	Universitas Negeri Surabaya **Vocational Faculty,** **D4 Electrical Engineering Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses		CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Practical Setup and Use of Electric Motors		2030504043	Compulsory Study Program Subjects	**T=4**	**P=0**	**ECTS=6.36**	5	August 22, 2023
AUTHORIZATION		**SP Developer**		**Course Cluster Coordinator**			**Study Program Coordinator**	
		Prof. Dr. Joko, M.Pd. MT.		....			Mahendra Widyartono, S.T., M.T.	

Learning model	**Project Based Learning**
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	Students have the ability, skills, attitude, communication, and responsibility in carrying out preparatory work, carrying out work, checking work results, and reporting work results in carrying out settings based on basic electromagnetic control equipment and modern control (starting, turning right-turning left, working alternately , working sequentially, braking) according to general requirements for electrical installations (PUIL) and IEC, according to load and environmental characteristics. Able to carry out maintenance and repair management of DC/AC Power, control components, and systems for regulating and using DC and AC motors in the field.

References	**Main :**

1. Austin Hughes, 2006. Electric Motors and Drivess. Foundamentals, Types, And Apilcations. Third Edition. Published by Elsevier Ltd. All rights reserved
2. Fang Qi, Daniel Scharfenstein & Claude Weiss, 2019. Motor Handbook. Institute for Power Electronics and Electrical Drives, RWTH Aachen University
3. Joko, 2018. Mesin Arus Bolak Balik. University Press, Surabaya
4. Joko, 2016. Mesin Arus Searah. University Press, Surabaya

Supporters:

1. Joko, dkk. 2023. Modul mahasiswa pengendali elektromagnetik motor listrik. Surabaya, LPPM Unesa
2. Joko, dkk. 2023. Bahan materi perencanaan dan pemasangan panel kontrol pengendali motor listrik 3 phasa. LPPM Unesa, Surabaya
3. Joko, dkk. 2023. PPT-Pengantar sistem pengendali motor listrik. LPPM Unesa, Surabaya

Supporting lecturer	Prof. Dr. Joko, M.Pd., M.T. Mahendra Widyartono, 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)

No	Learning Outcomes	Tasks	Assessment Criteria	Learning Method/Time	Learning Experience	Material/Reference	Weight
1	Students are able to prepare, carry out, test and report the results of project work on DOL system electromagnetic controllers and right/left rotation of 3 phase induction motors	1. Create a data table for tool requirements (order number, tool name, specifications, units and quantities) 2. Create a data table for material requirements (order number, name, specification, unit and quantity) 3. Create a control circuit drawing 4. Create a power circuit drawing 5. Write how it works 6. Participative	**Criteria:** 1. Accuracy of tool requirements data table, max score 5 2. Accuracy of material requirements data table, max score 5 3. Power circuit image accuracy, , max score 15 4. Power circuit image accuracy, max score 15 5. Accuracy of work method, max score 10 6. Participative, min score 50 **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentations, tracing sources, discussions and assignments do 2 X 50 preparatory work		**Material:** Electromagnetic controller for 3 phase induction motor DOL system and right/left rotation **Reference:** *Joko, et al. 2023. Student module for electromagnetic control of electric motors. Surabaya, LPPM Unesa*	4%
2	Students are able to carry out preparatory work on the electromagnetic control project for the starting current of a triangular star of a 3-phase induction motor manually and automatically	1. Create a data table for tool requirements (order number, tool name, specifications, units and quantities) 2. Create a data table for material requirements (order number, name, specification, unit and quantity) 3. Create a controller circuit image 4. Create a power circuit drawing 5. Write how it works 6. Participative	**Criteria:** 1. Accuracy of tool requirements data table, max score 5 2. Accuracy of material requirements data table, max score 5 3. Power circuit image accuracy, max score 15 4. Power circuit image accuracy, max score 15 5. Accuracy of work method, max score 10 6. Participative, min score 50 **Form of Assessment** : Participatory Activities, Portfolio Assessment		Presentations, tracing sources, discussions and assignments doing preparatory work (for class A synchronously) Tracing sources, discussions and assignments doing preparatory work (for class B asynchronously) 2X50	**Material:** Star/triangle starting current induction motor controller for 3 phase induction motor **References:** *Joko, et al. 2023. Materials for planning and installing a 3-phase electric motor controller control panel. LPPM Unesa, Surabaya*	4%
3	Students are able to carry out preparatory work on an electromagnetic control project for a 3-phase induction motor rotating alternately and rotating sequentially	1. Create a data table for tool requirements (order number, tool name, specifications, units and quantities) 2. Create a data table for material requirements (order number, name, specification, unit and quantity) 3. Create a controller circuit image 4. Create a power circuit drawing 5. Write how it works 6. Participative	**Criteria:** 1. Accuracy of tool requirements data table, max score 5 2. Accuracy of material requirements data table, max score 5 3. Power circuit image accuracy, max score 15 4. Power circuit image accuracy, max score 15 5. Accuracy of work method, max score 10 6. Participative, min score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment		Presentations, tracing sources, discussions and assignments doing preparatory work (for class A synchronously) Tracing sources, discussions and assignments doing preparatory work (for class B asynchronously) 2X50	**Material:** Electromagnetic controller for 3 phase induction motor rotating alternately and rotating sequentially **Reference:** *Joko, et al. 2023. PPT-Introduction to electric motor control systems. LPPM Unesa, Surabaya*	4%

4	Students are able to work on an electromagnetic control project for a 3 phase induction motor with a DOL system and right/left rotation	1. Doing project 2. Testing project results 3. Reporting the results of project work 4. Liveliness	**Criteria:** 1. Accuracy in working on projects, max score 30 2. Accuracy of testing project results, max score 10 3. Report accuracy, max score 10 4. Activeness, minimum score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Assignment of project work, discussions and reporting 2 X 50		**Material:** DOL system electromagnetic controller and right/left rotation **Reference:** *Joko, et al. 2023. Student module for electromagnetic control of electric motors. Surabaya, LPPM Unesa*	5%
5	Students are able to work on the electromagnetic control project for a 3 phase star/delta induction motor manually	1. Doing project 2. Testing project results 3. Reporting the results of project work 4. Liveliness	**Criteria:** 1. Accuracy in working on projects, max score 30 2. Accuracy of testing project results, max score 10 3. Report accuracy, max score 10 4. Activeness, minimum score 50 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Assignment to work on a 2 X 50 project		**Material:** Manual electromagnetic controller of star/delta 3 phase induction motor **References:** *Joko, et al. 2023. Materials for planning and installing a 3-phase electric motor controller control panel. LPPM Unesa, Surabaya*	6%
6	Students are able to carry out, test and report the results of the work on an electromagnetic control project for a 3 phase star/delta induction motor automatically	1. Doing preparatory work 2. Doing project 3. Testing project results 4. Reporting the results of project work 5. Liveliness	**Criteria:** 1. Accuracy of preparatory work, max score 5 2. Accuracy in working on projects, max score 30 3. Accuracy of testing project results, max score 10 4. Report accuracy, max score 10 5. Activeness, minimum score 50 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Project assignment, discussion 2 X 50		**Material:** Automatic star/delta electromagnetic controller for 3 phase induction motor **. References:** **Material:** Automatic 3 phase electromagnetic star/delta induction motor controller **Reference:** *Joko, et al. 2023. PPT-Introduction to electric motor control systems. LPPM Unesa, Surabaya*	6%

No	Learning Outcomes	Indicators	Assessment Criteria	Learning Methods		Learning Materials	Weight
7	Students are able to carry out, test and report the results of project work on electromagnetic control of a 3-phase induction motor rotating sequentially and rotating alternately	1.Doing project 2.Testing project results 3.Reporting the results of project work 4.Liveliness	**Criteria:** 1.Accuracy of preparatory work, max score 5 2.Accuracy in working on projects, max score 30 3.Accuracy of testing project results, max score 10 4.Report accuracy, max score 10 5.Activeness, minimum score 50 **Form of Assessment**: Participatory Activities	Presentations, tracing sources, discussions and project assignments 2 X 50		**Material:** Electromagnetic controller for 3 phase induction motor rotating sequentially and rotating alternately **Reference:** *Joko, et al. 2023. Student module for electromagnetic control of electric motors. Surabaya, LPPM Unesa*	6%
8	Understanding Induction Motors	1.Appearance 2.PPT Quality 3.Answering ability 4. Argumentation ability 5.Punctuality 6.Collaboration ability 7.Participative	**Criteria:** 1.Accuracy of working drawings, max score 10 2.Accuracy of preparatory work, max score 5 3.Accuracy in carrying out the work of assembling the control system, max score 10 4.Accuracy of testing work results, max score 10 5.Functionality of the control system, score is 10. Timeliness, max score is 5 6.Cooperation ability, max score 5 7.Participative, min score 50 **Form of Assessment**: Participatory Activities, Tests	UTS Meeting Results 1-7 2X50			15%
9							0%
10							0%
11							0%
12							0%
13							0%
14							0%
15							0%
16							0%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	25.5%
2.	Project Results Assessment / Product Assessment	8%
3.	Portfolio Assessment	7.33%
4.	Practice / Performance	1.67%
5.	Test	7.5%

	50%

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** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities 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.