UNESA	**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 Energy Conversion	2020102065	Compulsory Study Program Subjects	T=2 P=0 ECTS=3.18	3	July 17, 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

Program Objectives (PO)

PO - 1	Able to apply knowledge of mathematics, natural sciences, information technology, and electrical engineering to gain a thorough understanding of engineering principles

PLO-PO Matrix

P.O
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: Knowledge of types of energy, law of conservation of energy, definitions & quantities as well as units of work, power, energy, magnetism. Students have knowledge, and present their results orally and in writing regarding magnetic force, ampere coils, reluctance and permeance, generation of electromotive force, induced current and the underlying laws. Have knowledge, ability to explore, calculation skills, and compose scientific papers and present the results orally and in writing regarding the conversion of mechanical energy to electricity, heat energy to electricity, solar energy to electrical energy, steam energy to electricity, wind energy to electricity, batteries , marine energy to electricity, nuclear energy to electrical energy, conversion of new and renewable energy to electrical energy

References

Main :

1. Abdul Kadir. 1995. Energi. Jakarta : UI Press.
2. B.M. Weedy. 1988. Electric Power System, Third Edition Revised. Singapore : John Wiley and Sons.
3. Culp, A.W., 1995: Prinsip-prinsip Konversi Energi, Erlangga, Jakarta
4. Joko, 2015. Buku Mesin Arus Searah. University Press, Surabaya
5. Mislan. 1991. Mesin Tak Serempak. Surabaya: University Press IKIP Surabaya
6. Pudjanarsa, Astu. dan Nursuhud, Djati. 2006. Mesin konversi energi. Yogyakarta. Penerbit Andi.
7. Sulaiman, Mabuchi Magarisawa. 1984. Mesin Tak Serempak Dalam Praktek. Jakarta: Pradya Paramita
8. Goswami, D.Y., & Kreith, 2007. Energy Conversion. Boca Raton, FL: CRC PressTaylor & Francis Group.
9. Sthepen J. Chapman,2005. Electric Machinery Fundamentals, 4th Ed., Mc. Graw Hill,
10. Culp, A.W.,1995. Prinsip-prinsip Konversi Energi, Erlangga, Jakarta
11. The basics of Electricity. Book4_c01 httpwww.recampus.comdocumentsbook4_c01.pdf

Supporters:

Supporting lecturer: Prof. Dr. Joko, M.Pd., M.T.
Unit Three Kartini, S.T., M.T., Ph.D.
Yuli Sutoto Nugroho, 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	Understand and explain the basic concepts of work, power and energy.	1. Explain the meaning of energy 2. Explain the types of energy and the law of conservation of energy 3. Explain the units of work, power and energy.	**Criteria:** Completeness of the paper on energy problems in Indonesia **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 X 50		**Material:** Meeting material 1 **Reader:** *Abdul Kadir. 1995. Energy. Jakarta : UI Press.*	5%

2	Understand and explain the basics of electromagnetic energy conversion	1. Explain the definition and magnetic quantities 2. Explain permeability and magnetic flux 3. Explain the force on a conductor in a magnetic field 4. Explain the field strength in conductors and solenoids	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers and practice questions. 2 X 50		**Material:** Meeting material 2 **References:** *Goswami, DY, & Kreith, 2007. Energy Conversion. Boca Raton, FL: CRC PressTaylor & Francis Group.*	5%
3	Understand and explain the basics of electromagnetic energy conversion	1. Explain the definition and magnetic quantities 2. Explain permeability and magnetic flux 3. Explain the force on a conductor in a magnetic field 4. Explain the field strength in conductors and solenoids	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers and practice questions. 2 X 50		**Material:** Meeting material 3 **References:** *Sthepen J. Chapman, 2005. Electric Machinery Fundamentals, 4th Ed., Mc. Graw Hill,*	0%
4	Able to understand the basic concepts of magnetic circuits	1. Explain the basic concepts of electrical circuits 2. Explain magnetic force and ampere coils 3. Explain permeance, reluctance and magnetization curves	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, practice questions. 2 X 50		**Material:** Meeting material 4 **References:** *Culp, AW, 1995. Principles of Energy Conversion, Erlangga, Jakarta*	0%
5	Able to understand the basic concepts of magnetic circuits	1. Explain the basic concepts of electrical circuits 2. Explain magnetic force and ampere coils 3. Explain permeance, reluctance and magnetization curves	**Criteria:** Full marks are obtained if you do all the questions correctly	Lectures, discussions, questions and answers, practice questions. 2 X 50		**Material:** Meeting material 5 **Reader:** *BM Weedy. 1988. Electric Power Systems, Third Edition Revised. Singapore : John Wiley and Sons.*	5%
6	Understand, analyze and calculate electromagnetic induction	1. Explain the relationship between magnetism and electricity 2. Explain the generation of electromotive force 3. Explain induced current.	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, exercises and assignments 2 X 50		**Material:** Meeting material 6 **Literature:** *The basics of Electricity. Book4_c01 httpwww.recampus.comdocumentsbook4_c01.pdf*	0%
7	Understand, analyze and calculate electromagnetic induction	1. Explain the relationship between magnetism and electricity 2. Explain the generation of electromotive force 3. Explain induced current.	**Criteria:** Full marks are obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, exercises and assignments 2 X 50		**Material:** Meeting material 1 **Reader:** *BM Weedy. 1988. Electric Power Systems, Third Edition Revised. Singapore : John Wiley and Sons.*	5%

8	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1. Score number 1 max 36 2. No. 2's score is a maximum of 25 3. Score number 3 is a maximum of 25 4. Score number 4 max 14	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting material 5 **Reader:** *Abdul Kadir. 1995. Energy. Jakarta : UI Press.*	10%
9	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1. Score number 1 max 36 2. No. 2's score is a maximum of 25 3. Score number 3 is a maximum of 25 4. Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%
10	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1. Score number 1 max 36 2. No. 2's score is a maximum of 25 3. Score number 3 is a maximum of 25 4. Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%

11	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1.Score number 1 max 36 2.No. 2's score is a maximum of 25 3.Score number 3 is a maximum of 25 4.Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%
12	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1.Score number 1 max 36 2.No. 2's score is a maximum of 25 3.Score number 3 is a maximum of 25 4.Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%
13	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1.Score number 1 max 36 2.No. 2's score is a maximum of 25 3.Score number 3 is a maximum of 25 4.Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%

14	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1.Score number 1 max 36 2.No. 2's score is a maximum of 25 3.Score number 3 is a maximum of 25 4.Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%
15	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1.Score number 1 max 36 2.No. 2's score is a maximum of 25 3.Score number 3 is a maximum of 25 4.Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%
16	Analyzing the relationship between magnetism and electricity, analyzing and calculating the generation of electromotive force, induced current and Faraday's law and Lenz's law	Grouping types of tools for converting electrical energy into mechanical energy Grouping types of tools for converting mechanical energy into electrical energy Demonstrating the working principles of tools for converting electrical energy into mechanical Demonstrating the working principles of tools for converting mechanical energy into electricity Calculating quantities in the conversion of electrical energy into mechanical energy Calculating quantities in the conversion of electrical energy into mechanical energy	**Criteria:** 1.Score number 1 max 36 2.No. 2's score is a maximum of 25 3.Score number 3 is a maximum of 25 4.Score number 4 max 14 **Form of Assessment** : Participatory Activities	Scientific approach Problem-based learning model Method of discussion, practice, assignment and reflection 2 X 50		**Material:** Meeting 9 materials **Reference:** *Joko, 2015. Direct Current Machine Book. University Press, Surabaya*	5%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	55%
		55%

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.