	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
Electrical Machine Practicum	8320102130		T=2 P=0 ECTS=3.18	5	August 1, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Prof. Dr. Joko, M.Pd. MT.	.....	Dr. Nur Kholis, S.T., M.T.

Learning model: Project Based Learning

Program Learning Outcomes (PLO)

PLO study program that is charged to the course

PLO-5	Able to align the electrical and electronics engineering training curriculum in vocational education that is relevant to the demands of global industrial development (Education).

Program Objectives (PO)

PO - 1	Students are able to carry out preparatory work, carry out, check the results and report the results of work on testing the characteristics of transformers, DC generators/motors, synchronous generators/motors, asynchronous generators/motors; in writing and/or orally (presentation).

PLO-PO Matrix

P.O	PLO-5
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: This course equips students with cognitive, affective and psychomoral skills in carrying out preparatory work (formulating the title of the practicum, objectives, formulating the problem, formulating a hypothesis (if any), compiling a brief theoretical study, drawing up a test/practical plan, compiling a table of equipment requirements /materials/PPE (name of equipment/materials/PPE, specifications, units and quantities), preparing designs or testing/practical steps, preparing data table designs; checking work/practical results (data tabulation), interpreting data, analyzing data; formulate conclusions and suggestions); and report the results verbally and verbally (presentation) of transformer characteristic testing work. DC generator/motor, synchronous generator/motor, and asynchronous generator/motor.

References

Main :

1. Stephen J. Chapman, 2012. Electric Machinary Fundamentals Fifth Edition. MCGraw-Hill: New York.
2. Joko, 2016. Mesin arus searah. Unesa University Press
3. Joko, 2018. Mesin arus bolak balik. Unesa University Press
4. Joko, 2023. Modul praktikum transformator. Prodi Pendidikan Teknik Elektro FT Unesa

Supporters:

1. Joko, 2021. Exsperiment Sheet Generator DC. Jurusan Teknik Elektro Fakultas Teknik Unesa Surabaya
2. Joko, 2021. Exsperiment Sheet Generator DC. Jurusan Teknik Elektro Fakultas Teknik Unesa Surabaya
3. Joko, Agus Budi S, Parama D.W., Alfredo A. P.P. 2022. Pemeliharaan dan perbaikan motor listrik berbasis model pembelajaran berbasisi proyek. Unesa University Press.

Supporting lecturer: Prof. Dr. Ismet Basuki, M.Pd.
Prof. Dr. Joko, M.Pd., M.T.
Ibrohim, 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	Students are able to carry out preparatory work (formulating the title of the practicum, objectives, problem formulation, hypothesis, making a short theoretical study, making experimental design drawings, making experimental designs, making tables of equipment/materials/PPE requirements (name of equipment/materials/PPE, specifications, units , and quantity), designing a data table), carrying out work (testing characteristics of zero load, load, short circuit, carrying out data collection), evaluating the results of work (analyzing, interpreting data, making conclusions and suggestions), and reporting (written and/or orally) results of testing the characteristics of a single phase transformer	1. Doing preparatory work 2. Carrying out characteristic testing work 3. Carry out work results testing 4. Reporting work results 5. Participative	**Criteria:** 1. Accuracy of preparatory work, max score 5 2. Accuracy of doing work, max score 30 3. Accuracy of testing work results, max score 10 4. Accuracy of reporting work results, max score 5 5. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students are able to carry out work on testing the characteristics of a single phase transformer, inspecting work results, holding discussions and reporting work. 2 X 50	Students explore sources of information, discuss, carry out preparatory work for testing the characteristics of a 2X50 minute single phase transformer	**Material:** Testing transformer characteristics **Library:** *Transformer practice module*	3%
2	Students are able to carry out preparatory work, carry out work, check work results, and report the results of work on testing the characteristics of DC shunt motors and compounds	1. Doing preparatory work 2. Doing work 3. Carry out inspection of work results 4. Reporting work results 5. Participative	**Criteria:** 1. Accuracy of carrying out preparatory work, max score 5 2. Accuracy in doing work, score 25 3. Accuracy of testing work results, max score 10 4. Accuracy of reporting work results, max score 5 5. Punctuality, max score 5 6. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students test the characteristics of shunt DC motors and compound DC motors, and carry out 100 work results tests	Students explore sources of information, discuss, carry out preparatory work for testing the characteristics of DC shunt and compound motors, and report the results of their work 100	**Material:** Characteristics of DC motors **Reference:** *Joko, 2016. Direct current machines. University Press: Unesa Surabaya*	4%
3	Students are able to carry out preparatory work, carry out work, check work results, and report the results of work on testing the characteristics of DC shunt generators and compounds	1. Doing preparatory work 2. Doing work 3. Carry out inspection of work results 4. Reporting work results	**Criteria:** 1. Accuracy of carrying out preparatory work, max score 5 2. Accuracy in doing work, score 25 3. Accuracy of testing work results, max score 10 4. Accuracy of reporting work results, max score 5 5. Punctuality, max score 5 6. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students carry out work, check the results of the work, and report the results of the work on testing the characteristics of the DC shunt generator and the 2X50 compound	Students explore sources of information, discussions, and carry out preparation work for the DC shunt generator and 2X50 compound	**Material:** Characteristics of DC generators **Reference:** *Joko, 2016. Direct current machines. University Press: Unesa Surabaya*	5%

4	Students are able to carry out preparatory work, carry out work, check work results, and report the results of work on testing the characteristics of synchronous motors	1. Doing preparatory work 2. Doing work 3. Carry out work results testing 4. Reporting work results 5. Participative	**Criteria:** 1. Accuracy of preparatory work, max score 10 2. Accuracy of testing work, max score 25 3. Accuracy of testing work results, max score 5 4. Accuracy of reporting work, max score 5 5. Punctuality, max score 5 6. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students carry out work and test the results of work on testing the characteristics of a 2X50 synchronous motor	Students explore sources of information, discuss and carry out preparatory work, as well as report the results of their work on testing the characteristics of the 2X50 synchronous motor	**Material:** Characteristics of synchronous motors **Reference:** *Joko, 2018. Alternating current machines. University Press: Unesa Surabaya*	5%
5	Students are able to carry out preparatory work, carry out work, check work results, and report the results of work on testing the characteristics of synchronous generators	1. Doing preparatory work 2. Doing work 3. Carry out work results testing 4. Reporting work results 5. Participative	**Criteria:** 1. Accuracy of preparatory work, max score 10 2. Accuracy in doing work, score 25 3. Accuracy of testing work results, max score 10 4. Accuracy of reporting work results, max score 5 5. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students carry out work on testing the characteristics of synchronous generators and test the results of 2X50 work	Students explore sources of information, discuss, carry out preparatory work for testing the characteristics of synchronous generators, and report the results of 2X50 work	**Material:** characteristics of synchronous generators **Reference:** *Joko, 2018. Alternating current machines. University Press: Unesa Surabaya*	5%
6	Students are able to carry out preparatory work, carry out work, check the results of work, and report the results of work on testing the characteristics of a 3 phase cage rotor asynchronous motor	1. Doing preparatory work 2. Doing work 3. Carry out work results testing 4. Reporting work results 5. Participative	**Criteria:** 1. Accuracy of preparatory work, max score 10 2. Accuracy of performing testing work, mak score 20 3. Accuracy of testing work results, max score 10 4. Accuracy in reporting work results, max score 10 5. Participative, min score 50 **Form of Assessment** : Participatory Activities, Practice/Performance	Students carry out work on testing the characteristics of a 3 phase cage rotor asynchronous motor and test the results of the 2X50 work	Students explore sources of information, discuss, carry out preparatory work, and report the results of work on testing the characteristics of a 3-phase 2X50 cage rotor asynchronous motor	**Material:** Characteristics of a 3 phase cage rotor asynchronous motor **Reference:** *Joko, 2018. Alternating current machine. University Press: Unesa Surabaya*	5%

7	Students are able to carry out preparatory work, carry out work, check work results, and report the results of work on testing the characteristics of a 3 phase winding rotor asynchronous motor	1. Doing preparatory work 2. Doing work 3. Carry out work results testing 4. Reporting the results of participative work	**Criteria:** 1. Accuracy of preparatory work, max score 10 2. Accuracy in doing work, score 20 3. Accuracy of testing work results, max score 10 4. Accuracy in reporting work results, max score 10 5. Participatory, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students carry out work and test the results of work on testing the characteristics of a 2X50 winding rotor 3 phase asynchronous motor	Students explore sources of information, discuss, do preparatory work, and report the results of work 2X50	**Material:** Characteristics of a 3 phase winding rotor asynchronous motor **Reference:** *Joko, 2018. Alternating current machine. University Press: Unesa Surabaya*	4%
8	Students are able to carry out preparatory work, carry out work, check work results, and report the results of work on testing the characteristics of a 3 phase winding rotor asynchronous motor	1. PPT Quality 2. Quality of expressing opinions 3. Quality of answering and accepting suggestions 4. Punctuality 5. Personal appearance 6. Cooperation 7. Participative	**Criteria:** 1. PPT quality, max score. 10 2. Quality of expressing opinions, max score. 15 3. Quality of answering and receiving suggestions, max score 10 4. punctuality, max score. 5 5. Personal appearance, max score 5 6. Cooperation, max score. 5 7. Participative, min score. 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Tests	UTS 2X50	UTS Presentation of work results reports		15%
9	Students are able to carry out preparatory work, carry out repair work on single-phase synchronous generators that do not produce electrical voltage, check and report the results of the work.	1. Perform identification 2. Doing preparatory work 3. Make improvements 4. Checking the results of work 5. Reporting work results 6. Participative	**Criteria:** 1. Identification accuracy, max score 15 2. Accuracy in carrying out preparatory work, max score 20 3. Accuracy of carrying out repair work, max score 40 4. Accuracy of carrying out inspections, max score 30 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students carry out characteristic testing work and test work results Students search for sources of information, discuss, carry out preparatory work, and test work results 2X50	Students explore sources of information, discuss, and carry out preparatory work, and report the results of 2X50 work	**Material:** Maintenance and repair of single-phase synchronous generators **References:** *Joko, Agus Budi S, Parama DW, Alfredo APP 2022. Maintenance and repair of electric motors based on a project-based learning model. Unesa University Press.*	5%

10	Students are able to carry out preparatory work, carry out work, check the results of work to overcome a 3-phase synchronous generator that is rotated normally and does not produce electrical voltage and report the results of the work in writing.	1. Doing preparatory work 2. Perform identification 3. Make improvements 4. Testing work results 5. Reporting work results 6. Participative	**Criteria:** 1. Identification accuracy, max score 10 2. Accuracy of carrying out preparatory work, max score 5 3. Accuracy of carrying out repair work, max score 20 4. Accuracy of testing work results, max score 10 5. Accuracy of reporting work results, max score 5 6. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students carry out work and carry out the results of the work to overcome a 3 phase synchronous generator that rotates normally and does not produce a voltage of 2X50	Students explore sources of information, discuss, organize preparatory work, and report the results of 2X50 work	**Material:** Maintenance and repair of 3 phase generators **References:** *Joko, Agus Budi S, Parama DW, Alfredo APP 2022. Maintenance and repair of electric motors based on a project-based learning model. Unesa University Press.*	6%
11	Students are able to carry out preparatory work, carry out work, check the results of the work, and report the results of the work to overcome the DC generator being turned normally without voltage coming out	1. Doing preparatory work 2. Perform identification 3. Make improvements 4. Testing work results 5. Reporting work results 6. Participative	**Criteria:** 1. Accuracy of identification, max score 10 2. Accuracy of carrying out preparatory work, max score 5 3. Accuracy of doing work, max score 20 4. Accuracy of testing work results, max score 10 5. Accuracy of work results reports, max score 5 6. Participative, max score 50	Students do the work and test the results of the work 2X50	Students explore sources of information, discuss, do preparatory work, and report the results of work 2X50	**Material:** Maintenance and repair of DC generators **Reference:** *Joko, Agus Budi S, Parama DW, Alfredo APP 2022. Maintenance and repair of electric motors based on a project-based learning model. Unesa University Press.*	6%
12	Students are able to carry out preparatory work, carry out work, test the results of the work, and report the results of work dealing with DC motors provided with a voltage source whose rotation direction is reversed	1. Perform identification 2. Doing preparatory work 3. Carrying out repair work 4. Testing work results 5. Reporting work results 6. Participative	**Criteria:** 1. Identification accuracy, max score 10 2. Accuracy of carrying out preparatory work, max score 5 3. Accuracy of doing work, max score 25 4. Accuracy of testing work results, max score 5 5. Accuracy of reporting work results, max score 5 6. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students carry out work and test the results of their work when dealing with a DC motor given a voltage source with a reverse rotation direction of 100	Students explore sources of information, discuss, carry out preparatory work, and report the results of 100 work	**Material:** Overcoming the reverse direction of DC motor rotation. **Reference:** *Joko, Agus Budi S, Parama DW, Alfredo APP 2022. Maintenance and repair of electric motors based on a project-based learning model. Unesa University Press.*	6%

13	Students are able to carry out preparatory work, carry out work, check the results of the work to regulate the rotation speed of a 3-phase synchronous motor and report the results of the work in writing.	1. Perform identification 2. Doing preparatory work 3. Doing work 4. Testing work results 5. Reporting work results 6. Participative	**Criteria:** 1. Identification accuracy, max score 10 2. Accuracy of carrying out preparatory work, max score 5 3. Accuracy of doing work, max score 20 4. Accuracy of testing work results, max score 10 5. Accuracy of reporting work results, max score 5 6. Participative, max score 50 **Form of Assessment** : Participatory Activities, Practice/Performance	Students carry out work and test the results of 100 preparatory work	Students explore sources of information, discuss preparatory work, and report the results of their work	**Material:** Regulating the rotation speed of a 3-phase synchronous motor. **Reference:** *Joko, 2018. Alternating current machine. Unesa University Press*	6%
14	Students are able to carry out preparatory work, carry out work, check the results of work to overcome problems with 3-phase asynchronous motors whose rotation direction is reversed and report the results of the work in writing.	1. Perform identification 2. Doing preparatory work 3. Make improvements 4. Checking the results of work 5. Reporting work results 6. Participative	**Criteria:** 1. Identification accuracy, max score 15 2. Accuracy in carrying out preparatory work, max score 20 3. Accuracy of carrying out repair work, max score 40 4. Accuracy of carrying out inspections, max score 30 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Students do the work and test the results of the work 2X50	Students explore sources of information, discuss, do preparatory work, and report the results of work 2X50	**Material:** Regulating the direction of rotation of a 3-phase cage rotor asynchronous motor. **Reference:** *Joko, 2018. Alternating current machine. Unesa University Press*	5%
15	Students are able to carry out preparatory work, carry out work, test work results, and report work results testing the characteristics of a single phase induction motor	1. Doing preparatory work 2. Doing work 3. Testing work results 4. Reporting work results	**Criteria:** 1. Identification accuracy, max score 15 2. Accuracy in carrying out preparatory work, max score 20 3. Accuracy of carrying out repair work, max score 40 4. Accuracy of carrying out inspections, max score 30 5. Participative **Form of Assessment** : Participatory Activities, Practical Assessment	Students do the work and test the results of the work 2 X 50	Students explore sources of information, discuss, and report the results of their work 2 X 50	**Material:** Characteristics of a single phase induction motor **Reference:** *Joko, 2018. Alternating current machine. Unesa University Press*	6%
16	UAS	1. Explain 2. Differentiate 3. Analyze differences in characteristics 4. Repair procedures 5. Evaluate 6. Solve the problem 7. 8. Participative	**Criteria:** 1. Max score 8 2. Max score 8 3. Max score 8 4. Max score 8 5. Max score 8 6. Max score 10 7. Max score 50 **Form of Assessment** : Participatory Activities, Tests	UAS practice test 200			20%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	47.5%
2.	Project Results Assessment / Product Assessment	29%
3.	Practical Assessment	3%

4.	Practice / Performance	5.5%
5.	Test	15%
		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.