	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
Industrial Robots	2020103173	Study Program Elective Courses	T=3	P=0	ECTS=4.77	5	April 10, 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

Program Objectives (PO)

PO - 1	Students are able to analyze the need for robotics technology that can be implemented in the industrial world in accordance with currently developing technology
PO - 2	Students are able to analyze how robot components work, such as sensors, actuators and interfaces used in a robotics system
PO - 3	Students are able to design a robotics system starting from mechanical design, hardware design, control design and programming in robotics systems
PO - 4	Students are able to analyze the workings of robot kinematics equations in robot movement mechanisms

PLO-PO Matrix

P.O
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	The industrial robot course is a course with a project-based learning model where this course provides knowledge and experience to electrical engineering students in understanding simple definitions and concepts of using robots, robot classification, how robots work, structures found in robots, applications of robots in the field -certain fields and others. The industrial robot course discusses robotics theory and its application in the world of industrial automation. The material that will be presented in this course includes robot sensors and actuators, robot control systems, robot manipulators, kinematics, dynamics and robot trajectories. After taking this course, students are expected to be able to understand the basic concepts of robots and robot applications in the industrial world.
References	**Main :**

	1. Pitowarno, Endra. 2016. Robotika; Desain, Kontrol, dan Kecerdasan Buatan Edisi 1. Yogyakarta: Andi. 2. Koren, Yoran. 1985. Robotics for Engineers. McGraw-Hill. 3. Suyandhi, Taufiq Dwi Septian. 2012. Buku Pintar ROBOTIKA: Bagaimana merancang dan membuat robot sendiri. Yoyakarta: Andi
	Supporters:
Supporting lecturer	Muhamad Syariffuddien Zuhrie, S.Pd., 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	Understand the basic concepts of robots and robot applications in the industrial world.	1. Understand the basic concepts of robots. 2. Know the applications of robots in industry. 3. Distinguish between humanoid robots and industrial robots. 4. Identify types of industrial robots.	**Criteria:** Assessment rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Method: Discussion Approach: Scientific 2 X 50	Method: Discussion Approach: Scientific 2 X 50	**Material:** Meeting material 1 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	4%
2	Using various sensors and actuators on industrial robots	Can use speed sensors (rotary encoder), gyroscope, accelerometer, proximity and ultrasonic on the robot	**Criteria:** Assessment rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50	Method: Demonstration Approach: Scientific 2 X 50	**Material:** Meeting material 2 **References:** *Koren, Yoran. 1985. Robotics for Engineers. McGraw-Hill.*	5%
3	Using various sensors and actuators on industrial robots	Can use DC motors, stepper motors and servo motors on robots	**Criteria:** Assessment rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 3 **Reader:** *Suyandhi, Taufiq Dwi Septian. 2012. Smart Book ROBOTICS: How to design and make your own robot. Yoyakarta: Andi*	5%
4	Understanding control systems in industrial robots.	1. Understand the PID control system on line tracer robots. 2. Designing a PID control system for line tracer robots.	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 4 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	5%

5	Understanding control systems in industrial robots.	1. Understand the PID control system on line tracer robots. 2. Designing a PID control system for line tracer robots.	**Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 5 **References:** *Koren, Yoran. 1985. Robotics for Engineers. McGraw-Hill.*	0%
6	Identify the parts of an industrial robot manipulator	1. Identify the parts of an industrial robot manipulator2. Differentiate the types of manipulators in industrial robots 3. Determining the number of degrees-of-freedom of industrial robot manipulators	**Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 6 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	2%
7	Using kinematics equations in industrial robots	1. Understand the concept of forward kinematics and inverse kinematics2. Using the forward kinematics equation to determine the end effector point	**Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 7 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	3%
8	MIDDLE SEMESTER EXAMINATION / MID SEMESTER EXAMINATION	Can design electronic control systems for line tracer robots	**Criteria:** Evaluation Rubric **Form of Assessment** : Participatory Activities, Tests	Written Test 2 X 50		**Material:** Meeting material 1-7 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	20%
9	Using kinematics equations in industrial robots	1. Use the inverse kinematics equation to determine the arm angle2. Calculating the arm angle of a 2-DoF3 robot. Using point plotter media to determine the arm angle	**Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 11 **References:** *Koren, Yoran. 1985. Robotics for Engineers. McGraw-Hill.*	5%
10	Using kinematics equations in industrial robots	1. Use the inverse kinematics equation to determine the arm angle2. Calculating the arm angle of a 2-DoF3 robot. Using point plotter media to determine the arm angle	**Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 10 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	3%

11	Using simulation to solve kinematic equations	1. Understand writing kinematics formulas in the MATLAB2 program. Using simulation to solve forward kinematic equations3. Using simulation to solve inverse kinematic equations4. Calculate arm angles to draw triangles and circles	**Criteria:** Evaluation Rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 11 **References:** *Koren, Yoran. 1985. Robotics for Engineers. McGraw-Hill.*	3%
12	Using simulation to solve kinematic equations	1. Understand writing kinematics formulas in the MATLAB2 program. Using simulation to solve forward kinematic equations3. Using simulation to solve inverse kinematic equations4. Calculate arm angles to draw triangles and circles	**Criteria:** Evaluation Rubric **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 12 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	3%
13	Design and create programs to run SCARA type robots.	1. Design a program to run a SCARA type robot.2. Write initials with the SCARA robot	**Form of Assessment** : Portfolio Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 13 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	3%
14	Design and create programs to run SCARA type robots.	1. Design a program to run a SCARA type robot.2. Write initials with the SCARA robot	**Criteria:** Evaluation Rubric **Form of Assessment** : Project Results Assessment / Product Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 14 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	5%
15	Design and create programs to run SCARA type robots.	1. Design a program to run a SCARA type robot.2. Write initials with the SCARA robot	**Form of Assessment** : Portfolio Assessment	Method: Demonstration Approach: Scientific 2 X 50		**Material:** Meeting material 15 **Reader:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	4%

16	FINAL SEMESTER EXAMINATION / FINAL SEMESTER EXAMINATION		**Form of Assessment** : Test	2 X 50		**Material:** Meeting material 1=15 **References:** *Pitowarno, Endra. 2016. Robotics; Design, Control and Artificial Intelligence Edition 1. Yogyakarta: Andi.*	30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	14.5%
2.	Project Results Assessment / Product Assessment	36.5%
3.	Portfolio Assessment	9%
4.	Test	40%
		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.