	Universitas Negeri Surabaya Faculty of Engineering , Electrical Engineering Education Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Sensors and Actuators	8320102225		T=2	P=0	ECTS=3.18	3	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Nur Kholis, S.T., M.T.

Learning model	**Project Based Learning**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-6	Able to plan, implement, and evaluate effective and efficient innovative learning programs in electrical engineering vocational education that are relevant to global industrial developments (Education).
	PLO-7	Able to apply applied research to innovate vocational learning methods, optimize production process technology and electrical engineering services relevant to industry (Education).
	PLO-12	Able to carry out analysis on research and development of electrical engineering and electronics engineering skills programs by following the rules of scientific writing (SSC2.2).
	PLO-13	Able to design circuits, devices and products in the electrical and electronics engineering expertise program (SSC3.1).
	Program Objectives (PO)	
	PO - 1	Types of sensors and actuators in general. 2. Types of temperature sensors (thermistor, resistance temperature sensor, silicon resistive sensor) and temperature actuators (wax motor thermistor) and how they work 3. Types of optical sensors and photodetectors (phototransistor, photoresistor, IR sensor, CCD sensors) 4. Explain and understand the types of magnetic sensors and electric actuators 5. Explain and understand the types of acoustic and pressure sensors and actuators 6. Explain and understand the types of chemical sensors and actuators 7. Explain and understand the various tools or devices that apply sensor and actuator technology
	PLO-PO Matrix	

P.O	PLO-6	PLO-7	PLO-12	PLO-13
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 the different types of sensors and their measurements. Understand about actuators, especially DC motors. Able to condition signals that will be used in sensor and actuator applications. Understand and be able to apply/design sensors and actuators in a device. This course will be presented in theory and simulation.
References	**Main :**

1. Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group
2. Nathan Ida. 2014 Sensors, Actuators, and Their Interfaces. UK: Scitech publishing.

Supporters:

Supporting lecturer	Dr. Lilik Anifah, S.T., M.T. Dr. Farid Baskoro, S.T., M.T. Sayyidul Aulia Alamsyah, 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	Explain the definitions related to sensors and actuators	a. Describe the meaning and use of sensors b. Describe the meaning and use of actuators	**Criteria:** according to the assessment rubric **Form of Assessment** : Participatory Activities	case study 2 X 50		**Material:** Explaining definitions related to sensors and actuators **Reference:** *Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group*	5%
2	Explain the definitions related to the types of temperature sensors (thermistor, resistance temperature sensor, silicon resistive sensor) and temperature actuator (wax motor thermistor) and how they work)	Explain the definitions related to the types of temperature sensors (thermistor, resistance temperature sensor, silicon resistive sensor) and temperature actuator (wax motor thermistor) and how they work)	**Criteria:** according to the assessment rubric	case study 2 X 50		**Material:** Explaining definitions related to sensors and actuators **Reference:** *Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group*	4%
3	Explain the definitions related to the types of temperature sensors (thermistor, resistance temperature sensor, silicon resistive sensor) and temperature actuator (wax motor thermistor) and how they work)	Explain the definitions related to the types of temperature sensors (thermistor, resistance temperature sensor, silicon resistive sensor) and temperature actuator (wax motor thermistor) and how they work)	**Criteria:** according to the assessment rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	case study 2 X 50		**Material:** Explaining definitions related to sensors and actuators **Reference:** *Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group*	3%

4	Can explain light and radiation sensors (flux, photosensor, photoresistor, photodiode, phototransistor, photovoltaic) and their applications	Can explain light and radiation sensors (flux, photosensor, photoresistor, photodiode, phototransistor, photovoltaic) and their applications	**Criteria:** according to the assessment rubric **Form of Assessment** : Participatory Activities	case study 2 X 50		**Material:** Explaining definitions related to sensors and actuators **Reference:** *Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group* **Material:** explains light and radiation sensors (flux, photosensor, photoresistor, photodiode, phototransistor, photovoltaic) and their applications. **Reference:** *Nathan Ida. 2014 Sensors, Actuators, and Their Interfaces. UK: Scitech publishing.*	5%
5	Can explain light and radiation sensors (flux, photosensor, photoresistor, photodiode, phototransistor, photovoltaic) and their applications	Can explain light and radiation sensors (flux, photosensor, photoresistor, photodiode, phototransistor, photovoltaic) and their applications	**Criteria:** according to the assessment rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	case study 2 X 50		**Material:** Explaining definitions related to sensors and actuators **Reference:** *Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group* **Material:** explains light and radiation sensors (flux, photosensor, photoresistor, photodiode, phototransistor, photovoltaic) and their applications. **Reference:** *Nathan Ida. 2014 Sensors, Actuators, and Their Interfaces. UK: Scitech publishing.*	3%

6	Can classify and understand pressure sensors and Electric actuators (strain, stress, load cell, pressure gauge)	Can classify and understand pressure sensors and Electric actuators (strain, stress, load cell, pressure gauge)	**Criteria:** according to the assessment rubric **Form of Assessment** : Participatory Activities	case study 2 X 50		**Material:** Explaining definitions related to sensors and actuators **Reference:** *Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group* **Material:** Can classify and understand pressure sensors and Electric actuators (strain, stress, load cell, pressure gauge) **Reader:** *Nathan Ida. 2014 Sensors, Actuators, and Their Interfaces. UK: Scitech publishing.*	5%
7	Can classify and understand pressure sensors and Electric actuators (strain, stress, load cell, pressure gauge)	Can classify and understand pressure sensors and Electric actuators (strain, stress, load cell, pressure gauge)	**Criteria:** according to the assessment rubric **Form of Assessment** : Project Results Assessment / Product Assessment	case study 2 X 50		**Material:** Explaining definitions related to sensors and actuators **Reference:** *Andrzej M. Pawlak. 2006. Sensors and Actuators in Mechatronics, Design and Applications. US: Talyor and Francis Group* **Material:** Can classify and understand pressure sensors and Electric actuators (strain, stress, load cell, pressure gauge) **Reader:** *Nathan Ida. 2014 Sensors, Actuators, and Their Interfaces. UK: Scitech publishing.*	2%
8	UTS	UTS	**Form of Assessment** : Test	2 X 50		**Material:** UTS **Reader:** *Nathan Ida. 2014 Sensors, Actuators, and Their Interfaces. UK: Scitech publishing.*	20%

9	Can classify and understand chemical sensors and actuators	1.Can classify and understand chemical sensors and actuators 2.according to the assessment rubric	**Criteria:** according to the assessment rubric **Form of Assessment** : Participatory Activities	case study 2 X 50			5%
10	Can classify and understand chemical sensors and actuators	1.Can classify and understand chemical sensors and actuators 2.according to the assessment rubric	**Criteria:** according to the assessment rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	case study 2 X 50			5%
11	Can classify and understand acoustic sensors and actuators (ribbon microphone, piezoelectric microphone, ribbon speaker, ultrasonic	1.Can classify and understand acoustic sensors and actuators (ribbon microphone, piezoelectric microphone, ribbon speaker, ultrasonic 2.according to the assessment rubric	**Criteria:** according to the assessment rubric **Form of Assessment** : Project Results Assessment / Product Assessment	case study 2 X 50			5%
12	Can classify and understand acoustic sensors and actuators (ribbon microphone, piezoelectric microphone, ribbon speaker, ultrasonic	1.Can classify and understand acoustic sensors and actuators (ribbon microphone, piezoelectric microphone, ribbon speaker, ultrasonic 2.according to the assessment rubric	**Criteria:** according to the assessment rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	case study 2 X 50			3%
13	Can classify and understand chemical sensors and actuators	applications of sensors and actuators in everyday life	**Criteria:** according to the assessment rubric **Form of Assessment** : Project Results Assessment / Product Assessment	case study 2 X 50			4%
14	Can classify and understand chemical sensors and actuators	applications of sensors and actuators in everyday life	**Criteria:** according to the assessment rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	case study 2 X 50			5%

15	UAS	according to the assessment rubric	**Criteria:** according to the assessment rubric **Form of Assessment** : Test	2 X 50 test			30%
16							0%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	29.5%
2.	Project Results Assessment / Product Assessment	20.5%
3.	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.