



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																																																													
Machine Performance Analysis	8320302005	Compulsory Study Program Subjects	T=2 P=0 ECTS=3.18	6	August 15, 2022																																																													
AUTHORIZATION	SP Developer		Course Cluster Coordinator		Study Program Coordinator																																																													
	Rachmad Syarifudin Hidayatullah, S.Pd., M.Pd.; Dr. Warju, S.Pd., S.T., M.T.		Rachmad Syarifudin Hidayatullah, S.Pd., M.Pd.		Ir. Wahyu Dwi Kurniawan, S.Pd., M.Pd.																																																													
Learning model	Project Based Learning																																																																	
Program Learning Outcomes (PLO)	PLO study program which is charged to the course																																																																	
	PLO-5	Have social competence and personality competence in mechanical engineering education																																																																
	PLO-10	Have an understanding of mathematics and basic mechanical engineering																																																																
	Program Objectives (PO)																																																																	
	PO - 1	Students have basic theoretical and practical knowledge about various types of engine performance testing such as torque, power, specific fuel consumption, break mean effective pressure, thermal efficiency, exhaust gas emissions, and noise level testings																																																																
	PLO-PO Matrix																																																																	
		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">P.O</td> <td style="padding: 5px;">PLO-5</td> <td style="padding: 5px;">PLO-10</td> </tr> <tr> <td style="padding: 5px;">PO-1</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> </table>				P.O	PLO-5	PLO-10	PO-1																																																									
	P.O	PLO-5	PLO-10																																																															
	PO-1																																																																	
	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="padding: 5px;">P.O</td> <td colspan="16" style="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> <tr> <td style="padding: 5px;">PO-1</td> <td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td> </tr> </table>																P.O	Week																1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PO-1																
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PO-1																																																																		
Short Course Description	Understanding of theory and practice regarding motor vehicle engine performance testing which includes testing torque, effective power, specific fuel consumption, average effective pressure, thermal efficiency, exhaust emissions and noise levels.																																																																	
References	Main :																																																																	
	<ol style="list-style-type: none"> 1. Warju. 2009. Pengujian Performa Mesin Kendaraan Bermotor . Surabaya: Unesa University Press. 2. Obert, Edward F. 1973. Internal Combustion Engine and Air Pollution . Third Edition. New York: Harper & Row, Publisher, Inc 3. Heywood, John B. 1988. Internal Combustion Engine Fundamentals . New York: McGraw-Hill, Inc 4. Heisler, Heinz. 1995. Advanced Engine Technology . London: Edward Arnold 5. Crouse, William H. & Anglin, Donald L. 1997. Automotive Mechanics. Ninth Edition. New York: McGraw-Hill Book Company 6. Robert Bosch GmbH. 1988. Automotive Electric/Electronic System. Jerman: Stuttgart 7. Robert Bosch GmbH. 1999. Gasoline Engine Management. Jerman: Stuttgart 8. Arismunandar, Wiranto. 2002. Penggerak Mula: Motor Bakar Torak . Edisi Kelima. Bandung: Penerbit ITB 																																																																	
	Supporters:																																																																	
	<ol style="list-style-type: none"> 1. Wardhana, Wisnu Arya. 2001. Dampak Pencemaran Lingkungan . Yogyakarta: Penerbit Andi 2. Warju. 2013. Teknologi Reduksi Emisi Gas Buang Kendaraan Bermotor . Surabaya: Unesa University Press. 3. Sutantra, I Nyoman. 2001. Teknologi Otomotif Teori dan Aplikasinya. Surabaya: Guna Widya 4. Suyanto, Wardan. 1989. Teori Motor Bensin. Jakarta: Departemen Pendidikan dan Kebudayaan Direktorat Jenderal Pendidikan Tinggi 																																																																	
Supporting lecturer	Dr. Warju, S.Pd., S.T., M.T.																																																																	
Week-	Final abilities of each learning	Evaluation	Help Learning, Learning methods, Student Assignments, [Estimated time]	Learning materials [References]	Assessment Weight (%)																																																													

	stage (Sub-PO)	Indicator	Criteria & Form	Offline (offline)	Online (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Understand the four demands of automotive technology development.	1. Explain carburetor technology.2. Explain electronic fuel injection (EFI) technology3. Explain common-rail system technology. 4. Explain hybrid system technology. 5. Mention four demands for the development of automotive technology.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Developments in Automotive Technology Library: Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <p>Material: Development of Automotive Technology Reference: Obert, Edward F. 1973. <i>Internal Combustion Engine and Air Pollution. Third Edition</i>. New York: Harper & Row, Publisher, Inc</p> <p>Material: Development of Automotive Technology Reference: Heywood, John B. 1988. <i>Internal Combustion Engine Fundamentals</i>. New York: McGraw-Hill, Inc</p> <p>Material: Development of Automotive Technology Reference: Heisler, Heinz. 1995. <i>Advanced Engine Technology</i>. London: Edward Arnold</p>	5%

2	Understand the working principles of internal combustion engines.	1. Explain the working principle of a 4 stroke engine.2. Mention the parts of a 4 stroke engine.3. Explain the purpose of each part of the 4 step machine.4. Explain the working principle of a 2 stroke engine.5. Mention the parts of a 2 stroke engine.6. Explain the purpose of each part of a 2 stroke engine.	<p>Criteria: a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50	<p>Material: Working Principles of 4 Stroke and 2 Stroke Engines Library: Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <hr/> <p>Material: Working Principles of 4-Stroke and 2-Stroke Engines Reference: Obert, Edward F. 1973. <i>Internal Combustion Engines and Air Pollution. Third Edition</i>. New York: Harper & Row, Publisher, Inc</p> <hr/> <p>Material: Working Principles of 4 Stroke and 2 Stroke Engines Reference: Heywood, John B. 1988. <i>Internal Combustion Engine Fundamentals</i>. New York: McGraw-Hill, Inc</p> <hr/> <p>Material: Working Principles of 4 Stroke and 2 Stroke Engines Library: Heisler, Heinz. 1995. <i>Advanced Engine Technology</i>. London: Edward Arnold</p> <hr/> <p>Material: Working Principles of 4 Stroke and 2 Stroke Engines Reference: Crouse, William H. & Anglin, Donald L. 1997. <i>Automotive Mechanics. Ninth Edition</i>. New York: McGraw-Hill Book Company</p>	5%
3	Understand the difference between the ideal cycle vs the actual cycle that occurs in an internal combustion engine. Understand the difference between the ideal cycle vs the actual cycle that occurs in an internal combustion engine.	1. Explain the constant-volume air cycle (Otto cycle).2. Explain the constant-pressure air cycle (Diesel cycle).3. Explain the limited-pressure air cycle (combined cycle).4. Mention the losses that occurred in the actual cycle.	<p>Criteria: a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50	<p>Material: Ideal Cycle Vs Actual Cycle Reference: Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <hr/> <p>Material: Ideal Cycle Vs Actual Cycle References: Arismunandar, Wiranto. 2002. <i>Prime Mover: Reciprocating Motor. Fifth Edition</i>. Bandung: ITB Publishers</p>	5%

4	Understand vehicle specifications.	1. Mention the type of machine.2. Mention the diameter x stroke on a motorized vehicle.3. Mention the volume of cylinders in motor vehicles.4. State the compression ratio in motor vehicles.5. State the maximum torque in motor vehicles.6. Mentions the maximum power of motorized vehicles.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Vehicle Specifications Library: Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <p>Material: Vehicle Specifications Library: Arismunandar, Wiranto. 2002. <i>Prime Mover: Reciprocating Motor. Fifth Edition</i>. Bandung: ITB Publishers</p>	5%
5	Understand definitions, related terms, and factors that influence engine performance.	1. Explain the definition of engine performance.2. Mention terms related to engine performance.3. Mention the factors that influence engine performance.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Definitions, related terms, and factors that influence engine performance. Reference: Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <p>Material: Definitions, related terms, and factors that influence engine performance. References: Arismunandar, Wiranto. 2002. <i>Prime Mover: Reciprocating Motor. Fifth Edition</i>. Bandung: ITB Publishers</p> <p>Material: Definitions, related terms, and factors that influence engine performance. References: Crouse, William H. & Anglin, Donald L. 1997. <i>Automotive Mechanics. Ninth Edition</i>. New York: McGraw-Hill Book Company</p>	5%

6	Understand the performance parameters of motor vehicle engines.	1. Explain torque.2. Explain power.3. Explain the average effective pressure.4. Explains specific fuel consumption.5. Explain thermal efficiency.6. Explain the air-fuel and fuel-air ratios.1. Explain torque.2. Explain power.3. Explain the average effective pressure.4. Explains specific fuel consumption.5. Explain thermal efficiency.6. Explain the air-fuel and fuel-air ratios.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Motor vehicle engine performance parameters. Reference: Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <hr/> <p>Material: Motor vehicle engine performance parameters. References: Arismunandar, Wiranto. 2002. <i>Prime Mover: Reciprocating Motor. Fifth Edition</i>. Bandung: ITB Publishers</p> <hr/> <p>Material: Motor vehicle engine performance parameters. References: Crouse, William H. & Anglin, Donald L. 1997. <i>Automotive Mechanics. Ninth Edition</i>. New York: McGraw-Hill Book Company</p>	5%
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7	Understand the four demands of automotive technology development.	1. Explain carburetor technology.2. Explain 2. Explain electronic fuel injection (EFI) technology 3. Explain3. Explain common-rail system technology. 4. Explain hybrid system technology. 5. Mention four demands for the development of automotive technology.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Four demands for the development of automotive technology. Bibliography: <i>Warju. 2009. Motor Vehicle Engine Performance Testing. Surabaya: Unesa University Press.</i></p> <hr/> <p>Material: Low exhaust emission vehicles. References: <i>Obert, Edward F. 1973. Internal Combustion Engines and Air Pollution. Third Edition. New York: Harper & Row, Publisher, Inc</i></p> <hr/> <p>Material: Motorized vehicles that have high engine performance. References: <i>Heywood, John B. 1988. Internal Combustion Engine Fundamentals. New York: McGraw-Hill, Inc</i></p> <hr/> <p>Material: Low emission automotive technology. References: <i>Heisler, Heinz. 1995. Advanced Engine Technology. London: Edward Arnold</i></p> <hr/> <p>Material: Low emission automotive technology. References: <i>Crouse, William H. & Anglin, Donald L. 1997. Automotive Mechanics. Ninth Edition. New York: McGraw-Hill Book Company</i></p> <hr/> <p>Material: Electronic fuel injection (EFI) technology. Bibliography: <i>Robert Bosch Gmbh. 1988. Automotive Electric/Electronic Systems. Germany: Stuttgart</i></p> <hr/> <p>Material: Engine Management System Reference: <i>Robert Bosch Gmbh. 1999. Gasoline Engine Management. Germany: Stuttgart</i></p>	5%
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8	UTS	Students are able to answer the UTS questions given according to the answer key.	Form of Assessment : Test	2 X 50		<p>Material: Developments in Automotive Technology Library: Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <hr/> <p>Material: Working Principles of 4-Stroke and 2-Stroke Engines Reference: Obert, Edward F. 1973. <i>Internal Combustion Engines and Air Pollution. Third Edition</i>. New York: Harper & Row, Publisher, Inc</p> <hr/> <p>Material: Definitions, related terms, and factors that influence engine performance. References: Heywood, John B. 1988. <i>Internal Combustion Engine Fundamentals</i>. New York: McGraw-Hill, Inc</p> <hr/> <p>Material: Vehicle Specifications Library: Heisler, Heinz. 1995. <i>Advanced Engine Technology</i>. London: Edward Arnold</p> <hr/> <p>Material: Vehicle Specifications References: Crouse, William H. & Anglin, Donald L. 1997. <i>Automotive Mechanics. Ninth Edition</i>. New York: McGraw-Hill Book Company</p> <hr/> <p>Material: Motor vehicle engine performance parameters. References: Arismunandar, Wiranto. 2002. <i>Prime Mover: Reciprocating Motor. Fifth Edition</i>. Bandung: ITB Publishers</p>	10%
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9	Understand engine performance testing procedures using a dynamometer.	1. Mention the types of dynamometers.2. Explain how to measure speed.3. Explain how to measure fuel consumption.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Procedure for testing engine performance using a dynamometer. Bibliography: <i>Warju. 2009. Motor Vehicle Engine Performance Testing. Surabaya: Unesa University Press.</i></p>	5%
10	Understand engine performance testing procedures using a dynamometer.	1. Carry out loading.2. Measuring engine speed.3. Calculate torque.4. Calculate effective power.5. Measuring specific fuel consumption.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment : Participatory Activities, Practice/Performance</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Procedure for testing engine performance using a dynamometer. Reference: <i>Warju. 2009. Motor Vehicle Engine Performance Testing. Surabaya: Unesa University Press.</i></p>	8%

11	Understand engine performance testing procedures using a dynamometer.	1. Measuring torque.2. Measuring effective power.3. Measuring engine speed.4. Measuring roller rotation.5. Measuring vehicle speed.6. Measuring the time to reach vehicle speed.7. Measuring fuel consumption.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Forms of Assessment :</p> <p>Participatory Activities, Portfolio Assessment, Practice / Performance</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Procedure for testing engine performance using a dynamometer.</p> <p>Reference: <i>Warju. 2009. Motor Vehicle Engine Performance Testing. Surabaya: Unesa University Press.</i></p>	8%
12	Understand the nature, sources, causes and impacts of motor vehicle exhaust emissions.	1. Mention the sources of motor vehicle exhaust emissions.2. Explain carbon monoxide (CO) emissions.3. Explain hydrocarbon (HC) emissions.4. Explain nitrogen oxide (NOx) emissions.5. Explain sulfur oxide (SOx) emissions.6. Explain lead (Pb) emissions.7. Explain particulate matter (PM) emissions.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Form of Assessment :</p> <p>Participatory Activities</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material: Nature, sources, and impacts of motor vehicle exhaust emissions.</p> <p>Reference: <i>Warju. 2009. Motor Vehicle Engine Performance Testing. Surabaya: Unesa University Press.</i></p> <p>Material: Types of exhaust emissions and their impact on humans and the environment.</p> <p>Reference: <i>Warju. 2013. Motor Vehicle Exhaust Emission Reduction Technology. Surabaya: Unesa University Press.</i></p> <p>Material: Impact of motor vehicle exhaust emissions.</p> <p>References: <i>Wardhana, Vishnu Arya. 2001. Impact of Environmental Pollution. Yogyakarta: Andi Publishers</i></p>	5%

13	Understand the exhaust emissions testing procedures for gasoline and diesel vehicles.	1. Explain the exhaust emissions testing procedure for gasoline vehicles.2. Explain the exhaust emissions testing procedure for diesel fueled vehicles.1. Explain the procedure for testing exhaust emissions of gasoline vehicles.2. Explain the exhaust emissions testing procedure for diesel fueled vehicles.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Forms of Assessment :</p> <p>Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment, Practice / Performance</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material:</p> <p>Procedure for testing exhaust gas emissions from petrol and diesel vehicles.</p> <p>Reference:</p> <p>Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p>	5%
14	Understand the procedure for testing exhaust gas emissions from gasoline vehicles using an exhaust gas analyzer. Understand the procedure for testing the exhaust gas opacity of diesel fueled vehicles using a smoke opacity meter.	1. Prepare emission test equipment.2. Carry out exhaust emission testing of gasoline vehicles.3. Read emission test results.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Forms of Assessment :</p> <p>Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment, Practice / Performance</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material:</p> <p>Procedure for testing exhaust gas emissions from petrol vehicles using an exhaust gas analyzer & procedure for testing the exhaust gas opacity of diesel vehicles using a smoke opacity meter.</p> <p>Bibliography:</p> <p>Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p>	7%
15	Understand the noise level testing procedure using a sound level meter (SLM).	1. Explain the meaning of noise.2. Mention the types of noise.3. Explain the procedure for testing noise levels using a sound level meter (SLM).4. Explain noise control.5. Carry out noise level testing on motor vehicle exhausts.	<p>Criteria:</p> <p>a. Conformity with reporting format.b. Results of analysis of the articles read.c. Conclusions and suggestions have been prepared. Conformity with the Answer Key. Conformity with the answer key. Presence.b. Activeness in questions and answers, seriousness in attending lectures.</p> <p>Forms of Assessment :</p> <p>Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment, Practice / Performance</p>	1. Lecture2. Demonstration3. Questions and answers 4. Discussion 2 X 50		<p>Material:</p> <p>Noise level testing procedure using a sound level meter (SLM).</p> <p>Bibliography:</p> <p>Warju. 2013. <i>Motor Vehicle Exhaust Emission Reduction Technology</i>. Surabaya: Unesa University Press.</p> <p>Material:</p> <p>Noise intensity.</p> <p>References:</p> <p>Wardhana, Vishnu Arya. 2001. <i>Impact of Environmental Pollution</i>. Yogyakarta: Andi Publishers</p>	7%
16	UAS	Students are able to answer the UAS questions given according to the answer key.	<p>Criteria:</p> <p>Cognitive Test</p> <p>Form of Assessment :</p> <p>Test</p>	2 X 50		<p>Material:</p> <p>Developments in Automotive Technology</p> <p>Library:</p> <p>Warju. 2009. <i>Motor Vehicle Engine Performance Testing</i>. Surabaya: Unesa University Press.</p> <p>Material:</p> <p>Working Principles of 4-Stroke and 2-Stroke Engines</p> <p>Reference:</p> <p>Obert, Edward F. 1973. <i>Internal Combustion Engines and Air Pollution</i>. Third</p>	9%

Edition. New York: Harper & Row, Publisher, Inc

Material: Ideal Cycle Vs Actual Cycle.

References:
Heywood, John B. 1988. Internal Combustion Engine Fundamentals. New York: McGraw-Hill, Inc

Material:
Advanced Automotive Technology

References:
Heisler, Heinz. 1995. Advanced Engine Technology. London: Edward Arnold

Material:
Definitions, related terms, and factors that influence engine performance.

References:
Crouse, William H. & Anglin, Donald L. 1997. Automotive Mechanics. Ninth Edition. New York: McGraw-Hill Book Company

Material: EFI, Common-rail system

Reference:
Robert Bosch GmbH. 1988. Automotive Electric/Electronic Systems. Germany: Stuttgart

Material: EFI Technology

Reference:
Robert Bosch GmbH. 1999. Gasoline Engine Management. Germany: Stuttgart

Material:
Definitions, related terms, and factors that influence engine performance.

References:
Arismunandar, Wiranto. 2002. Prime Mover: Reciprocating Motor. Fifth Edition. Bandung: ITB Publishers

Material: Impact of air pollution

References:
Wardhana, Vishnu Arya. 2001. Impact of Environmental Pollution. Yogyakarta: Andi Publishers

Material: Low emission automotive

						<p>technology. Reference: <i>Warju. 2013. Motor Vehicle Exhaust Emission Reduction Technology. Surabaya: Unesa University Press.</i></p> <p>Material: Automotive Technology Literature: <i>Sutantra, I Nyoman. 2001. Automotive Technology Theory and Applications. Surabaya: Guna Widya</i></p> <p>Material: Working Principles of Gasoline Engines Reference: <i>Suyanto, Wardan. 1989. Gasoline Motor Theory. Jakarta: Department of Education and Culture, Directorate General of Higher Education</i></p>
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Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	53.92%
2.	Project Results Assessment / Product Assessment	7.25%
3.	Portfolio Assessment	7.42%
4.	Practice / Performance	11.42%
5.	Test	19%
		99.01%

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.