	Universitas Negeri Surabaya **Faculty of Engineering** **, Electrical Engineering Education Undergraduate Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Optimization and Operation of Electric Power Systems	8320103249	Compulsory Study Program Subjects	**T=3**	**P=0**	**ECTS=4.77**	5	July 19, 2023

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**	
	Program Objectives (PO)	
	PO - 1	Students have knowledge about the process of delivering electric power to customers
	PO - 2	Students have knowledge about the characteristics of interconnected hydrothermal plants
	PO - 3	Students can understand and be able to comprehend load distribution for hydro and thermal generators from interconnected electric power systems
	PO - 4	Students have knowledge about LOLP (Loss of Load Probability)
	PO - 5	Students have knowledge about generator constraints
	PO - 6	Students are able to understand and analyze frequency knowledge

PLO-PO Matrix

P.O
PO-1
PO-2
PO-3
PO-4
PO-5
PO-6

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																
PO-3																
PO-4																
PO-5																
PO-6																

Short Course Description	Interconnected electric power systems, Characteristics of power plants, Scheduling system maintenance and operations, Reliability of the system calculating LOLP (Loss of Load Probability), Load distribution of generating units, Hydro thermal optimization, Plant constraints, System security, Operation control	
References	**Main :**	

	1. Stevenson, William D., Jr, Kamal Idris, 1994, Analisis Sistem Tenaga Listrik, Jakarta: Erlangga
	Supporters:
	1. Bruce F.,Wollenberg, 2001, Power System Operation and Control, The Electric Power Engineering Handbook, Ed. L.L. Grigsby, CRC Press LLC.
Supporting lecturer	Unit Three Kartini, S.T., M.T., Ph.D.

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		Explain the electric power system	**Form of Assessment** : Participatory Activities, Tests	Introduction Introduction to RPS and lecture contracts 07.00-08.40		**Material:** 1. Introduction to Electric Power Systems and components in electric power systems **References:** *Bruce F., Wollenberg, 2001, Power System Operation and Control, The Electric Power Engineering Handbook, Ed. L.L. Grigsby, CRC Press LLC.* **Material:** Introduction to the delivery of electric power systems **References:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electrical Power System Analysis, Jakarta: Erlangga*	5%
2	Students get to know the characteristics of hydro and thermal plants	Explain the characteristics of hydro thermal plants	**Form of Assessment** : Participatory Activities, Tests	Presentation, discussion, reflection and practice 07.00-08.40		**Material:** Characteristics of hydro and thermal plants **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%

3	1. Students get to know the characteristics of hydro and thermal plants 2. Students are able to explain the loading of hydro and thermal plants	Explain the characteristics of hydro thermal plants	**Criteria:** The assessment criteria are carried out by looking at the following aspects: 1. Participation: carried out by observing student activities (weight 2) 2. UTS: carried out with assessments during the middle of the semester (weight 2) 3. UAS: carried out every semester to measure all indicators (weight 3) 4. Assignments: carried out on each indicator (weight 3) Final Student Score: Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, discussion, reflection and practice 07.00-08.40		**Material:** Characteristics of hydro and thermal plants **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga* **Material:** Generator loading **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%
4	Calculate and analyze fuel costs for hydro and thermal plants	1. Calculate and analyze fuel costs for hydro and thermal plants 2. Calculating Loss Of load Probability	**Criteria:** The assessment criteria are carried out by looking at the following aspects: 1. Participation: carried out by observing student activities (weight 2) 2. UTS: carried out with assessments during the middle of the semester (weight 2) 3. UAS: carried out every semester to measure all indicators (weight 3) 4. Assignments: carried out on each indicator (weight 3) Final Student Score: Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentations, assignments, discussions and reflections 07.00 -08.40		**Material:** LOLP Calculations **References:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%

5	1. Calculate and analyze fuel costs for hydro and thermal plants 2. LOLP calculation when the generator enters the system and the generator leaves the system	1. Calculate and analyze fuel costs for hydro and thermal plants 2. Calculating Loss Of load Probability 3. Not Serve Energy Calculations	**Criteria:** The assessment criteria are carried out by looking at the following aspects: 1. Participation: carried out by observing student activities (weight 2) 2. UTS: carried out with assessments during the middle of the semester (weight 2) 3. UAS: carried out every semester to measure all indicators (weight 3) 4. Assignments: carried out on each indicator (weight 3) Final Student Score: Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Tests	Presentations, assignments, discussions and reflections 07.00 -08.40		**Material:** LOLP Calculations **References:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%
6	1. Calculate and analyze fuel costs for hydro and thermal plants 2. LOLP calculation when the generator enters the system and the generator leaves the system	1. Calculate and analyze fuel costs for hydro and thermal plants 2. Calculating Loss Of load Probability 3. Not Serve Energy Calculations	**Criteria:** The assessment criteria are carried out by looking at the following aspects: 1. Participation: carried out by observing student activities (weight 2) 2. UTS: carried out with assessments during the middle of the semester (weight 2) 3. UAS: carried out every semester to measure all indicators (weight 3) 4. Assignments: carried out on each indicator (weight 3) Final Student Score: Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	Presentations, assignments, discussions and reflections 07.00 -08.40		**Material:** LOLP Calculations **References:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	7%

7	1. Calculate and analyze fuel costs for hydro and thermal plants 2. LOLP calculation when the generator enters the system and the generator leaves the system	1. Calculate and analyze fuel costs for hydro and thermal plants 2. Calculating Loss Of load Probability 3. Not Serve Energy Calculations	**Criteria:** The assessment criteria are carried out by looking at the following aspects: 1. Participation: carried out by observing student activities (weight 2) 2. UTS: carried out with assessments during the middle of the semester (weight 2) 3. UAS: carried out every semester to measure all indicators (weight 3) 4. Assignments: carried out on each indicator (weight 3) Final Student Score: Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Tests	Presentations, assignments, discussions and reflections 07.00 -08.40		**Material:** LOLP Calculations **References:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%
8		Midterm exam	**Criteria:** The assessment criteria are carried out by looking at the following aspects: 1. Participation: carried out by observing student activities (weight 2) 2. UTS: carried out with assessments during the middle of the semester (weight 2) 3. UAS: carried out every semester to measure all indicators (weight 3) 4. Assignments: carried out on each indicator (weight 3) Final Student Score: Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities, Tests	Test 07.00 - 08.40		**Material:** Midterm Exam **References:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electrical Power System Analysis, Jakarta: Erlangga*	6%
9	Frequency Settings	Explains frequency settings	**Form of Assessment** : Participatory Activities, Tests	Presentation, Discussion, test and reflection 07.00 - 08.40		**Material:** Frequency regulation **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%
10	Frequency Settings	Explains frequency settings	**Form of Assessment** : Participatory Activities, Tests	Presentation, Discussion, test and reflection 07.00 - 08.40		**Material:** Frequency regulation **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%

11	Frequency Settings	Explains frequency settings	**Form of Assessment** : Participatory Activities, Tests	Presentation, Discussion, test and reflection 07.00 - 08.40		**Material:** Frequency regulation **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%
12	Frequency Settings	Explains frequency settings	**Form of Assessment** : Participatory Activities, Tests	Presentation, Discussion, test and reflection 07.00 - 08.40		**Material:** Frequency regulation **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	7%
13	Frequency Settings	Explains frequency settings	**Form of Assessment** : Participatory Activities, Tests	Presentation, Discussion, test and reflection 07.00 - 08.40		**Material:** Frequency regulation **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	6%
14	Frequency Settings	Explains frequency settings	**Form of Assessment** : Participatory Activities, Tests	Presentation, Discussion, test and reflection 07.00 - 08.40		**Material:** Frequency regulation **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	7%
15	Frequency Settings	Explains frequency settings	**Form of Assessment** : Participatory Activities	Presentation, Discussion, test and reflection 07.00 - 08.40		**Material:** Frequency regulation **Reference:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	7%

16	Final exams	Final Semester Exam (All Lecture Material)	**Criteria:** The assessment criteria are carried out by looking at the following aspects: 1. Participation: carried out by observing student activities (weight 2) 2. UTS: carried out with assessments during the middle of the semester (weight 2) 3. UAS: carried out every semester to measure all indicators (weight 3) 4. Assignments: carried out on each indicator (weight 3) Final Student Score: Participation Score (2) x Assignment Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Test	Test 07.00 - 08.40		**Material:** All Chapters **References:** *Stevenson, William D., Jr, Kamal Idris, 1994, Electric Power System Analysis, Jakarta: Erlangga*	7%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	51.5%
2.	Project Results Assessment / Product Assessment	10%
3.	Test	38.5%
		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.