	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
Thermodynamics	8320302223		T=2	P=0	ECTS=3.18	3	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Ir. Wahyu Dwi Kurniawan, S.Pd., M.Pd.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

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

Short Course Description	This course is an understanding of the concept of the First Law of Thermodynamics regarding the conservation of energy and the concept of control mass and control volume systems. The discussion begins with an introduction to SI and British unit conversions, the concept of work and energy in thermodynamics, and energy balance in closed systems. Then the discussion is deepened for control mass systems with an introduction to thermodynamic properties related to control mass systems, namely pressure, temperature, specific volume and specific internal energy. The discussion of control mass systems is further deepened with the introduction of the ideal gas model for fluids in the gas phase. The next discussion is evaluating control volume systems such as nozzles, diffusers, turbines, compressors, pumps and introducing fluid properties related to control volume systems, namely enthalpy.
References	**Main :**

1. Moran, Michael J., Howard N. Saphiro, Daisie D. Boettner, and Margareth B. Bailey. 2011. Fundamentals of Engineering Thermodynamics 7th ed., John Wiley & Sons.
2. Cengel, Yunus A. and Boles, Michael A. 2010. Thermodynamics An Engineering Aproach 7th ed., McGraw-Hill.
3. Sonntag., Borgnakke., Van Wylen, 1998, Fundamental of Thermodynamics 7th ed., John Willey & Sons.
4. Holman, 1980. Thermodynamics 3rd ed., McGraw-Hill,

Supporters:	
Supporting lecturer	Prof. Dr. Muhaji, S.T., M.T. Saiful Anwar, S.Pd., M.T.

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	Introduction: Understand the rules and general instructions for students. Understand the basic concepts of thermodynamics	Students are able to understand the definition of property, types of systems, SI and British unit systems.	**Criteria:** liveliness, duty	Lectures, discussions, questions and answers and/or online 2 X 50			0%
2	Understand the basic concepts of thermodynamics	Students are able to understand types of energy, conditions and equilibrium.	**Criteria:** student activeness in discussing and answering questions	Lectures, discussions, questions and answers and/or online 2 X 50			0%
3	Understand the basic concepts of thermodynamics	Students are able to understand the law of thermodynamics along with the methodology for solving thermodynamic problems	**Criteria:** student activeness during discussions	Lectures, discussions, questions and answers and/or online 2 X 50			0%
4	Understand the properties of pure substances	Students understand the nature of pure substances and their phase changes	**Criteria:** student activeness during discussions	Lectures, discussions, questions and answers and/or online 2 X 50			0%
5	Understand the properties of pure substances	Students understand the nature of pure substances and their phase changes	**Criteria:** student activeness during discussions	Lectures, discussions, questions and answers and/or online 2 X 50			0%
6	Understanding Energy and the first law of thermodynamics	Students understand the principles of energy and the use of the first law of thermodynamics	**Criteria:** Student activity during discussions	Lectures, discussions, questions and answers, exercises, assignments and/or online 2 X 50			0%
7	Understanding Energy and the first law of thermodynamics	Students understand the principles of energy and the use of the first law of thermodynamics	**Criteria:** student activity	Lectures, discussions, questions and answers, exercises, assignments and/or online 2 X 50			0%
8	UTS			2 X 50			0%
9	Understand the first law of thermodynamics for closed systems	Students are able to understand the principles of energy balance for closed systems, specific heat of ideal gases, internal energy and thermodynamic processes	**Criteria:** student activeness during discussions	Lectures, discussions, questions and answers, exercises, assignments and/or online 2 X 50			0%

10	Understand the first law of thermodynamics for closed systems	Students are able to understand the principles of energy balance for closed systems, specific heat of ideal gases, internal energy and thermodynamic processes	**Criteria:** student activeness during discussions	Lectures, discussions, questions and answers, exercises, assignments and/or online 2 X 50			0%
11	Understand the first law of thermodynamics for closed systems	Students are able to understand the principles of energy balance for closed systems, specific heat of ideal gases, internal energy and thermodynamic processes	**Criteria:** student activeness during discussions	Lectures, discussions, questions and answers, exercises, assignments and/or online 2 X 50			0%
12	Understand the first law of thermodynamics for open systems	Students are able to understand the control volume system by analyzing the system in nozzles, diffusers, turbines, pumps, compressors and heat exchangers	**Criteria:** student activity during lectures	Lectures, discussions, questions and answers, exercises and assignments 2 X 50			0%
13	Understand the first law of thermodynamics for open systems	Students are able to understand the control volume system by analyzing the system in nozzles, diffusers, turbines, pumps, compressors and heat exchangers	**Criteria:** student activity during lectures	Lectures, discussions, questions and answers, exercises and assignments 2 X 50			0%
14	Understand the first law of thermodynamics for open systems	Students are able to understand the control volume system by analyzing the system in nozzles, diffusers, turbines, pumps, compressors and heat exchangers	**Criteria:** student activity during lectures	Lectures, discussions, questions and answers, exercises and assignments 2 X 50			0%
15	Understand the first law of thermodynamics for open systems	Students are able to understand the control volume system by analyzing the system in nozzles, diffusers, turbines, pumps, compressors and heat exchangers	**Criteria:** student activity during lectures	Lectures, discussions, questions and answers, exercises and assignments 2 X 50			0%
16							0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
		0%

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** 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.
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.