	Universitas Negeri Surabaya Faculty of Engineering, Mechanical Engineering Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Solar Energy	2120102143	Study Program Elective Courses	T=2	P=0	ECTS=3.18	5	July 16, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Aris Ansori, S.Pd., MT	.....	Ir. Priyo Heru Adiwibowo, S.T., M.T.

Learning model	**Case Studies**

Program Learning Outcomes (PLO)

PLO study program that is charged to the course

Program Objectives (PO)

PO - 1	Understanding of radiation heat transfer caused by sunlight and parameters relating to solar radiation falling on the earth's surface, as well as applications for the use of solar energy

PLO-PO Matrix

P.O
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 radiation heat transfer caused by sunlight and parameters relating to solar radiation falling on the earth's surface, as well as applications for the use of solar energy

References

Main :

1. John A. Duffie and William A. Beckman, 2006.Solar Engineering of Thermal Process 3rd edition, JohnWiley and Sons, 2006
   Bahan-bahan dari Internetdan kepustakaan lain

Supporters:

1. Modul Energy surya dan PPT

Supporting lecturer	Dr. Aris Ansori, 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	1. Analyzing the use of solar energy in everyday life 2. Analyze existing solar energy conversion devices in the community	1. Students can analyze the use of solar energy in society 2. Students can analyze solar energy conversion devices that exist in society	**Criteria:** Observation **Form of Assessment** : Participatory Activities	lectures and discussions 2 X 50			4%
2	1. Able to analyze factors that influence radiation on the earth's surface 2. Able to calculate the value of solar radiation	Students can calculate extraterrestrial radiation flux correctly	**Criteria:** 1. Use the correct calculation formula 2. The calculation results are correct according to geographic location **Form of Assessment** : Participatory Activities	lectures and discussions 2 X 50			5%
3	1. Students are able to calculate the angles of solar radiation 2. Students are able to calculate the angle of declination, angle of incidence, azimuth	Students can accurately calculate the angle of declination and angle of incidence	**Criteria:** null **Form of Assessment** : Participatory Activities	Lecture, Discussion (Task-3: Calculating the angle of declination and angle of incidence) 2 X 50			4%
4	1. Students are able to calculate direct radiation and scattered radiation of solar energy 2. Students are able to calculate the total radiation of solar energy	Students are able to explain direct radiation, as well as calculate direct radiation	**Criteria:** 1. Calculates direct radiation and scattered radiation of solar energy 2. Calculates direct radiation of solar energy **Form of Assessment** : Participatory Activities	lectures, discussions, assignments and Quiz 2 X 50			4%
5	Students are able to compare direct radiation on an inclined plane against a flat plane and the average daily radiation on a monthly basis	students are able to calculate and compare direct radiation on an inclined plane to a flat plane and the average daily radiation to the monthly	**Criteria:** Correctly calculate average daily radiation **Form of Assessment** : Participatory Activities	lectures, discussions, assignments 2 X 50			3%
6	students analyze components of solar energy technology, such as photovoltaics, thermal electricity and solar air heaters	Can determine the components of solar energy technology correctly	**Criteria:** 10	lectures, discussions and assignments 2 X 50			5%
7	1. students analyze the components of a Solar Air Heater 2. students analyze the working components and components of a Solar Air Heater	1. can determine the components of the Solar Air Heater correctly 2. can analyze the work of the Solar Air Heater correctly	**Criteria:** determine the components of the Solar Air Heater correctly	lectures, discussions, assignments 2 X 50			5%

8	Students are able to calculate solar collector efficiency, temperature distribution in the x direction, calculate temperature distribution in the y direction, removal factor in Solar Air Heaters	Students can calculate solar collector efficiency, temperature distribution in the x direction, calculate temperature distribution in the y direction, removal factor in Solar Air Heaters	**Criteria:** 60% correct **Form of Assessment** : Participatory Activities	lectures, discussions, assignments 2 X 50			5%
9	UTS	1. Calculates the daily average total solar energy radiation in a certain area 2. Calculate the solar energy radiation angle correctly	**Criteria:** Calculate the solar energy radiation angle correctly **Form of Assessment** : Practice/Performance, Test	2 X 50			15%
10	Students know the working principles and components of lighting technology using solar energy	Students can explain the working principles and components of lighting technology using solar energy	**Criteria:** 1. calculate light intensity with a luxmeter correctly 2. explains the working principles and components of lighting technology using solar energy **Form of Assessment** : Participatory Activities	lectures, discussions and assignments 2 X 50			5%
11	Students can learn about solar cell technology	Students can explain the working principles and components of the solar cell technology system	**Criteria:** can explain the working principles and components of the solar cell technology system correctly **Form of Assessment** : Participatory Activities	lectures, discussions and assignments 2 X 50			5%
12	Students can find out the potential and use of solar energy with solar cells	Students can calculate the potential and utilization of solar energy with solar cells	**Criteria:** 1. can calculate the potential solar energy for solar cells correctly 2. can calculate the electrical energy produced by solar cells correctly **Form of Assessment** : Participatory Activities	lectures, discussions and assignments 2 X 50			5%
13	Students know the working principles and components of solar energy stove technology	Students can explain the working principles and components of solar energy stove technology	**Criteria:** 1. can determine the components of a solar stove correctly 2. can explain the working system of a solar stove correctly **Form of Assessment** : Participatory Activities	lectures, discussions, assignments 2 X 50			5%
14	Students know how the components of thermalelectric technology work in using solar energy	Students can explain how thermalelectric technology components work in using solar energy	**Criteria:** can determine the components of thermoelectric technology correctly **Form of Assessment** : Participatory Activities	lectures, discussions, assignments 2 X 50			5%

15	1. Students can analyze the working of a solar energy drying system 2. Students can determine the components of a solar energy drying system	1. can analyze the working of the solar energy dryer system 2. can determine the components of a solar energy drying system	**Criteria:** can determine the solar energy drying system correctly **Form of Assessment** : Participatory Activities	discussion and presentation 2 X 50			5%
16	UAS		**Form of Assessment** : Project Results Assessment / Product Assessment	2 X 50			20%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	55%
2.	Project Results Assessment / Product Assessment	20%
3.	Practice / Performance	7.5%
4.	Test	7.5%
		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.