	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
Analog Electronic Circuits	2020103158	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	3	April 24, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Miftahur Rohman, S.T., M.T.	Prof. Dr. Bambang Suprianto, M.T.	Dr. Lusia Rakhmawati, S.T., M.T.

Learning model	**Project Based Learning**

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

Program Objectives (PO)

PO - 1	Able to apply basic knowledge of transistors and Op-Amps to gain a thorough understanding of analog electronics and its applications.

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	Students are able to explain, understand and practice the principles of electronics, able to understand how current sources, voltage sources, diodes work, including diodes as rectifiers, choke filters, clippers, clampers and voltage multipliers. Transistors include voltage amplifiers and power amplifiers

References

Main :

1. Bogart,.Beasley &Rico.(1997). Electronic Devices and Circuits . 5th ed. New Jersey: Prentice Hall International Inc. Coughlin.R.F & Driscoll.F.F.(1985). Penguat Operasional dan Rangkaian Terpadu Linier . Edisi kedua (alih bahasa : Herman Widodo Sumitro). Jakarta : Penerbit Erlangga. Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co.Japan Sutrisno.(1986). Elektronika : Teori dan Penerapannya .jilid 1.Bandung ITB Sutrisno.(1986). Elektronika : Teori dan Penerapannya .jilid 2.Bandung ITB

Supporters:

1. J. Millmann. 2008. Microelectronics. McGraw Hill.
2. Floyd Thomas L. 2001. Electronics Fundamentals, Fifth Edition. New Jersey: Prentice-Hall International, Inc.

Supporting lecturer	Dr. Nur Kholis, 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 can discuss the basic concepts and principles of electronic components needed in the process of analysis, simulation, design and application description of analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	5%

2	Students can discuss the basic concepts and principles of electronic components needed in the process of analysis, simulation, design and application description of analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	5%

3	Students can discuss the basic concepts and principles of electronic components needed in the process of analysis, simulation, design and application description of analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	5%

4	Students can discuss the basic concepts and principles of electronic components needed in the process of analysis, simulation, design and application description of analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	5%

5	Students can discuss the basic concepts and principles of electronic components needed in the process of analysis, simulation, design and application description of analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	5%

6	Students can discuss the basic concepts and principles of electronic components needed in the process of analysis, simulation, design and application description of analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	5%

7	Students can discuss the basic concepts and principles of electronic components needed in the process of analysis, simulation, design and application description of analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	5%

8	Students can complete UTS	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

9	identify the characteristics of diodes, bipolar junction transistors, field effect transistors, and op-amps	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

10	identify the characteristics of diodes, bipolar junction transistors, field effect transistors, and op-amps	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc. Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers. Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

11	distinguish DC bias, AC analysis, and frequency effects of each transistor	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

12	distinguish DC bias, AC analysis, and frequency effects of each transistor	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

13	explain how transistors and op-amps work	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

14	summarize the advantages and disadvantages of transistors and opamps	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Contextual Instruction 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

15	explore various formulas from opamp theory, categorize circuit applications that use transistors and opamps to solve problems in analog electronic circuits	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	case method 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

16	Carry out UAS Meetings 1 to 15	Evaluation Rubric	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	case method 3 x 50		**Material:** Meeting material 1 **References:** *Bogart, Beasley & Rico (1997). Electronic Devices and Circuits. 5th ed. New Jersey: Prentice Hall International Inc.* *Coughlin RF & Driscoll FF (1985). Operational Amplifiers and Linear Integrated Circuits. Second edition (translation: Herman Widodo Sumitro). Jakarta: Erlangga Publishers.* *Millman & Halkias (1983). Integrated Electronics: Analog and Digital Circuits and Systems. 26th printing. Tokyo: McGraw-Hill Book Co. Japan* *Sutrisno. (1986). Electronics: Theory and Application. Volume 1. Bandung ITB* *Sutrisno. (1986). Electronics: Theory and Application. Volume 2. Bandung ITB*	10%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	125%
		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** 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.