	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 Electronics	2020102400	Compulsory Study Program Subjects	T=2	P=0	ECTS=3.18	4	February 23, 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

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	Students are able to explain the concept of semiconductor materials using their own sentences. (AK2)
PO - 2	Students are able to interpret information about the characteristics of electronic components which include diodes, transistors, FETs and MOSFETs. (AK2)
PO - 3	Students are able to use the basic concepts of op-amps and op-amp characteristics in the applications of inverting and non-inverting amplifiers, differential amplifiers, integral amplifiers, instrumentation amplifiers and positive feedback amplifiers. (AK3)
PO - 4	Students are able to use the concept of filters in applications which include LPF, HPF, BSF and BPF. (AK3)
PO - 5	Students are able to explain the concept of Oscillators using their own sentences. (AK2)
PO - 6	Students are able to explore the development of other semiconductor components in electronics. (AK4)

PLO-PO Matrix

P.O	PLO-5	PLO-8
PO-1		
PO-2		
PO-3		
PO-4		
PO-5		
PO-6		

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																
PO-6																

Short Course Description	This course discusses semiconductor materials; characteristics of electronic components including diodes, transistors, FETs and MOSFETs; Op-amps which include the basics of op-amps, characteristics of op-amps, inverting and non-inverting amplifiers, differential amplifiers, integral amplifiers, instrumentation amplifiers and positive feedback amplifiers; Filters including LPF, HPF, BSF and BPF; Oscillators and development of other semiconductor components using the case study method.

References	**Main :**	
	1. Floyd, Thomas L. 2005. Electronic Devices. New Yersey: Prentice Hall	
	Supporters:	
	1. Paynter, Robert dan Boydell, Toby. 2006. Introductory Electronics Devices and Circuits. Singapore: Pearson Education Asia 2. Floyd, Tom dan Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall 3. Grob, Bernard dan Mitchel, Schultz. 2003. Basic Electronics. Singapore: McGraw-Hill Education 4. Schuler, Charles A. 2003. Electronics Principles and Applications New York: McGraw-Hill 5. Anderson, Betty Lise dan Anderson, Richard L. 2005. Fundamentals of Semiconductor Devices. Singapore: McGraw-Hill	
Supporting lecturer	Dr. Edy Sulistiyo, M.Pd. L. Endah Cahya Ningrum, 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	Students are able to explain the concept of semiconductor materials using their own sentences	Students are able to explain the concept of semiconductor materials using their own sentences through a structured description test	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through lectures, questions and answers and 100 minute assignments		**Material:** Semiconductors **Bibliography:** *Anderson, Betty Lise and Anderson, Richard L. 2005. Fundamentals of Semiconductor Devices. Singapore: McGraw-Hill*	5%
2	Students are able to interpret information about the characteristics of diode components	Students are able to interpret information about the characteristics of diode components through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through discussion activities to increase activeness, determine the depth of students' knowledge and analytical skills, 100 minutes		**Material:** Diodes **Reference:** *Floyd, Thomas L. 2005. Electronic Devices. New Yersey: Prentice Hall*	5%

3	Students are able to interpret information about the characteristics of transistor components	Students are able to interpret information about the characteristics of transistor components through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through discussion activities to increase activeness, determine the depth of students' knowledge and analytical skills, 100 minutes		**Material:** Transistors **References:** *Floyd, Thomas L. 2005. Electronic Devices. New Yersey: Prentice Hall*	3%
4	Students are able to interpret information about the characteristics of FET components	Students are able to interpret information about the characteristics of FET components through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through discussion activities to increase activeness, determine the depth of students' knowledge and analytical skills, 100 minutes		**Material:** FET **Reference:** *Floyd, Thomas L. 2005. Electronic Devices. New Yersey: Prentice Hall*	2%

5	Students are able to interpret information about the characteristics of MOSFET components	Students are able to interpret information about the characteristics of MOSFET components through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through discussion activities to increase activeness, determine the depth of students' knowledge and analytical skills, 100 minutes		**Material:** MOSFET **Reference:** *Floyd, Thomas L. 2005. Electronic Devices. New Yersey: Prentice Hall*	2%
6	Students are able to interpret information about the basic concepts of op-amps and op-amp characteristics	Students are able to interpret information about the basics of op-amps and op-amp characteristics through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through discussion activities to increase activeness, determine the depth of students' knowledge and analytical skills, 100 minutes		**Material:** Op-amp **Literature:** *Floyd, Tom and Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall*	5%

7	Students are able to use the basic concepts of op-amps and op-amp characteristics in inverting and non-inverting amplifier applications	Students are able to use the basic concepts of op-amps and op-amp characteristics in inverting and non-inverting amplifier applications through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through group activities to train the ability to coordinate the division of tasks, increase student initiative and cohesiveness 100 minutes		**Material:** Inverting and non-inverting amplifiers **References:** *Floyd, Tom and Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall*	5%
8	UTS	Students are able to interpret information about semiconductors, diodes, transistors, FETs, MOSFETs and Op-amps with their applications through free explanation tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	By giving questions about semiconductors, diodes, transistors, FETs, MOSFETs and Op-amps with their applications 100 minutes		**Material:** Semiconductors **Bibliography:** *Anderson, Betty Lise and Anderson, Richard L. 2005. Fundamentals of Semiconductor Devices. Singapore: McGraw-Hill* **Material:** Diodes, transistors, FETs, MOSFETs **Reference:** *Floyd, Thomas L. 2005. Electronic Devices. New Yersey: Prentice Hall* **Material:** Op-amp **Literature:** *Floyd, Tom and Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall*	20%

9	Students are able to use the basic concepts of op-amps and op-amp characteristics in differential amplifier and integral amplifier applications	Students are able to use the basic concepts of op-amps and op-amp characteristics in differential amplifier and integral amplifier applications through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through group activities to train the ability to coordinate the division of tasks, increase student initiative and cohesiveness 100 minutes		**Material:** Differential amplifier and integral amplifier **Reference:** *Floyd, Tom and Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall*	3%
10	Students are able to use the basic concepts of op-amps and op-amp characteristics in instrumentation amplifier and positive feedback amplifier applications	Students are able to use the basic concepts of op-amps and op-amp characteristics in instrumentation amplifier and positive feedback amplifier applications through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through group activities to train the ability to coordinate the division of tasks, increase student initiative and cohesiveness 100 minutes		**Material:** Instrumentation amplifiers and positive feedback amplifiers **References:** *Floyd, Tom and Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall*	2%

11	Students are able to interpret information about the filter concept	Students are able to interpret information about filters through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through group activities to train the ability to coordinate the division of tasks, increase student initiative and cohesiveness 100 minutes		**Material:** Filter **Bibliography:** *Schuler, Charles A. 2003. Electronics Principles and Applications New York: McGraw-Hill*	5%
12	Students are able to use the filter concept in LPF and HPF applications	Students are able to use the filter concept in LPF and HPF applications through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through group activities to train the ability to coordinate the division of tasks, increase student initiative and cohesiveness 100 minutes		**Material:** LPF and HPF **Reference:** *Schuler, Charles A. 2003. Electronics Principles and Applications New York: McGraw-Hill*	3%

13	Students are able to use the filter concept in the BSF and BPF applications	Students are able to use the filter concept in the BSF and BPF applications through structured description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through group activities to train the ability to coordinate the division of tasks, increase student initiative and cohesiveness 100 minutes		**Material:** BSF and BPF **Reference:** *Schuler, Charles A. 2003. Electronics Principles and Applications New York: McGraw-Hill*	2%
14	Students are able to explain the concept of oscillators using their own sentences	Students are able to explain the concept of oscillators using their own sentences through a structured description test	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through lectures, questions and answers and 100 minute assignments		**Material:** Oscillators **References:** *Schuler, Charles A. 2003. Electronics Principles and Applications New York: McGraw-Hill*	5%

15	Students are able to explore the development of other semiconductor components in electronics	Students are able to explain the development of other semiconductor components in electronics	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	Through exploration activities so that students can study independently for 100 minutes		**Material:** Semiconductor components **References:** *Floyd, Tom and Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall*	3%
16	UAS	Students are able to interpret information about op-amps in the applications of differential amplifiers, integral amplifiers, instrumentation amplifiers and positive feedback amplifiers; filters on applications including LPF, HPF, BSF and BPF; oscillator; and developments in other semiconductor components in electronics through free description tests	**Criteria:** 1. Explain accurately and clearly 2. Explain accurately and clearly; Presented comprehensively 3. Explain accurately and clearly; Delivered comprehensively; Based on analysis 4. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias 5. Explain accurately and clearly; Delivered comprehensively; Based on analysis; Explained without bias; Information is conveyed with the support of facts **Form of Assessment** : Participatory Activities, Tests	By providing questions about op-amps in the application of differential amplifiers, integral amplifiers, instrumentation amplifiers and positive feedback amplifiers; filters on applications including LPF, HPF, BSF and BPF; oscillator; and developments in other semiconductor components in electronics 100 minutes		**Material:** Op-amp **Literature:** *Floyd, Tom and Buchla, Dave. 2002. Fundamentals of Analog Circuits. New Yersey: Prentice Hall* **Material:** Filters and Oscillators **Bibliography:** *Schuler, Charles A. 2003. Electronics Principles and Applications New York: McGraw-Hill*	30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Test	50%
		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.