	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Undergraduate Physics Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Robotics	4520102242	Study Program Elective Courses	T=2	P=0	ECTS=3.18	6	July 29, 2021

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 which is charged to the course**	
	PLO-6	Able to demonstrate appreciation of religious values and carry out their duties professionally.
	PLO-9	Able to work as an individual or team effectively, have entrepreneurial skills, and care about environmental issues.
	PLO-12	Have the ability to improve their knowledge and be able to continue their studies to a higher level.
	Program Objectives (PO)	
	PO - 1	Demonstrate independent, creative and honest character in completing student assignments, middle and final exams.
	PO - 2	Understand the concept of robotics and its classification based on systems and functions.
	PO - 3	Understand the concept and implementation of various sensors and actuators applied in robotics.
	PO - 4	Understand mechanical design concepts for certain robot functions
	PO - 5	Understand the concept of implementing kinematics in robotics
	PO - 6	Understand the concept and how to design mobile robots (wheeled and legged robots)
	PO - 7	Understand the concept and how to design a robot arm manipulator.
	PLO-PO Matrix	

P.O	PLO-6	PLO-9	PLO-12
PO-1			
PO-2			
PO-3			
PO-4			
PO-5			
PO-6			
PO-7			

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																
PO-5																
PO-6																
PO-7																

Short Course Description	Robotics is a course that studies the concepts, functions and applications of robots. Students will learn about robot components, including sensors, actuators, mechanical design and algorithms. Students will be given assignments and need to design and build various projects (mobile robots and arm manipulator robots) using these components. Students will work independently or in small groups.
References	**Main :**
	1. Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4. 2. Margolis, M. 2012. Make An Arduino Controlled Robot. United State of America: O'Reilly Media Inc., pp. 1-235. ISBN: 978-1-449-34437-5. 3. Cook, D. 2015. Robot Building for Beginners. 3rd Edition. New York: Springer, pp.1- 449. ISBN-13: 978-1-4842-1359-9.
	Supporters:
	1. Siciliano, B. and Khatib, O. Handbook of Robotics. Berlin: Springer-Verlag, pp. 1-1559. e-ISBN: 978-3-540-30301-5. Levin
Supporting lecturer	Dzulkiflih, S.Si., M.T. Endah Rahmawati, S.T., M.Si. Muhammad Nurul Fahmi, S.Si., M.Si.

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	Able to understand the concept of robotics and its classification based on systems and functions	Students can explain the concept of robotics and its classification based on systems and functions	**Form of Assessment** : Participatory Activities	Contextual Learning Discussion 2 x 50 minutes		**Material:** Robotic aspects, applications and components **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	3%

2	Able to understand the concept and implementation of various sensors (infrared, ultrasonic, camera, compass) and actuators (DC motors, stepper motors, servo motors and pneumatics)	Students can explain various sensors and actuators for robots	**Form of Assessment** : Participatory Activities	Discussion, Contextual Learning, Questions and Answers 2 x 50 minutes		**Materials:** Sensors: IR, ultrasonic, camera, compass Actuators: DC motors, stepper motors, servo motors, pneumatics **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	3%
3	Able to understand the concept and implementation of various sensors (infrared, ultrasonic, camera, compass) and actuators (DC motors, stepper motors, servo motors and pneumatics)	Students can implement various sensors (infrared, ultrasonic, camera, compass) for robots	**Criteria:** Student assignment description: Several small experiments to learn the application of sensors used in robots **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Contextual Learning, practice, discussion 2 x 50 minutes		**Materials:** Sensors: IR, ultrasonic, camera, compass Actuators: DC motors, stepper motors, servo motors, pneumatics **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.* **Material:** Sensors for robots: IR, ultrasonic, camera, compass **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	3%
4	Able to understand the concept and implementation of various sensors (infrared, ultrasonic, camera, compass) and actuators (DC motors, stepper motors, servo motors and pneumatics).	Students can implement actuators (DC motors, stepper motors, servo motors and pneumatics)	**Criteria:** Student assignment description: Several small experiments to learn the application of sensors used in robots **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Contextual Learning, practice, discussion 2 x 50 minutes		**Material:** Actuators for: DC motors, stepper motors, servo motors, pneumatics **Reference:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	3%

5	Able to understand robot mechanical systems for special tasks	Students can explain robot mechanical systems for specific tasks	**Form of Assessment** : Participatory Activities	Discussion, Contextual Learning, Questions and Answers 2 x 50 minutes		**Material:** Robot mechanical system **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	3%
6	Able to understand and apply inverse kinematics to robots	Students can derive inverse kinematics algorithms in robots	**Form of Assessment** : Participatory Activities	Contextual Learning, practice, discussion 2 x 50 minutes		**Material:** Inverse Kinematics Algorithm **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	3%
7	Able to understand and apply inverse kinematics to robots	Students can apply inverse kinematics algorithms in robots	**Form of Assessment** : Participatory Activities	Contextual Learning, practice, discussion 2 x 50 minutes		**Material:** Inverse Kinematics Algorithm **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%
8	Students are able to understand UTS questions	UTS	**Criteria:** Projects **Form of Assessment** : Project Results Assessment / Product Assessment	Midterm 100 minutes			20%
9	Able to design and control mobile robots (wheeled or legged robots)	Students can design and control mobile robots (wheeled robots)	**Form of Assessment** : Participatory Activities	Contextual Learning, practice 2 x 50 minutes		**Material:** Moving robots (wheeled robots) **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%
10	Able to design and control mobile robots (wheeled or legged robots)	Students can design and control mobile robots (wheeled robots)	**Criteria:** Task 1. Presentation and demonstration **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Contextual Learning, practice, discussion 2 x 50 minutes		**Material:** Moving robots (wheeled robots) **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%

11	Able to design and control mobile robots (wheeled or legged robots)	Students can design and control mobile robots (robots with legs)	**Criteria:** **Form of Assessment** : Participatory Activities	Contextual Learning, practice 2 x 50 minutes		**Material:** Moving robots (legged robots) **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%
12	Able to design and control mobile robots (wheeled or legged robots)	Students can design and control mobile robots (robots with legs)	**Criteria:** Task 2 (Presentation and demonstration) **Form of Assessment** : Participatory Activities	Contextual Learning, practice, 2 x 50 minute discussions		**Material:** Moving robots (legged robots) **References:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%
13	Able to design and control a 4DOF robot arm manipulator for certain tasks	Students can understand the concept of robot arm manipulators	**Criteria:** **Form of Assessment** : Participatory Activities	Contextual Learning, practice, discussion 2 x 50 minutes		**Material:** Design and control of a 4DOF arm manipulator robot **Reference:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%
14	Able to design and control a 4DOF robot arm manipulator for certain tasks	Students can understand the concept of robot arm manipulators	**Criteria:** **Form of Assessment** : Participatory Activities	Contextual Learning, practice, discussion 2 x 50 minutes		**Material:** Design and control of a 4DOF arm manipulator robot **Reference:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%
15	Able to design and control a 4DOF robot arm manipulator for certain tasks	Students can understand the concept of robot arm manipulators	**Criteria:** **Form of Assessment** : Participatory Activities	Contextual Learning, practice, discussion 2 x 50 minutes		**Material:** Design and control of a 4DOF arm manipulator robot **Reference:** *Mihelj, M. et.al. 2019. Robotics. 2nd Edition. Switzerland: Springer, pp. 1-247. ISBN 978-3-319-72911-4.*	4%

16	Students are able to understand UAS questions	UAS	**Criteria:** Projects	UAS 100 Minutes			30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	45%
2.	Project Results Assessment / Product Assessment	25%
		70%

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.