	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
Medical Electronics	2020102339	Compulsory Study Program Subjects	T=0	P=0	ECTS=0	5	April 24, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**
	Program Objectives (PO)
	PO - 1: Able to apply knowledge of mathematics and medical electronics 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	Understand electronic circuits used in medical devices such as ECG, EEG, EMG. understand and condition signals in medical equipment which will later be processed into data. designing simple medical equipment systems such as EMG or ECG.
References	**Main :**
	1. Prutchi, D dan M. Norris. 2005. Design and Development of Medical Electronic Instrumentation. Canada: John Wiley & Sons. 2. Tompkins, W. J. 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.
	Supporters:
	1. Northrop, R. B. 2004. Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation. Florida: CRC Press.
Supporting lecturer	Dr. Lilik Anifah, S.T., M.T. Arif Widodo, S.T., M.Sc. Parama Diptya Widayaka, S.ST., 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	Can explain the concept of medical electronics and also explain the sensors used in medical electronics	Explains the concept of medical electronics and also explains the sensors used in medical electronics	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion Scientific Approach: - Observing Listening to the lecturer's explanation about medical electronics and sensors used - Asking questions Discussing solutions to problems - Exploring Making observation reports on medical electronics and sensors used - Associating Analyzing observation results - Communicating Discussing results observation. 3 X 50		**Material:** Meeting material 1 **References:** *Prutchi, D and M. Norris. 2005. Design and Development of Medical Electronic Instrumentation. Canada: John Wiley & Sons.*	5%
2	Can explain the basic structure of sensors used in electromedicine. Can explain the sensing components of sensors used in devices.	Explain the basic structure of sensors used in electromedicine. Explain the sensing components of sensors used in devices.	**Criteria:** Evaluation Rubric	Model: Cooperative learning Method: Discussion Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic structure of sensors and sensing components - Asking questions Discussing solutions to problems - Exploring Making observation reports regarding the basic structure of sensors and sensing components - Associating Analyzing observation results - Communicating Discussing observation results. 3 X 50		**Material:** Meeting material 2 **References:** *Prutchi, D and M. Norris. 2005. Design and Development of Medical Electronic Instrumentation. Canada: John Wiley & Sons.*	5%

3	Can explain the basic structure of sensors used in electromedicine. Can explain the sensing components of sensors used in devices.	Explain the basic structure of sensors used in electromedicine. Explain the sensing components of sensors used in devices.	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic structure of sensors and sensing components - Asking questions Discussing solutions to problems - Exploring Making observation reports regarding the basic structure of sensors and sensing components - Associating Analyzing observation results - Communicating Discussing observation results. 3 X 50		**Material:** Meeting material 3 **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%
4	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting material 4 **References:** *Prutchi, D and M. Norris. 2005. Design and Development of Medical Electronic Instrumentation. Canada: John Wiley & Sons.*	5%

5	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Criteria:** Evaluation Rubric	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 5 materials **References:** *Northrop, RB 2004. Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation. Florida: CRC Press.*	5%
6	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%

7	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer‘s explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%
8	Complete the Midterm Exam	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer‘s explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%

9	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer‘s explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%
10	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer‘s explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%

11	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer‘s explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%
12	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer‘s explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%

13	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%
14	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%

15	Can explain how electrocardiography works and can design simple electronic circuits for ECG	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	5%
16	Solving UAS questions	Explain how electrocardiography works and design a simple electronic circuit for ECG	**Form of Assessment** : Participatory Activities	Model: Cooperative learning Method: Discussion and simulation Scientific Approach: - Observing Listening to the lecturer's explanation regarding the basic circuit of the ECG - Asking questions Discussing the solution to the problem - Exploring Making an observation report regarding the basic circuit of the ECG - Associating Simulating and analyzing the results of the observation - Communicating Discussing observation results. 3 X 50		**Material:** Meeting 6 materials **References:** *Tompkins, WJ 2000. Biomedical Digital Signal Processing. New Jersey: Prentice Hall.*	10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	75%
		75%

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.