTM Department, FT Unesa</i></p> <hr/> <p><b>Material:</b> Inspecting car AC components <b>References:</b> <i>Abdillah, Margiono. 2017. Car AC System Maintenance and Repair. Pontianak: Engineering Progress Foundation</i></p>	5%
10	Students are able to analyze Car AC Components (Continued)	<ol style="list-style-type: none"> <li>1.Students are able to analyze Blower Switches</li> <li>2.Students are able to analyze Outer Prisoners</li> <li>3.Students are able to analyze the thermostat</li> </ol>	<p><b>Criteria:</b> Report format: Title, objectives, tools and materials, theoretical study, work safety, work steps, practical results data, data analysis, conclusions</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Car AC components <b>Reference:</b> <i>I Made Muliatna. 2010 . Car AC Teaching Materials. Surabaya: PTM Department, FT Unesa</i></p> <hr/> <p><b>Material:</b> Inspecting car AC components <b>References:</b> <i>Abdillah, Margiono. 2017. Car AC System Maintenance and Repair. Pontianak: Engineering Progress Foundation</i></p>	5%

11	Students are able to understand and assemble the Electrical System in Car AC	Students are able to assemble the Car AC Electrical System on the Car AC Electrical Trainer	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.Report Format: Title, Objectives, Tools and Materials, Theory Study, Work Safety (K-3), Work Steps,</li> <li>2.Practical Results Data, Data Analysis and Conclusions</li> </ol> <p><b>Form of Assessment :</b> Participatory Activities, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Assembling car AC electricity <b>Reference:</b> <i>Abdillah, Margiono. 2017. Car AC System Maintenance and Repair. Pontianak: Engineering Progress Foundation</i></p>	5%
12	Students are able to understand and assemble the Electrical System in Car AC (Continued)	Students are able to assemble the Car AC Electrical System on the Car AC Electrical Trainer	<p><b>Criteria:</b></p> <ol style="list-style-type: none"> <li>1.Report Format: Title, Objectives, Tools and Materials, Theory Study, Work Safety (K-3)</li> <li>2.Work Steps, Practical Results Data, Data Analysis and Conclusions</li> </ol> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Assembling car AC electricity <b>Reference:</b> <i>Abdillah, Margiono. 2017. Car AC System Maintenance and Repair. Pontianak: Engineering Progress Foundation</i></p>	5%
13	Students are able to understand how to empty and vacuum a car AC trainer	Students are able to understand how to empty and vacuum a car AC trainer	<p><b>Criteria:</b> REPORT FORMAT: Title, Objectives, Tools and Materials, Theory Study, Work Safety (K-3), Work steps, Practical Results Data, Data Analysis and Conclusions</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Discharging and vacuuming car AC <b>Reference:</b> <i>I Made Muliatna. 2010 . Car AC Teaching Materials. Surabaya: PTM Department, FT Unesa</i></p>	5%
14	<ol style="list-style-type: none"> <li>1.Students are able to apply the Freon Filling method to the Car AC Trainer</li> <li>2.Students are able to apply the Freon Filling method to the Car AC Trainer</li> </ol>	Students skillfully carry out Freon filling in the Car AC Trainer	<p><b>Criteria:</b> REPORT FORMAT: Report Title, Objectives, Tools and Materials, Theory Study, Work Safety (K-3) Work Steps, Practical Results Data, Data Analysis and Conclusions</p> <p><b>Forms of Assessment :</b> Participatory Activities, Portfolio Assessment, Practical Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Low and High Pressure Freon Filling <b>Reference:</b> <i>Abdillah, Margiono. 2017. Car AC System Maintenance and Repair. Pontianak: Engineering Progress Foundation</i></p>	5%

15	Students are able to analyze the power/work of a car AC system	<p>1. Students are able to analyze the power of a car's AC system</p> <p>2. Students are able to determine damage to a car's AC system</p>	<p><b>Criteria:</b></p> <p>1. REPORT FORMAT: Report Title, Objectives, Tools and Materials, Theory Study, Work Safety (K-3), Work Steps,</p> <p>2. Data report results, Data Analysis and Conclusions</p> <p><b>Form of Assessment :</b> Participatory Activities, Portfolio Assessment</p>	Lectures, discussions, questions and answers, exercises and 4 X 50 demonstrations		<p><b>Material:</b> Checking damage and output power of the car AC system.</p> <p><b>Reference:</b> <i>I Made Muliatna. 2010 . Car AC Teaching Materials. Surabaya: PTM Department, FT Unesa</i></p> <p><b>Material:</b> Checking damage and output power of the car AC system.</p> <p><b>Reference:</b> <i>Abdillah, Margiono. 2017. Car AC System Maintenance and Repair. Pontianak: Engineering Progress Foundation</i></p>	5%
16	FINAL SEMESTER EXAMINATION (UAS)	FINAL SEMESTER EXAMINATION (UAS)	<p><b>Criteria:</b> ACCORDING TO THE ASSESSMENT RUBRIC AND ANSWER KEY</p> <p><b>Form of Assessment :</b> Participatory Activities, Practical Assessment</p>	FINAL SEMESTER EXAMINATION (UAS) 4 X 50		<p><b>Material:</b> All material</p> <p><b>Library:</b> <i>I Made Muliatna. 2010 . Car AC Teaching Materials. Surabaya: PTM Department, FT Unesa</i></p>	25%

#### Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	59.19%
2.	Portfolio Assessment	14.19%
3.	Practical Assessment	26.69%
		100%

#### 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.

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.