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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Electrical Machines II	2020102086		T=2	P=0	ECTS=3.18	6	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Lusia Rakhmawati, S.T., M.T.

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	This Electrical Machines 2 course discusses the understanding of simultaneous machines regarding dynamic energy conversion, construction, working principles, induction EMF, anchor/armature coils, voltage regulation, armature reactions, characteristics of simultaneous generators, losses and efficiency, working principles of synchronous motors. Apart from the above, this course also discusses understanding asynchronous machines regarding working principles, construction, circuit analysis, coupling, characteristics, losses and efficiency, harmonics, calculating rotor resistance, induction machines working as generators and single phase induction machines.
References	**Main :**

1. Kadir A. 1999. Mesin Sinkron . Jakarta: Penerbit Jambatan.
2. Achyanto D. 1990. Mesin-Mesin Listrik . Jakarta: Erlangga.
3. Mislan. 1991. Mesin Serempak . Surabaya: University Press IKIP Surabaya.
4. Mehta V.K. & Mehta R. 2006. Principles of Electrical Machines.
5. Wildi T. 2006. Electrical Machines, Drives, and Power Systems, Sixth Edition . New Jersey: Prentice Hall.
6. Zuhal. 2000. Dasar Teknik Tenaga Listrik dan Elektronika Daya . Jakarta: PT. Gramedia Pustaka Utama.

Supporters:	
Supporting lecturer	Dr. Subuh Isnur Haryudo, S.T., M.T. Mahendra Widyartono, S.T., M.T. Fendi Achmad, S.Pd., M.Pd.

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 basic principles of Alternating Current Machines	1. Explain the basic laws of electromagnetism. 2. Explain alternating current machines based on function and rotation. 3. Explain the factors that influence the generator's EMF. 4. Explain the shape of the flux wave and the distribution of the flux. 5. Explains coils with partial range, shortness factor, distribution coils. 6. Explain the effect of distribution coils on harmonics. 7. Exercises.	**Criteria:** Participation: carried out by observing student activities	Lectures, discussions, questions and answers and practice questions 2 X 50			0%
2	Explain the basic principles of Alternating Current Machines	1. Explain the basic laws of electromagnetism. 2. Explain alternating current machines based on function and rotation. 3. Explain the factors that influence the generator's EMF. 4. Explain the shape of the flux wave and the distribution of the flux. 5. Explains coils with partial range, shortness factor, distribution coils. 6. Explain the effect of distribution coils on harmonics. 7. Exercises.	**Criteria:** Participation: carried out by observing student activities	Lectures, discussions, questions and answers and practice questions 2 X 50			0%
3	Explain the basic principles of Alternating Current Machines	1. Explain the basic laws of electromagnetism. 2. Explain alternating current machines based on function and rotation. 3. Explain the factors that influence the generator's EMF. 4. Explain the shape of the flux wave and the distribution of the flux. 5. Explains coils with partial range, shortness factor, distribution coils. 6. Explain the effect of distribution coils on harmonics. 7. Exercises.	**Criteria:** Participation: carried out by observing student activities	Lectures, discussions, questions and answers and practice questions 2 X 50			0%

4	Explain anchor coil.	1. Explain single phase armature coil. 2. Explain three phase armature coil. 3. Explaining single layer winding. 4. Explaining double layer winding. 5. Explain the relationship between stars (Y) and triangles (Δ)	**Criteria:** Participation: carried out by observing student activities	Lectures, discussions, questions and answers. 2 X 50			0%
5	Understand, calculate and analyze voltage regulation in alternating current machines	1. Explain the voltage regulation of alternating current generators. 2. Explain effective resistance. 3. Explain the armature leak reaction. 4. Explain the armature/anchor reaction. 5. Explain diagram vector. 6. Exercises	**Criteria:** Participation: carried out by observing student activities	Lectures, discussions, questions and answers, and practice questions. 2 X 50			0%
6	Understand, calculate and analyze voltage regulation in alternating current machines	1. Explain the voltage regulation of alternating current generators. 2. Explain effective resistance. 3. Explain the armature leak reaction. 4. Explain the armature/anchor reaction. 5. Explain diagram vector. 6. Exercises	**Criteria:** Participation: carried out by observing student activities	Lectures, discussions, questions and answers, and practice questions. 2 X 50			0%
7	Understand the losses and efficiency of alternating current generators	1. Explain generator efficiency. 2. Explain the losses in AC generators. 3. Task efficiency and losses of AC generators.	**Criteria:** 1. Participation: carried out by observing student activities 2. Tasks: performed on each indicator	Lectures, discussions, questions and answers, and assignments. 2 X 50			0%

8	UTS	Able to do UTS	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	written test 2 X 50			0%
9	Understand the classification of AC motors. Understand the working principles and construction of induction motors	1. Students are able to: differentiate between types of AC motors 2. Explain the working principle of an induction motor 3. mention the parts/construction of an induction motor	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	lectures, discussions and questions and answers 2 X 50			0%

10	understand the construction of a winding rotor induction motor understand the mathematical model of an induction motor understand the relationship between torque and power factor in an induction motor understand the condition of maximum torque when stopping and when running understand the relationship between rotor EMF and reactance when running	1. Students are able to: identify the construction of a wound rotor induction motor 2. understand the mathematical model of an induction motor 3. explain the relationship between torque and power factor in induction motors 4. understand, explain and differentiate maximum torque conditions when stopping and running 5. explain the relationship between rotor EMF and reactance when running	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	lectures, discussions, questions and answers and practice questions 2 X 50			0%
11	understand the construction of a winding rotor induction motor understand the mathematical model of an induction motor understand the relationship between torque and power factor in an induction motor understand the condition of maximum torque when stopping and when running understand the relationship between rotor EMF and reactance when running	1. Students are able to: identify the construction of a wound rotor induction motor 2. understand the mathematical model of an induction motor 3. explain the relationship between torque and power factor in induction motors 4. understand, explain and differentiate maximum torque conditions when stopping and running 5. explain the relationship between rotor EMF and reactance when running	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	lectures, discussions, questions and answers and practice questions 2 X 50			0%

12	understand the relationship between torque and slip in induction motors understand the relationship between maximum torque and full load torque of induction motors understand the difference between starting torque and maximum torque of induction motors understand the torque/speed characteristics of induction motors under load understand the torque/speed curve of three phase motors	1. students are able to explain the relationship between torque and slip in induction motors 2. explains the relationship between maximum torque, full load torque and starting torque in induction motors 3. explains the torque/speed characteristics of an induction motor when under load 4. explain the torque/speed curve of a three-phase motor	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	lectures, discussions and questions and answers 2 X 50			0%
13	understand the relationship between torque and slip in induction motors understand the relationship between maximum torque and full load torque of induction motors understand the difference between starting torque and maximum torque of induction motors understand the torque/speed characteristics of induction motors under load understand the torque/speed curve of three phase motors	1. students are able to explain the relationship between torque and slip in induction motors 2. explains the relationship between maximum torque, full load torque and starting torque in induction motors 3. explains the torque/speed characteristics of an induction motor when under load 4. explain the torque/speed curve of a three-phase motor	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	lectures, discussions and questions and answers 2 X 50			0%

14	understand the types of single phase motors understand the working principles and types of single phase induction motors understand self starting induction motors understand the equivalent circuit of single phase induction motors	1. Students are able to differentiate and explain the various types of single-phase motors. 2. explain the working principles of various single phase induction motors 3. explains how a self starting induction motor works 4. explain the equivalent circuit of a single phase induction motor	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	lectures, discussions and questions and answers 2 X 50			0%
15	understand the working principle of a transformer identify the parts of a transformer understand shell type and shell type transformers understand the transformer EMF formula understand the transformer voltage ratio understand transformer efficiency	1. Students are able to explain the working principles of transformers 2. explain the parts of a transformer 3. explain shell type transformer 4. explain shell type transformer 5. understand the transformer EMF formula 6. understand the efficiency of the transformer	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities 3. (weight 2) 4. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5. 3. UAS: carried out every semester to measure all indicators (weight 3) 6. 4. Task: carried out on each indicator (weight 3) 7. Student Final Grade: 8. Participation Score (2)%2 Lever Score (3)%2 UTS Score (2)%2 UAS Score (3) divided by 10.	discussion lecture and question and answer 2 X 50			0%
16							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.