	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
Electric Circuit I	2020102164	Compulsory Study Program Subjects	T=2	P=0	ECTS=3.18	3	April 10, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Project Based Learning**	
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-5	Able to apply knowledge of mathematics, natural sciences, information technology, and engineering to gain a thorough understanding of the principles of electrical engineering
	PLO-8	Able to apply engineering principles, identify, formulate and analyze data/information to solve problems in the electrical field
	Program Objectives (PO)	
	PO - 1	Able to apply basic knowledge of voltage, current, resistors, capacitors and inductors to gain a comprehensive understanding of direct current electrical circuits and their applications.
	PO - 2	Able to design and analyze direct current electrical circuit data using Ohm's law and Kirchoff's law to strengthen engineering assessments.
	PO - 3	Able to apply circuit analysis methods, identify appropriate methods, formulate circuit simplifications, and analyze data/information in solving problems regarding direct current electrical circuits.
	PO - 4	Able to plan, complete and evaluate tasks related to direct current electrical circuits.
	PO - 5	Able to understand the need for lifelong learning in the field of electrical engineering related to relevant current issues
	PLO-PO Matrix	

P.O	PLO-5	PLO-8
PO-1		
PO-2		
PO-3		
PO-4		
PO-5		

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																

Short Course Description	Students can discuss basic concepts, the benefits of studying electrical circuits and the stages of solving general problems related to electrical circuits, identify the types of components in an electrical circuit and their functions, differentiate between the node analysis method and the mesh analysis method, analyze the basic properties elements of electrical circuits such as resistance, capacitance, and inductance, explaining the superposition circuit theorem, source transformation, Thevenin's theorem, and Norton's theorem, determining power and energy in electrical circuits, using basic theorems such as Ohm's law, Kirchhoff's law, and Thevenin's theorem to solve problems in electrical circuits using the case method in lectures.
References	**Main :** 1. Edminister. 1972. Electrical Circuits. Schaum Serie, Outline. New York: Mc.Graw-Hill Book Company. 2. Munoto. 2008. Analisis Rangkaian Listrik AC . Surabaya: Unesa University PressMunoto. 2014. Ringkasan Teori dan pemecahan soal-soal Rangkaian Listrik AC 1 . Surabaya: Unesa 3. Boylestad. 2007. Introductory circuit analysis-11th ed. Pearson Prentice Hall **Supporters:** 1. Boylestad, Robert L., 2007. Introductory Circuit Analysis -11th ed . New Jersey; Pearson Prentice Hall. 2. Floyd, 2007. Electric Circuits Fundamentals 13 7th ed. New Jersey; Pearson Prentice Hall.
Supporting lecturer	Prof. Dr. H. Munoto, M.Pd. Dr. Tri Rijanto, M.Pd., M.T. Dr. Edy Sulistiyo, M.Pd. Dr. Nur Kholis, S.T., M.T. Yulia Fransisca, 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	Describe, give examples and apply atomic theory, basic knowledge concepts and circuit parameters	1. Explain about atomic theory, 2. Explain the meaning of electron flow 3. Explain the meaning of electric current 4. Explain the meaning of electric potential 5. Explain the meaning of voltage/voltage difference 6. Explain the meaning of electrical units 7. Explain the meaning of electric charge 8. Explain the meaning of capacitance 9. Calculating conductor resistance 10. Calculate changes in resistance due to changes in temperature	**Criteria:** The correct answer gets a score of 100 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, providing examples of application and assignments in the 4 X 50 theory class		**Material:** Meeting material 1 **Reader:** *Edminister. 1972. Electrical Circuits. Schaum Serie, Outline. New York: Mc. Graw-Hill Book Company.*	5%

2	Describe, give examples and apply atomic theory, basic knowledge concepts and circuit parameters	1. Explain about atomic theory, 2. Explain the meaning of electron flow 3. Explain the meaning of electric current 4. Explain the meaning of electric potential 5. Explain the meaning of voltage/voltage difference 6. Explain the meaning of electrical units 7. Explain the meaning of electric charge 8. Explain the meaning of capacitance 9. Calculating conductor resistance 10. Calculate changes in resistance due to changes in temperature	**Criteria:** The correct answer gets a score of 100 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, providing examples of application and assignments in the 4 X 50 theory class		**Material:** Meeting material 2 **Reader:** *Munoto. 2008. AC Electrical Circuit Analysis. Surabaya: Unesa University Press* *Munoto. 2014. Summary of Theory and solutions to AC Electrical Circuit questions 1. Surabaya: Unesa*	5%
3	Understand and apply the basic laws of electricity and basic theory of electrical circuits	1. Explain direct current (DC) generation 2. Explain the types of direct current 3. Explain Faraday's law 4. Explain Kirchhoff's law 19s 5. Explain Ohm's law 6. Explain Lenz's law 7. Calculate the branch voltage across some resistance 8. Calculate the equivalent resistance in a series circuit. 9. Calculating equivalent resistance in parallel circuits. 10. Calculating the branch current in a two-branch parallel circuit. 11. Calculating equivalent resistance in series-parallel (mixed) circuits 12. Calculate the magnitude of the conductance G 13. Skilled in carrying out practical work in the laboratory to validate series, parallel and mixed connections.	**Criteria:** test score: number of correct answers x 100, divided by the number of test items **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, giving examples of R circuit problems and assignments in theory class, Practical validation of 4 X 50 series, parallel and mixed R circuits		**Material:** Meeting material 3 **Reader:** *Boylestad. 2007. Introductory circuit analysis-11th ed. Pearson Prentice Hall*	5%

4	Understand and apply the basic laws of electricity and basic theory of electrical circuits	1. Explain direct current (DC) generation 2. Explain the types of direct current 3. Explain Faraday's law 4. Explain Kirchhoff's law 19s 5. Explain Ohm's law 6. Explain Lenz's law 7. Calculate the branch voltage across some resistance 8. Calculate the equivalent resistance in a series circuit. 9. Calculating equivalent resistance in parallel circuits. 10. Calculating the branch current in a two-branch parallel circuit. 11. Calculating equivalent resistance in series-parallel (mixed) circuits 12. Calculate the magnitude of the conductance G 13. Skilled in carrying out practical work in the laboratory to validate series, parallel and mixed connections.	**Criteria:** test score: number of correct answers x 100, divided by the number of test items **Form of Assessment** : Participatory Activities	Discussion, giving examples of R circuit problems and assignments in theory class, Practical validation of 4 X 50 series, parallel and mixed R circuits		**Material:** Meeting material 4 **Reader:** *Boylestad. 2007. Introductory circuit analysis-11th ed. Pearson Prentice Hall*	5%
5	Can analyze and evaluate the concept of direct current electric power, and practice in the laboratory	1. Calculate the amount of DC2 electrical power. calculate DC3 electrical work. calculate DC4 electric heat. Skilled in carrying out practical work in the laboratory to validate electrical power.	**Criteria:** The test score is obtained by: number of correct answers x 100 then divided by the number of test items **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, providing examples of electrical power problems and assignments in theory class. Practical validation of the R 2 X 50 circuit		**Material:** Meeting material 5 **References:** *Floyd, 2007. Electric Circuits Fundamentals 13 7th ed. New Jersey; Pearson Prentice Hall.*	10%

6	1. Able to use the mesh current method to solve problems in complex direct current circuits 2. Skilled in validating the theory of the mesh current method in the laboratory	1. Calculating the number of mesh currents, 2. Determines the direction of the mesh current, 3. Write down the mesh current equation 4. Calculate the magnitude of each mesh current using elimination 5. Calculate the magnitude of each mesh current using a matrix. 6. Calculate the amount of current, voltage, or resistance in the mesh using driving point resistance 7. Calculate the amount of current, voltage, or resistance in the mesh using transfer resistance 8. Skilled in validating the mesh flow method through practical work in the laboratory	**Criteria:** The score obtained by students is the number of correct answers x 100 divided by the number of test items **Form of Assessment** : Participatory Activities	Discussion, providing examples of solving complex electrical circuits using the mesh current method and assignments in theory classes. Practical validation of the 4 X 50 mesh flow method		**Material:** Meeting material 6 **Library:** *Edminister. 1972. Electrical Circuits. Schaum Serie, Outline. New York: Mc. Graw-Hill Book Company.*	10%

7	1. Able to use the mesh current method to solve problems in complex direct current circuits 2. Skilled in validating the theory of the mesh current method in the laboratory	1. Calculating the number of mesh currents, 2. Determines the direction of the mesh current, 3. Write down the mesh current equation 4. Calculate the magnitude of each mesh current using elimination 5. Calculate the magnitude of each mesh current using a matrix. 6. Calculate the amount of current, voltage, or resistance in the mesh using driving point resistance 7. Calculate the amount of current, voltage, or resistance in the mesh using transfer resistance 8. Skilled in validating the mesh flow method through practical work in the laboratory	**Criteria:** The score obtained by students is the number of correct answers x 100 divided by the number of test items **Form of Assessment** : Project Results Assessment / Product Assessment	Discussion, providing examples of solving complex electrical circuits using the mesh current method and assignments in theory classes. Practical validation of the 4 X 50 mesh flow method		**Material:** Meeting materials 7 **References:** *Boylestad, Robert L., 2007. Introductory Circuit Analysis -11th ed. New Jersey; Pearson Prentice Hall.*	5%
8	Explore meetings 3 to 7 regarding basic electrical circuits, electric power, and mesh current methods	1. Correctly solve basic electrical circuit problems 2. Correctly solve DC electrical power problems 3. Correctly solve DC electrical circuit problems using the mesh current method. 4. Skilled in carrying out practical work to validate theory	**Criteria:** There isn't any **Form of Assessment** : Participatory Activities	Practice solving basic electrical circuit problems, electrical power, and 2 X 50 mesh current		**Material:** Meeting material 8 **Library:** *Edminister. 1972. Electrical Circuits. Schaum Serie, Outline. New York: Mc. Graw-Hill Book Company.*	20%
9	MID SEMESTER EXAMINATION See meetings 1 to 8	See meetings 1 to 8	**Criteria:** The score is obtained by: the number of items answered is multiplied by 100 then divided by the number of test items. **Form of Assessment** : Project Results Assessment / Product Assessment	2 X 50 exam		**Material:** Meeting material 9 **Reader:** *Munoto. 2008. AC Electrical Circuit Analysis. Surabaya: Unesa University Press Munoto. 2014. Summary of Theory and solutions to AC Electrical Circuit questions 1. Surabaya: Unesa*	5%

10	Able to use the node voltage method to solve problems in complex direct current circuits	1. Counting the number of vertices, 2. Write down the equation of the vertex 3. Calculate the magnitude of the voltage at each node using the node equation by elimination. 4. Calculate the magnitude of the voltage at each node using the node equation in matrix form. 5. Calculate the magnitude of current, voltage, conductance or resistance at node points using driving point conductance 6. Calculate the amount of current, conductance, or resistance at a node using the node equation in the form of transfer resistance 7. Skilled in validating the node stress method through practical work in the laboratory	**Criteria:** The test score is obtained by: the number of test items answered correctly x 100 then divided by the number of test items **Form of Assessment** : Participatory Activities	Discussion, providing examples of solving complex electrical circuits using the nodal voltage method and assignments in theory class. Practical validation of the 4 X 50 nodal voltage method		**Material:** Meeting material 10 **Reader:** *Munoto. 2008. AC Electrical Circuit Analysis. Surabaya: Unesa University Press* *Munoto. 2014. Summary of Theory and solutions to AC Electrical Circuit questions 1. Surabaya: Unesa*	5%

11	Able to use the node voltage method to solve problems in complex direct current circuits	1. Counting the number of vertices, 2. Write down the equation of the vertex 3. Calculate the magnitude of the voltage at each node using the node equation by elimination. 4. Calculate the magnitude of the voltage at each node using the node equation in matrix form. 5. Calculate the magnitude of current, voltage, conductance or resistance at node points using driving point conductance 6. Calculate the amount of current, conductance, or resistance at a node using the node equation in the form of transfer resistance 7. Skilled in validating the node stress method through practical work in the laboratory	**Criteria:** The test score is obtained by: the number of test items answered correctly x 100 then divided by the number of test items **Form of Assessment** : Participatory Activities	Discussion, providing examples of solving complex electrical circuits using the nodal voltage method and assignments in theory class. Practical validation of the 2 X 50 nodal voltage method		**Material:** 11th meeting materials **References:** *Boylestad, Robert L., 2007. Introductory Circuit Analysis -11th ed. New Jersey; Pearson Prentice Hall.*	5%

12	Able to use impedance network analysis solving methods to solve problems in direct current electrical circuits	1. Calculating the equivalent resistance for the Thevenins and Norton circuits, 2. Calculate the open circuit voltage (Voc) for the Thevenins circuit. 3. Calculate the short circuit current (Isc) for the Norton circuit, 4. Establish the Thevenins and Nortons equivalent circuits 5. Understand the triangle-star transformation equation 6. Determine the magnitude of the impedance of the star from the triangular connection 7. Determine the magnitude of the triangle impedance of the star connection. 8. Calculating the amount of electricity from a source that works alone 9. Calculating the amount of electricity caused by several sources working simultaneously 10. Proving the reciprocity theory 11. Proving the compensation theory 12. Calculating series-parallel equivalent circuits 13. Determine matching requirements 14. Calculate the maximum power transfer 15. Skilled in validating resistance network theory through practical work in the laboratory	**Criteria:** The test score is obtained by: the number of test items answered correctly x 100 then divided by the total number of test items **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, providing examples of solving complex electrical circuits using the R network analysis method, and assignments in theory classes. Practical validation of several R 2 X 50 network analyzes		**Material:** Meeting material 12 **Reader:** *Boylestad. 2007. Introductory circuit analysis-11th ed. Pearson Prentice Hall*	5%

13	Able to use impedance network analysis solving methods to solve problems in direct current electrical circuits	1. Calculating the equivalent resistance for the Thevenins and Norton circuits, 2. Calculate the open circuit voltage (Voc) for the Thevenins circuit. 3. Calculate the short circuit current (Isc) for the Norton circuit, 4. Establish the Thevenins and Nortons equivalent circuits 5. Understand the triangle-star transformation equation 6. Determine the magnitude of the impedance of the star from the triangular connection 7. Determine the magnitude of the triangle impedance of the star connection. 8. Calculating the amount of electricity from a source that works alone 9. Calculating the amount of electricity caused by several sources working simultaneously 10. Proving the reciprocity theory 11. Proving the compensation theory 12. Calculating series-parallel equivalent circuits 13. Determine matching requirements 14. Calculate the maximum power transfer 15. Skilled in validating resistance network theory through practical work in the laboratory	**Criteria:** The test score is obtained by: the number of test items answered correctly x 100 then divided by the total number of test items **Form of Assessment** : Participatory Activities	Discussion, providing examples of solving complex electrical circuits using the R network analysis method, and assignments in theory classes. Practical validation of several R 2 X 50 network analyzes		**Material:** Meeting material 12 **Reader:** *Boylestad. 2007. Introductory circuit analysis-11th ed. Pearson Prentice Hall*	5%

14	Able to use impedance network analysis solving methods to solve problems in direct current electrical circuits	1. Calculating the equivalent resistance for the Thevenins and Norton circuits, 2. Calculate the open circuit voltage (Voc) for the Thevenins circuit. 3. Calculate the short circuit current (Isc) for the Norton circuit, 4. Establish the Thevenins and Nortons equivalent circuits 5. Understand the triangle-star transformation equation 6. Determine the magnitude of the impedance of the star from the triangular connection 7. Determine the magnitude of the triangle impedance of the star connection. 8. Calculating the amount of electricity from a source that works alone 9. Calculating the amount of electricity caused by several sources working simultaneously 10. Proving the reciprocity theory 11. Proving the compensation theory 12. Calculating series-parallel equivalent circuits 13. Determine matching requirements 14. Calculate the maximum power transfer 15. Skilled in validating resistance network theory through practical work in the laboratory	**Criteria:** The test score is obtained by: the number of test items answered correctly x 100 then divided by the total number of test items **Form of Assessment** : Participatory Activities	Discussion, providing examples of solving complex electrical circuits using the R network analysis method, and assignments in theory classes. Practical validation of several R 2 X 50 network analyzes		**Material:** Meeting material 14 **Reader:** *Munoto. 2008. AC Electrical Circuit Analysis. Surabaya: Unesa University Press* *Munoto. 2014. Summary of Theory and solutions to AC Electrical Circuit questions 1. Surabaya: Unesa*	5%

15	Explore meetings 10 to 14 regarding the node voltage method and R resistance network	1. Correctly solve circuit problems using the node voltage method 2. Correctly solving DC electrical circuit problems through R resistance network analysis 3. Skilled in carrying out practicums to validate theories	**Criteria:** calculate the rational amount of activity **Form of Assessment** : Project Results Assessment / Product Assessment	Training in solving mesh flow method problems and R 2 X 50 network analysis		**Material:** 15th meeting materials **Reference:** *Floyd, 2007. Electric Circuits Fundamentals 13 7th ed. New Jersey; Pearson Prentice Hall.*	5%
16	FINAL EXAMS	See meetings 1 through 15	**Criteria:** See meetings 1 through 15	2 X 50 test exam		**Material:** Meeting materials 1-15 **References:** *Floyd, 2007. Electric Circuits Fundamentals 13 7th ed. New Jersey; Pearson Prentice Hall.*	30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	62.5%
2.	Project Results Assessment / Product Assessment	37.5%
		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.