	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
Internal Combustion Motor Technology	8320304266	Compulsory Study Program Subjects	T=2	P=0	ECTS=3.18	2	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model: Case Studies

Program Learning Outcomes (PLO)

PLO study program that is charged to the course

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)

Program Objectives (PO)

PO - 1	Students have the ability to apply theories of internal combustion motor components including: combustion motors, fuel systems, lubrication systems, cooling systems, exhaust systems, valve mechanical systems, basic motor calculations, fuel, and basic theories of petrol and diesel motors.

PLO-PO Matrix

P.O	PLO-8
PO-1	✔

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1	✔	✔	✔													

Short Course Description: Understanding of internal combustion motor component theories including: combustion motor, fuel system, lubrication system, cooling system, exhaust system, valve mechanical system, basic motor calculations, fuel, and basic theory of petrol/diesel motors.

References

Main :

1. Arismunandar, Wiranto. 2002. Penggerak Mula: Motor Bakar Torak. Edisi Kelima
2. Sutantra, I Nyoman. 2001. Teknologi Otomotif Teori dan Aplikasinya. Surabaya: Guna Widya
3. Robert Bosch Gmbh. 1999. Gasoline Engine Management. Jerman: Stuttgart

Supporters:

1. Warju. 2009. Pengujian Performa Mesin Kendaraan Bermotor. Surabaya: Unesa University Press.
2. Warju. 2013. Teknologi Reduksi Emisi Gas Buang Kendaraan Bermotor. Surabaya: Unesa University Press.

Supporting lecturer: Iskandar, S.T., M.T.
Rachmad Syarifudin Hidayatullah, S.Pd., M.Pd.

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 analyze Energy Conversion		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in Engine Definition, Heat Engine Definition, Classification and Some Basic Details of Heat Engines, students are asked to answer questions given by the lecturer, then the lecturer gives feedback and asks questions. in depth and ask other students to answer questions from the lecturer for 2 credits		**Material:** 1. Four-Stroke Spark-Ignition Engine 13 2. Four-Stroke Compression-Ignition Engine 15 4. Two-Stroke Engine 17 5. Comparison of 4-Stroke and 2-Stroke Engines 20 6. Actual Engines 21 **Reference:** *Robert Bosch Gmbh. 1999. Gasoline Engine Management. Germany: Stuttgart*	5%
2	Students are able to analyze Energy Conversion		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in External Combustion (EC) and Internal Combustion Engines (ICE), BASIC COMPONENTS AND MACHINE NOMENCLATURE, Engine Components, Nomenclature, students are asked to answer the questions given by the lecturer , then the lecturer gives feedback and asks in-depth questions and asks other students to answer questions from the lecturer for 2 credits		**Material:** External Combustion (EC) and Internal Combustion Engines (ICE) BASIC COMPONENTS AND MACHINE NOMENCLATURE Engine Components Nomenclature **Library:** *Robert Bosch Gmbh. 1999. Gasoline Engine Management. Germany: Stuttgart*	5%

3	Students are able to analyze the working principles of machines		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in Four-Stroke Spark-Ignition Engines, Four-Stroke Compression-Ignition Engines, Two-Stroke Engines, Comparison of 4 Stroke and 2 Stroke Engines Actual Engines, students asked to answer questions given by the lecturer, then the lecturer gives feedback and provides in-depth questions and asks other students to answer questions from the lecturer. The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in External Combustion (EC). and Internal Combustion Engines (ICE), BASIC COMPONENTS AND MACHINE NOMENCLATURE, Engine Components, Nomenclature, students are asked to answer questions given by the lecturer, then the lecturer gives feedback and provides in-depth questions and asks other students to answer questions from the lecturer 2 credits		**Material:** Four-Stroke Spark-Ignition Engine Four-Stroke Compression-Ignition Engine Two-Stroke Engine Comparison of 4 Stroke and 2 Stroke Engines Actual Engines **Reference:** *Robert Bosch Gmbh. 1999. Gasoline Engine Management. Germany: Stuttgart* **Material:** Four-Stroke Spark-Ignition Engine Four-Stroke Compression-Ignition Engine Two-Stroke Engine Comparison of 4 Stroke and 2 Stroke Engines Actual Engines **Reference:** *Sutantra, I Nyoman. 2001. Automotive Technology Theory and Applications. Surabaya: Guna Widya*	5%
4	Students are able to analyze the Classification of Internal Combustion (Ic) Engines		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in the operating cycle, type of fuel used, filling method, ignition type, cooling type, cylinder arrangement , students are asked to answer the questions given by the lecturer, then the lecturer provide feedback and ask in-depth questions and ask other students to answer questions from the 2 credits lecturer		**Material:** Operation cycle Type of fuel used Charging method Ignition type Cooling type Cylinder arrangement **Library:** *Robert Bosch Gmbh. 1999. Gasoline Engine Management. Germany: Stuttgart*	5%

5	Students are able to analyze Internal Combustion Engine (ICE) Applications		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in Two Stroke Gasoline Engines, Two Stroke Diesel Engines, Four Stroke Gasoline Engines, Four Stroke Diesel Engines, students are asked to answer the questions given by the lecturer, then the lecturer gives a speech. come back and ask in-depth questions and ask other students to answer questions from the lecturer for 2 credits		**Material:** Two Stroke Gasoline Engine Two Stroke Diesel Engine Four Stroke Gasoline Engine Four Stroke Diesel Engine **Library:** *Robert Bosch Gmbh. 1999. Gasoline Engine Management. Germany: Stuttgart*	5%
6	Students are able to analyze the First Law in Analyzing Machine Operations		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in Indicated thermal efficiency (ηith), Brake thermal efficiency (ηbth), Mechanical efficiency (ηm), Volumetric efficiency (ηv) , students are asked to answer the questions given by the lecturer, then the lecturer gives feedback and asks in-depth questions and asks other students to answer questions from the lecturer 2 credits		**Material:** Indicated thermal efficiency (ηith) Brake thermal efficiency (ηbth) Mechanical efficiency (ηm) Volumetric efficiency (ηv) **Reference:** *Warju. 2009. Motor Vehicle Engine Performance Testing. Surabaya: Unesa University Press.*	5%
7	Students are able to analyze the First Law in Analyzing Machine Operations		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in Relative efficiency or Efficiency ratio (ηrel), Mean effective pressure (pm), Mean piston speed (sp), Specific power output (Ps) Specific fuel consumption (sfc), students are asked to answer questions given by the lecturer, then the lecturer gives feedback and asks in-depth questions and asks other students to answer questions from the lecturer 2 credits		**Material:** Relative efficiency or efficiency ratio (ηrel) Mean effective pressure (pm) Mean piston speed (sp) Specific power output (Ps) Specific fuel consumption (sfc) **References:** *Arismunandar, Wiranto. 2002. Prime Mover: Piston Engine. Fifth Edition*	5%

8	UTS		**Form of Assessment** : Participatory Activities, Tests	2 credits			0%
9	Students are able to analyze the cooling system		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in heat transfer, parameters that influence engine heat transfer, the power required to cool the engine, cooling system requirements, students are asked to answer the questions given by the lecturer, then the lecturer gives feedback and asking in-depth questions and asking other students to answer questions from the lecturer for 2 credits		**Material:** Heat Transfer Parameters That Influence Engine Heat Transfer Power Required to Cool the Engine Cooling System Requirements **Reference:** *Sutantra, I Nyoman. 2001. Automotive Technology Theory and Applications. Surabaya: Guna Widya*	10%
10	Students are able to analyze the cooling system		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in the Characteristics of Efficient Cooling Systems, Types of Cooling Systems, Liquid Cooling Systems (liquid or indirect cooling systems), Air Cooled Systems (air or direct cooling systems), System Comparisons Liquid and Air Cooling, students are asked to answer questions given by the lecturer, then the lecturer gives feedback and provides in-depth questions and asks other students to answer questions from the lecturer 2 credits		**Material:** Characteristics of Efficient Cooling Systems Types of Cooling Systems Liquid Cooling Systems (liquid or indirect cooling systems) Air Cooled Systems (air or direct cooling systems) Comparison of Liquid and Air Cooling Systems **References:** *Arismunandar, Wiranto. 2002. Prime Mover: Piston Engine. Fifth Edition*	10%

11	Students are able to analyze lubricants		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in the Classification of Lubricating Oils, Lubricant Functions, Lubricating Oil Analysis, Aspects of Lubricant Properties Testing, students are asked to answer questions given by the lecturer, then the lecturer gives feedback and provides in-depth questions and asking other students to answer questions from the lecturer for 2 credits		**Material:** Classification of Lubricating Oils Lubricant Function Analysis of Lubricating Oils Aspects of Testing Lubricant Properties **References:** *Arismunandar, Wiranto. 2002. Prime Mover: Piston Engine. Fifth Edition*	10%
12	Students are able to analyze lubricants		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in the Types of Lubricating Oil, Properties and Characteristics of Lubricating Oil, Liquid Lubricants, Solid Lubricants , students are asked to answer the questions given by the lecturer, then the lecturer gives feedback as well as asking in-depth questions and asking other students to answer questions from the lecturer for 2 credits		**Material:** Types of Lubricating Oils Properties and Characteristics of Lubricating Oils Liquid Lubricants Solid Lubricants References **:** *Arismunandar, Wiranto. 2002. Prime Mover: Piston Engine. Fifth Edition*	10%
13	Students are able to analyze lubricants		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities, Practice/Performance	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in Semi-Solid Lubricants (Grease), Gas Lubricants, Synthetic Lubricants, students are asked to answer questions given by the lecturer, then the lecturer gives feedback and asks in-depth questions. and ask other students to answer questions from the lecturer for 2 credits		**Material:** Semi-Solid Lubricants (Grease) Gas Lubricants Synthetic Lubricants **References:** *Arismunandar, Wiranto. 2002. Prime Mover: Piston Engine. Fifth Edition*	10%

14	Students are able to analyze fuel		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in the Definition of Fuel, Fuel Properties, Various types of fuel, students are asked to answer the questions given by the lecturer, then the lecturer gives feedback and provides in-depth questions and asking other students to answer questions from the lecturer for 2 credits		**Material:** Understanding Fuel Properties of Fuel Various types of fuel **Reference:** *Arismunandar, Wiranto. 2002. Prime Mover: Piston Engine. Fifth Edition*	10%
15	Students are able to analyze fuel		**Criteria:** if the student can answer correctly without the lecturer's guidance the score is 100, if the student can answer correctly with the guidance of the lecturer the score is 90, if the student can answer incorrectly the score is 80 **Form of Assessment** : Participatory Activities	The lecturer explains the material using PPT, while explaining the material the lecturer gives questions in the form of problems that occur in Fuel Characteristics, Types of Fuel, Gasoline Engine Fuel, Diesel Engine Fuel, Fuel Rating , students are asked to answer the questions given by the lecturer, Next, the lecturer gives feedback and asks in-depth questions and asks other students to answer questions from the lecturer for 2 credits		**Material:** Fuel Characteristics Types of fuel Gasoline Engine Fuel Diesel Engine Fuel Fuel Ratings **Library:** *Robert Bosch Gmbh. 1999. Gasoline Engine Management. Germany: Stuttgart* **Material:** h **References:** **Material:** Fuel Characteristics Types of fuel Gasoline Engine Fuel Diesel Engine Fuel Fuel Ratings **References:** *Arismunandar, Wiranto. 2002. Prime Mover: Piston Engine. Fifth Edition*	5%
16			**Form of Assessment** : Project Results Assessment / Product Assessment, Test	UAS, Students work on questions that have been prepared by the lecturer for 2 credits			0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	80%
2.	Project Results Assessment / Product Assessment	5%
3.	Practice / Performance	5%
		90%

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.