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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Mechatronics	8320302072		T=2	P=0	ECTS=3.18	6	January 23, 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

PLO-8	Able to carry out maintenance and repairs in the automotive engineering field (automotive concentration) or able to operate various production equipment and machines in the manufacturing sector (production concentration)

Program Objectives (PO)

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

PLO-PO Matrix

P.O	PLO-8
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. Johnson, C.D. 2003. Process Control Instrumentation Technology, Seventh Edition. USA: Prentice Hall Inc., New Jersey.

Supporters:

1. Bolton, W. 1999. Mechatronics, Second Edition. England: Prentice Hall.
2. Dunn, William C. 2005. Fundamentals of Industrial Istrumentation and Process Control.USA: Mc Graw-Hill Companies, Inc.
3. David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition

Supporting lecturer: Ir. Wahyu Dwi Kurniawan, S.Pd., M.Pd.
Ali Hasbi Ramadani, 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 describe the basic principles of mechatronic systems	Accuracy in describing the basic principles of mechatronics	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture, * Discussion in groups * 2x50		**Material:** Mechatronic systems **Reference:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	5%
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	* Lecture, * Case study, discussion in groups * Task-1: Identify mechatronic systems through case study examples ^ 2x50		**Material:** Case study of mechatronic systems **References:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	5%
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	* Lectures, * Discovery learning, discussions in groups, * 2x50		**Material:** Sensors and Transducers **References:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	5%
4	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, Practice/Performance	* Lecture, * Discovery learning, discussion in groups, * Task 2: Identify various types of sensors and transducers, * 2x50		**Material:** Sensors and Transducers **References:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	3%
5	Distinguish the working principles of basic logic gates	Accuracy in distinguishing the working principles of AND, OR, NOT, NAND, NOR, EXOR, EXNOR, and RS FF logic gates.	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities	* Lecture, * Discussion in groups, * Task-3: Explain the differences in the working principles of AND, OR, NOT, NAND, NOR, EXOR, EXNOR, and RS FF logic gates, * 2x50		**Material:** Logic gates **Reference:** *Bolton, W. 1999. Mechatronics, Second Edition. England: Prentice Hall.*	5%
6	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 in groups, * 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	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 in groups, * Assignment-4: 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 **Form of Assessment** : Test	Sub Summative Exam 2 X 50		**Material:** Meeting material 1 to 7 **References:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	10%

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 in groups, * 2x50		**Material:** Actuators **References:** *Dunn, William C. 2005. Fundamentals of Industrial Instrumentation and Process Control. USA: Mc Graw-Hill Companies, Inc.*	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 in groups, * Task-5: Identify the characteristics of various types of actuators * 2x50		**Material:** Actuators **References:** *Dunn, William C. 2005. Fundamentals of Industrial Instrumentation and Process Control. USA: Mc Graw-Hill Companies, Inc.*	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, Practice/Performance	* Lecture, * Discussion in groups, * 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 application. \Programmer	**Criteria:** Assessment rubric **Form of Assessment** : Participatory Activities, Practice/Performance	* Laboratory Practice, • Project Based Learning, Discussion in groups, * Task 6: Create a series of DOL, interlock, sequential, and alternating * 2x50		**Material:** PLC Programming **Bibliography:** *David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition*	10%
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 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	* Laboratory Practice, • Project Based Learning, Discussion in groups, * Task 7: Make a series of traffic lights and automatic garage doors * 2x50		**Material:** PLC Programming **Bibliography:** *David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition*	7%
14	Able to operate PLC according to procedures	Accuracy of demonstrating DOL, interlock, sequential, alternating circuits using the PLC trainer according to procedures	**Criteria:** Assessment rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	* Laboratory Practice, • Project Based Learning, Discussion in groups, * Task 8: Demonstrate the DOL circuit, interlock, sequentially, alternately using the PLC trainer * 2x50		**Material:** PLC Operation **Bibliography:** *David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition*	5%
15	Able to operate PLC according to procedures	Accuracy in 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, Practical / Performance	* Laboratory Practice, • Project Based Learning, Discussion in groups, * Task 9: Demonstrate a traffic light circuit and automatic garage door using a PLC trainer * 2x50		**Material:** PLC Operation **Bibliography:** *David G. Alciatore, Michael B. Histand (2017), Introduction to Mechatronics and Measurement Systems.McGRAW.Hill International Edition*	5%
16	Summative Exam	Summative Exam	**Criteria:** Compliance with the answer key **Form of Assessment** : Test	Summative Exam * 2x50		**Material:** All material **Reference:** *Adi, AN 2010, Mechatronics. Yogyakarta: Graha Ilmu.*	15%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	55.42%
2.	Project Results Assessment / Product Assessment	6.42%
3.	Practical Assessment	1.25%
4.	Practice / Performance	11.92%
5.	Test	25%
		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.