	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Undergraduate Physics Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Solar Cells	4520102184		T=2	P=0	ECTS=3.18	0	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Munasir, S.Si., M.Si.

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	Study the concept of basic materials for photovoltaics, the working principles of solar cells and their parameters (IV curve, Isc, Voc, fill factor, efficiency), temperature effects, design and structure of solar cells, modules and arrays including the effects of module interconnection. PN Junction includes semiconductor materials, light absorption, absorption coefficient, absorption depth, diode equation for PV; Solar cells include structure, the process of current generation by solar radiation, photovoltaic effects, solar cell parameters and their influences; Principles of solar cell design and prototyping and testing.
References	**Main :**

1. Aldo Dieira da Rosa . 2009. Fundamental of Renewable Energy Process. Elseivier.
2. J.P. Dunlop . 2010. Photovoltaic Systems . Second Edition, American Technical Publishers.
3. Christiana Honsberg & Stuart Bowden . 1998. Photovoltaics: Devices, Systems and Applications. John Welly & Sons.
4. V. Quasschning . 2005. Understanding Renewable Energy Systems . London Sterling Erthscan.
5. Konrad Mertens . 2014. Photovoltaics: Fundamentals, Technology and Practice. John Welly & Sons
6. James P. Dunlop . 2012. Photovoltaic Systems . John Welly & Sons.
7. Heinrich Haberlin . 2012. Photovoltaics System Design and Practice. John Welly & Sons.

	Supporters:
Supporting lecturer	Prof. Dr. Budi Jatmiko, M.Pd. Prof. Dr. Munasir, S.Si., M.Si.

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 understand the general concept of solar cells and the working principles of photovoltaics and prototype solar cell systems	Able to explain the general concept of solar cells and the working principles of photovoltaics and prototype solar cell systems	**Criteria:** Maximum test and presentation scores are 100 (same weight)	Lectures, Question and Answer Discussions and 2 X 50 Assignments			0%
2	Students understand the concept of: Semiconductors: intrinsic, p type and n type	Able to explain the concept of Semiconductors: intrinsic, p type and n type	**Criteria:** Maximum test and presentation scores are 100 (same weight)	Presentation, Question and Answer Discussion and Assignment 2 X 50			0%
3	Students understand the concept and working principles of pn connections: photovoltaic work processes	Able to explain the concept and working principles of pn connections: photovoltaic working processes	**Criteria:** Maximum test and presentation scores are 100 (same weight)	Presentation, Question and Answer Discussion and Assignment 2 X 50			0%
4	Students understand the general concepts of c-Si, a-Si/thin film and polymer solar cells	Able to explain the general concepts of c-Si, a-Si/thin films and polymers	**Criteria:** Maximum test and presentation scores are 100 (same weight)	Presentation, Question and Answer Discussion and Assignment 2 X 50			0%
5	Students understand the general concept of solar cells (c-Si)	Able to explain the general concept of solar cells (c-Si)	**Criteria:** Maximum test and presentation scores are 100 (same weight)	Presentation, Question and Answer Discussion and Assignment 2 X 50			0%
6	Students understand the general concept of solar cells (c-Si)	Able to explain the general concept of solar cells (c-Si)	**Criteria:** Maximum test and presentation scores are 100 (same weight)	Presentation, Question and Answer Discussion and Assignment 2 X 50			0%
7	Students understand the general concept of a-Si:H based solar cells	Able to explain the general concept of a-Si:H based solar cells	**Criteria:** Maximum test and presentation scores are 100 (same weight)	Presentation, Question and Answer Discussion and Assignment 2 X 50			0%
8	UTS			2 X 50			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** 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.