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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Mechatronics	2120102048		T=2	P=0	ECTS=3.18	5	January 18, 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 that is charged to the course	
PLO-5	Work independently and in groups
PLO-6	Experimentation and data analysis
PLO-11	Design and development of solutions that take into account the environment and sustainability

Program Objectives (PO)	
PO - 1	Have good morals, ethics and personality in studying mechatronic systems
PO - 2	Have knowledge of microcontroller-based mechatronic systems and programmable logic controllers
PO - 3	Have the ability to design mechatronic systems based on microcontrollers and programmable logic controllers
PO - 4	Able to collaborate and be responsible in developing mechatronic systems according to needs

PLO-PO Matrix

P.O	PLO-5	PLO-6	PLO-11
PO-1			
PO-2			
PO-3			
PO-4			

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																

Short Course Description

This course discusses Basic Logic and Electronic Circuits, Sensors and Transducers, Actuators (DC Motor, Servo Motor, Stepper Motor), Microcontroller, PLC (Programmable Logic Controller) using various forms of learning in the form of lectures, practicums, designing and using various learning methods in the form of group discussions, simulations, case studies, and project-based learning.

References

Main :

1. Adi, A.N. 2010, Mekatronika. Yogyakarta: Graha Ilmu.
2. Bolton, W. 1999. Mechatronics, Second Edition. England: Prentice Hall.
3. David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition

Supporters:

1. Dunn, William C. 2005. Fundamentals of Industrial Istrumentation and Process Control.USA: Mc Graw-Hill Companies, Inc.
2. Johnson, C.D. 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.

Supporting lecturer	Agung Prijo Budijono, 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 are able to describe the basic principles of mechatronic systems	Accuracy in describing mechatronic systems	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture, * Discussion, * 2x50	* Lecture, * Discussion, * 2x50	**Material:** basics of mechatronics **Reference:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	2%
2	Students are able to identify mechatronic systems through case study examples	Accuracy in identifying mechatronic systems through case study examples	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities, Tests	* Lecture, * Discussion, * Assignment: Identify mechatronic systems through case study examples * 2x50	* Lecture, * Discussion, * Assignment: Identify mechatronic systems through case study examples * 2x50	**Material:** Mechatronic systems **Reference:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.* **Material:** Case study of mechatronic systems **References:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	2%
3	Students are able to identify various types of sensors and transducers	Accuracy of identifying at least 5 types of sensors and transducers	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities, Portfolio Assessment	* Lecture, * Discussion, * 2x50	* Lecture, * Discussion, * 2x50	**Material:** Sensors and Transducers **References:** *Bolton, W. 1999. Mechatronics, Second Edition. England: Prentice Hall.*	5%
4	Students are able to identify various types of sensors and transducers	1. Designing a block diagram of a control system 2. Accuracy of identifying at least 5 types of sensors and transducers	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities, Tests	* Lecture, * Discussion, * Assignment: Identify various types of sensors and transducers * 2x50	* Lecture, * Discussion, * Assignment: Identify various types of sensors and transducers * 2x50	**Material:** Sensors and Transducers **References:** *Bolton, W. 1999. Mechatronics, Second Edition. England: Prentice Hall.*	5%
5	Students are able to distinguish the working principles of basic logic gates	Accuracy in distinguishing AND, OR, NOT, NAND, NOR, EXOR, EXNOR, and RS FF logic gates,	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities, Tests	* Lecture, * Discussion, * Assignment: Explain the differences in the working principles of AND, OR, NOT, NAND, NOR, EXOR, EXNOR, and RS FF logic gates, * 2x50	* Lecture, * Discussion, * Assignment: Explain the differences in the working principles of AND, OR, NOT, NAND, NOR, EXOR, EXNOR, and RS FF logic gates, * 2x50	**Material:** sensors **Reference:** *Dunn, William C. 2005. Fundamentals of Industrial Instrumentation and Process Control. USA: Mc Graw-Hill Companies, Inc.* **Material:** Logic gates **Bibliography:** *David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition*	5%
6	Students are able to understand microcontroller systems and their application	Accuracy of identifying microcontroller systems and their application	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture * Discussion * Question and answer * 2x50	* Lecture * Discussion * Question and answer * 2x50	**Material:** Microcontroller systems and their applications **References:** *David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition*	5%
7	Students are able to understand microcontroller systems and their application	1. Identify signal conditioning in an automatic control system 2. Accuracy of identifying microcontroller systems and their application	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture * Discussion * Question and answer * Assignment: Identify microcontroller systems and their applications * 2x50	* Lecture * Discussion * Question and answer * Assignment: Identify microcontroller systems and their applications * 2x50	**Material:** Microcontroller systems and their applications **References:** *David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition*	5%

8	Sub Summative Exam	Sub Summative Exam	**Criteria:** Compliance with the answer key	Sub Summative Exam * 2x50			20%
9	Able to identify the characteristics of various types of actuators	Accuracy of identifying characteristics of different types of actuators	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture, * Discussion, * 2x50	* Lecture, * Discussion, * 2x50	**Material:** Actuators **Reference:** *Johnson, CD 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.*	5%
10	Able to identify the characteristics of various types of actuators	Accuracy of identifying characteristics of different types of actuators	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture, * Discussion, * Assignment: Identify the characteristics of various types of actuators * 2x50	* Lecture, * Discussion, * Assignment: Identify the characteristics of various types of actuators * 2x50	**Material:** Actuators **Reference:** *Johnson, CD 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.*	5%
11	Able to understand PLC systems	Accuracy in understanding functions, main parts, advantages and disadvantages and PLC programming procedures	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture, * Discussion, * 2x50	* Lecture, * Discussion, * 2x50	**Material:** PLC System **Reference:** *Johnson, CD 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.*	5%
12	Able to design PLC programs	Accuracy in creating DOL, interlock, sequential and alternating circuits using the Cx.Programmer application	**Criteria:** Assessment rubric **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	* Lecture, * Discussion, * Assignment 6: Create a series of DOL, interlock, sequential, and alternating, * 2x50	* Lecture, * Discussion, * Assignment 6: Create a series of DOL, interlock, sequential, and alternating, * 2x50	**Material:** PLC Programming **Reference:** *Johnson, CD 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.*	5%
13	Able to design PLC programs	Accuracy in creating a series of traffic lights and automatic garage doors using the Cx.Programmer application	**Criteria:** Assessment rubric **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	* Lecture, * Discussion, * Task 6: Make a series of traffic lights and automatic garage doors, * 2x50	* Lecture, * Discussion, * Task 6: Make a series of traffic lights and automatic garage doors, * 2x50	**Material:** PLC Programming **Reference:** *Johnson, CD 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.*	5%
14	Able to operate PLC according to procedures	Accuracy in making DOL circuits, interlocks, sequentially, alternately using the PLC trainer according to procedures	**Criteria:** Assessment rubric **Forms of Assessment** : Participatory Activities, Practical Assessment, Tests	* Laboratory Practice, * Discussion, * Task 6: Create a DOL circuit, interlock, sequentially, alternately using the PLC trainer * 2x50		**Material:** PLC Programming **Reference:** *Johnson, CD 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.* **Material:** PLC Operation **Bibliography:** *Bolton, W. 1999. Mechatronics, Second Edition. England: Prentice Hall.*	10%
15	Students are able to operate the PLC according to procedures	Accuracy of demonstrating traffic light circuits and automatic garage doors using a PLC trainer according to procedures	**Criteria:** Assessment rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment, Tests	* Laboratory Practice, * Discussion, * Task 6: Demonstrate a traffic light and automatic garage door circuit using a PLC trainer * 2x50		**Material:** PLC Programming **Reference:** *Johnson, CD 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.* **Material:** PLC Operation **Bibliography:** *Bolton, W. 1999. Mechatronics, Second Edition. England: Prentice Hall.*	10%
16	Summative Exam		**Criteria:** Assessment rubric	Summative Exam * 2x50	Summative Exam * 2x50		30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage

1.	Participatory Activities	44.67%
2.	Project Results Assessment / Product Assessment	2.5%
3.	Portfolio Assessment	2.5%
4.	Practical Assessment	9.17%
5.	Test	15.17%
		74.01%

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.