	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
Wind and Water Energy	2120102144		T=2	P=0	ECTS=3.18	5	July 16, 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-5	Work independently and in groups
PLO-7	Problem analysis
PLO-14	Science and engineering knowledge

Program Objectives (PO)	
PO - 1	Able to collaborate, analyze and present matters related to wind energy sources
PO - 2	Able to collaborate, analyze and present matters related to water energy sources

PLO-PO Matrix

P.O	PLO-5	PLO-7	PLO-14
PO-1			
PO-2			

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																
PO-2																

Short Course Description: In this course students will study the main topics regarding wind and water as renewable energy sources. Apart from that, students also learn about energy conversion technology from wind and water into electrical energy.

References

Main :

1. Siregar, Indra Herlamba dkk. (2020), Turbin Angin Sumbu Vertikal Berbasis Drag Forces, Yogyakarta, Deepublish
2. Tong, Wei. (2010), Wind Power Generation anda Wind Turbine Design, southampton, WIT Press
3. IMIDAP, (2010), Modul Pelatihan Studi Kelayakan Pembangunan Mikrohidro, Jakarta, Direktorat Jendral Listrik dan Pemanfaatan energi.
4. Hidayat, (2017), Buku Ajar Mikrohidro, Padang, Bung Hatta University Press
5. Leyland, Bryan. (2014), Small hydroelectric engineering practice, Boca Ranton, CRC Press
6. IMIDAP, (2009), Pedoman Studi Kelayakan Hidrologi, Jakarta, Direktorat Jendral Listrik dan Pemanfaatan energi.
7. IMIDAP, (2009), Pedoman Studi Kelayakan Mekanikal elektrikal Jakarta, Direktorat Jendral Listrik dan Pemanfaatan energi.

Supporters:

1. Warjito dan Rachman, Akbar. (2012), Pemetaan Potensi Energi Angin di Indonesia, Proceeding Seminar Nasional Tahunan Teknik Mesin XI, Yogyakarta, BKSTM
2. BKMG, Data Angin di berbagai Wilayah Indonesia, https://dataonline.bmkg.go.id/home

Supporting lecturer: Indra Herlamba Siregar, S.T., 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	Able to map the potential of wind energy in Indonesia	Explain the potential of wind energy in Indonesia	**Criteria:** according to the rubric **Form of Assessment** : Participatory Activities	Introduction to the potential of wind energy in Indonesia 2x50		**Material:** Wind potential in Indonesia **References:** *Siregar, Indra Herlamba et al. (2020), Vertical Axis Wind Turbine Based on Drag Forces, Yogyakarta, Deepublish*	3%
2	Able to map the potential of wind energy in Indonesia	Explain the potential of wind energy in Indonesia	**Criteria:** according to the rubric **Form of Assessment** : Participatory Activities	Case study Mapping Wind Energy Potential in Indonesia 1. Group Discussion 2. Class Discussion 2x50		**Material:** Wind potential in Indonesia **References:** *Siregar, Indra Herlamba et al. (2020), Vertical Axis Wind Turbine Based on Drag Forces, Yogyakarta, Deepublish* **Material:** Mapping Wind Energy Potential in Indonesia **References:** *Warjito and Rachman, Akbar. (2012), Mapping Wind Energy Potential in Indonesia, Proceedings of the XI Annual National Seminar on Mechanical Engineering, Yogyakarta, BKSTM*	3%
3	Able to map the potential of wind energy in Indonesia	Informative mapping results	**Criteria:** according to the rubric **Form of Assessment** : Participatory Activities	Case study Mapping Wind Energy Potential in Indonesia 1. Presentation of Group Work Results 2. Literacy reading assignment Weibull Distribution Application to represent wind speed 2x50		**Material:** Wind potential in Indonesia **References:** *Siregar, Indra Herlamba et al. (2020), Vertical Axis Wind Turbine Based on Drag Forces, Yogyakarta, Deepublish* **Material:** Mapping Wind Energy Potential in Indonesia **References:** *Warjito and Rachman, Akbar. (2012), Mapping Wind Energy Potential in Indonesia, Proceedings of the XI Annual National Seminar on Mechanical Engineering, Yogyakarta, BKSTM*	3%
4	Able to apply the Weibull distribution function to see the probability of wind speed	Application of the Weibull distribution function to see the probability of wind speed in an area	**Form of Assessment** : Portfolio Assessment	Case study: create a Weibull Distribution from wind data group 1. Group Discussion 2. Class Discussion 2x50		**Material:** average wind speed data for 2022 **Reference:** *BKMG, Wind Data in various regions of Indonesia, https://dataonline.bmkg.go.id/...*	7%
5	Able to apply the Weibull distribution function to see the probability of wind speed	Application of the Weibull distribution function to see the probability of wind speed in an area	**Form of Assessment** : Project Results Assessment / Product Assessment	Case study create a Weibull Distribution from a group of wind data 1. Presentation of Results 2. Literacy assignments related to the main components of a Wind Power Plant 2x50		**Material:** average wind speed data for 2022 **Reference:** *BKMG, Wind Data in various regions of Indonesia, https://dataonline.bmkg.go.id/...*	11%

6	Able to describe the series of main components of a wind power plant	Able to assemble the main components of a Wind Power Plant	**Criteria:** According to the rubric **Form of Assessment** : Portfolio Assessment	Case study describes the main components of a Wind Power Plant 1. Group Discussion 2. Class Discussion 2x50		**Material:** Wind Power Generation **References:** *Tong, Wei. (2010), Wind Power Generation and Wind Turbine Design, Southampton, WIT Press*	7%
7	Able to describe the series of main components of a wind power plant	Able to assemble the main components of a Wind Power Plant	**Criteria:** According to the rubric **Form of Assessment** : Portfolio Assessment	Case study describes the main components of a Wind Power Plant 1. Group Presentation 2x50		**Material:** Wind Power Generation **References:** *Tong, Wei. (2010), Wind Power Generation and Wind Turbine Design, Southampton, WIT Press*	7%
8			**Form of Assessment** : Test	UTS 2x50			15%
9	understand the basic concepts of Microhydro Power Plant (PLTMH) design	able to understand the basic concepts of Microhydro Power Plant (PLTMH) design	**Criteria:** according to the rubric **Form of Assessment** : Participatory Activities	Case Study Identify and create the basic concept of a PLTMH 1. Group Discussion 2. Class Discussion 2x50		**Material:** Basic concepts of design of an MHP **Library:** *Hidayat, (2017), Microhydro Textbook, Padang, Bung Hatta University Press*	3%
10	understand the basic concepts of Microhydro Power Plant (PLTMH) design	able to understand the basic concepts of Microhydro Power Plant (PLTMH) design	**Criteria:** according to the rubric **Form of Assessment** : Participatory Activities	Case Study Identify and create the basic concept of a MHP 1. Group Presentation 2. Literacy assignment Hydrological feasibility study 2x50		**Material:** Basic concepts of design of an MHP **Library:** *Hidayat, (2017), Microhydro Textbook, Padang, Bung Hatta University Press*	3%
11	Able to carry out a hydrological feasibility study for a PLTMH development plan	Hydrological feasibility study simulation report for a PLTMH	**Form of Assessment** : Participatory Activities	Case Study Simulate a hydrological feasibility study of a PLTMH 1. Group Discussion 2. Class Discussion 2x50		**Material:** All of Chapter **Bibliography:** *IMIDAP, (2009), Hydrological Feasibility Study Guidelines, Jakarta, Directorate General of Electricity and Energy Utilization.*	3%
12	Able to carry out a hydrological feasibility study for a PLTMH development plan	Hydrological feasibility study simulation report for a PLTMH	**Form of Assessment** : Project Results Assessment / Product Assessment	Case Study Simulate a hydrological feasibility study of a PLTMH 1. Group Discussion 2. Class Discussion 2x50		**Material:** All of Chapter **Bibliography:** *IMIDAP, (2009), Hydrological Feasibility Study Guidelines, Jakarta, Directorate General of Electricity and Energy Utilization.*	11%
13	Able to carry out a hydrological feasibility study for a PLTMH development plan	Hydrological feasibility study simulation report for a PLTMH	**Form of Assessment** : Participatory Activities	Case Study Simulate a hydrological feasibility study of a PLTMH 1. Presentation of Group Results 2. Mechanical and electrical feasibility study literacy assignment 2x50		**Material:** All of Chapter **Bibliography:** *IMIDAP, (2009), Hydrological Feasibility Study Guidelines, Jakarta, Directorate General of Electricity and Energy Utilization.*	3%

14	Able to carry out mechanical and electrical feasibility study simulations for a PLTMH development plan	Simulation report on mechanical and electrical feasibility study for a PLTMH	**Criteria:** according to the rubric **Form of Assessment** : Participatory Activities	Case Study Carry out a simulation of a mechanical and electrical feasibility study for a PLTMH 1. Group Discussion 2. Class Discussion 2x50		**Material:** all of chapters **References:** *IMIDAP, (2009), Electrical Mechanical Feasibility Study Guidelines for Jakarta, Directorate General of Electricity and Energy Utilization.*	3%
15	Able to carry out mechanical and electrical feasibility study simulations for a PLTMH development plan	Simulation report on mechanical and electrical feasibility study for a PLTMH	**Criteria:** according to the rubric **Form of Assessment** : Participatory Activities	Case Study Carry out a simulation of a mechanical and electrical feasibility study for a PLTMH 1. Group Presentation 2x50		**Material:** all of chapters **References:** *IMIDAP, (2009), Electrical Mechanical Feasibility Study Guidelines for Jakarta, Directorate General of Electricity and Energy Utilization.*	3%
16			**Form of Assessment** : Test	UAS 2x50			15%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	27%
2.	Project Results Assessment / Product Assessment	22%
3.	Portfolio Assessment	21%
4.	Test	30%
		100%

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.