	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
Microcontroller	4520102241	Study Program Elective Courses	T=2	P=0	ECTS=3.18	6	February 1, 2024

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-5	Able to demonstrate as a good scientist, critical thinking skills and innovation in research and professional fields.
PLO-15	Solve problems in physical systems comprehensively using mathematics and computational tools.
Program Objectives (PO)	
PO - 1	Able to understand the meaning of a microcontroller and its differences with a microprocessor. □
PO - 2	Able to understand and explain the history of development and types and specifications of microprocessors and microcontrollers
PO - 3	Able to understand microprocessor, microcontroller and microcomputer architecture.
PO - 4	Able to understand the minimum microcontroller system, its constituent components and design scheme.
PO - 5	Have basic microcontroller programming skills.
PO - 6	Able to design and create simple microcontroller application circuits.

PLO-PO Matrix

P.O	PLO-5	PLO-15
PO-1		
PO-2		
PO-3		
PO-4		
PO-5		
PO-6		

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																

Short Course Description	This course discusses the meaning of microcontrollers, the difference between microprocessors and microcontrollers, microprocessor architecture, microcontroller architecture, microcomputer architecture, minimum microcontroller systems, interface systems, basic programming and simple applications of microcontroller systems.
References	**Main :**

1. John Crisp. 2004. Introduction Microprocessors and Microcontrollers (2nd □Edition) . Elsevier, ISBN: 0-7506-5989-0 □
2. John Boxall. 2013. Arduino Workshop . William Pollock, ISBN-13: □978-1-59327-448-1 □
3. Michael Margolis. 2011. Arduino Cookbook . O'Reilly Media, Inc., □ISBN: 978-0-596-80247-9 □
4. Jack Purdum. 2011. Beginning C for Arduino . ISBN-13 (electronic): 978-1-4302- □4777-7 □
5. Wilcher, Don. 2014. Make: Basic Arduino Projects. USA: Maker Media, Inc.

Supporters:

1. Richardson, Matt, dan Wallace, Shawn. 2013. Getting Started with Raspberry Pi. USA: O'Reilly Media, Inc.
2. Kurniawan, Agus. 2019. Internet of Things with ESP32. Birmingham: Packt Publishing.

Supporting lecturer	Drs. Imam Sucahyo, M.Si. Endah Rahmawati, S.T., M.Si. Meta Yantidewi, 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	Understand digital systems and signal conditioning	Students can explain digital systems and signal conditioning	**Criteria:** Accuracy in explaining digital systems and signal conditioning **Form of Assessment** : Participatory Activities		Virtual meeting (2 x 50 minutes)	**Material:** Introduction, contract and lecture orientation: Discussing objectives, materials, strategies, sources and evaluation, assignments and bills in lectures. **References:**	3%
2	Understand and explain the history of development and types and specifications of microprocessors and microcontrollers	1.Students understand the difference between microcontrollers and microprocessors 2.Students are able to explain the development of microprocessors and microcontrollers	**Criteria:** 1.Accuracy in explaining microprocessor and microcontroller systems 2.Ability to explain the history of the development of microprocessors and microcontrollers **Form of Assessment** : Participatory Activities		virtual meeting (2 x 50 minutes)	**Material:** Introduction to microprocessors, microprocessor systems and microcontrollers • History and development of microprocessors • History and development of microcontrollers **Reader:** *John Crisp. 2004. Introduction to Microprocessors and Microcontrollers (2nd Edition). Elsevier, ISBN: 0-7506-5989-0* **Material:** Types and specifications of microprocessors and microcontrollers **Reader:** *John Crisp. 2004. Introduction to Microprocessors and Microcontrollers (2nd Edition). Elsevier, ISBN: 0-7506-5989-0*	3%

3	Understand and explain the basic architecture of the Raspberry Pi	Students can explain the basic architecture of the Raspberry Pi	**Criteria:** Accuracy in explaining the basic architecture of the Raspberry Pi **Form of Assessment** : Participatory Activities		virtual meeting (2 x 50 minutes)	**Material:** Microcontroller Minimum System **Reader:** *John Crisp. 2004. Introduction to Microprocessors and Microcontrollers (2nd Edition). Elsevier, ISBN: 0-7506-5989-0* **Material:** Arduino **Reader:** *John Boxall. 2013. Arduino Workshop. William Pollock, ISBN-13: 978-1-59327-448-1* **Material:** Arduino **Reader:** *Michael Margolis. 2011. Arduino Cookbook. O'Reilly Media, Inc., ISBN: 978-0-596-80247-9* **Material:** Race **Readers:** *Richardson, Matt, and Wallace, Shawn. 2013. Getting Started with Raspberry Pi. USA: O'Reilly Media, Inc.*	3%
4	Understand and explain the basic architecture of Arduino	Students can explain the basic architecture of Arduino	**Form of Assessment** : Participatory Activities		virtual meeting (2 x 50 minutes)	**Material:** Microcontroller Minimum System **Reader:** *John Crisp. 2004. Introduction to Microprocessors and Microcontrollers (2nd Edition). Elsevier, ISBN: 0-7506-5989-0* **Material:** Arduino **Reader:** *John Boxall. 2013. Arduino Workshop. William Pollock, ISBN-13: 978-1-59327-448-1* **Material:** Arduino **Reader:** *Michael Margolis. 2011. Arduino Cookbook. O'Reilly Media, Inc., ISBN: 978-0-596-80247-9* **Material:** Race **Readers:** *Richardson, Matt, and Wallace, Shawn. 2013. Getting Started with Raspberry Pi. USA: O'Reilly Media, Inc.*	3%

5	Understanding the Internet of Things (IoT) based microprocessor working system	Students are able to understand the working system of microprocessors based on the Internet of Things (IoT)	**Criteria:** Accuracy in describing and explaining the schematic of an Internet of Things (IoT) based microprocessor working system **Form of Assessment** : Participatory Activities		virtual meeting (2 x 50 minutes)	**Material:** Microcontroller Minimum System **Reader:** *John Crisp. 2004. Introduction to Microprocessors and Microcontrollers (2nd Edition). Elsevier, ISBN: 0-7506-5989-0* **Material:** IoT with ESP32 **Reader:** *Kurniawan, Agus. 2019. Internet of Things with ESP32. Birmingham: Packt Publishing.*	3%
6	Understand the basics of microcontroller programming	Students can use microcontroller programming software.	**Criteria:** Able to use microcontroller programming software. **Form of Assessment** : Participatory Activities, Practice/Performance		virtual meeting (2 x 50 minutes)	**Material:** Basic programming of microcontrollers **Reader:** *Jack Purdum. 2011. Beginning C for Arduino. ISBN-13 (electronic): 978-1-4302-4777-7*	7%
7	Simulate measurement systems using Wokwi or Proteus.	Students are able to use Wokwi or Proteus to simulate measurement systems.	**Criteria:** Able to simulate measurement systems using Wokwi or Proteus. **Form of Assessment** : Participatory Activities, Practice/Performance		virtual meeting (2 x 50 minutes)		7%
8	Midterm Examination (UTS)/Midterm Evaluation	Present/present the material that has been studied	**Criteria:** Able to present/present the material that has been studied **Form of Assessment** : Participatory Activities, Portfolio Assessment		UTS virtual meeting (2 x 50 minutes)		9%
9	Designing a simple microprocessor-based application circuit	Students design a series of simple microprocessor-based applications.	**Criteria:** Students are able to present a simple microprocessor-based application design plan. **Form of Assessment** : Participatory Activities, Portfolio Assessment		virtual meeting (2 x 50 minutes)	**Material:** Arduino projects **Reference:** *Wilcher, Don. 2014. Make: Basic Arduino Projects. USA: Maker Media, Inc.*	7%
10	Designing a simple microprocessor-based application circuit	Students design a series of simple microprocessor-based applications.	**Criteria:** Students are able to present a simple microprocessor-based application design plan. **Form of Assessment** : Participatory Activities, Portfolio Assessment		virtual meeting (2 x 50 minutes)	**Material:** Arduino projects **Reference:** *Wilcher, Don. 2014. Make: Basic Arduino Projects. USA: Maker Media, Inc.*	7%
11	Simulating the design of a simple microprocessor-based application circuit.	Students simulate the design of a simple microprocessor-based application circuit using Wokwi or Proteus.	**Criteria:** Students are able to simulate simple microprocessor-based application circuit designs using Wokwi or Proteus. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance		virtual meeting (2 x 50 minutes)	**Material:** Arduino projects **Reference:** *Wilcher, Don. 2014. Make: Basic Arduino Projects. USA: Maker Media, Inc.*	7%

12	Create and test prototypes of simple microprocessor-based application designs.	1. Students create a prototype of a simple microprocessor-based application design. 2. Students test the prototype designs they create.	**Criteria:** 1. Students are able to create prototypes of simple microprocessor-based application designs. 2. Students are able to test the prototype designs created. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance		virtual meeting (2 x 50 minutes)	**Material:** Arduino projects **Reference:** *Wilcher, Don. 2014. Make: Basic Arduino Projects. USA: Maker Media, Inc.*	8%
13	Create and test prototypes of simple microprocessor-based application designs.	1. Students create a prototype of a simple microprocessor-based application design. 2. Students test the prototype designs they create.	**Criteria:** 1. Students are able to create prototypes of simple microprocessor-based application designs. 2. Students are able to test the prototype designs created. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance		virtual meeting (2 x 50 minutes)	**Material:** Arduino projects **Reference:** *Wilcher, Don. 2014. Make: Basic Arduino Projects. USA: Maker Media, Inc.*	8%
14	Analyze the prototype of a simple application series created.	Students analyze the prototype of a simple application circuit created.	**Criteria:** Students are able to analyze prototypes of simple application circuits that are created. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance		virtual meeting (2 x 50 minutes)		7%
15	Analyze the prototype of a simple application series created.	Students analyze the prototype of a simple application circuit created.	**Criteria:** Students are able to analyze prototypes of simple application circuits that are created. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance		virtual meeting (2 x 50 minutes)		7%
16	Final Semester Examination (UAS)	Students are able to present the design prototype that has been created.	**Criteria:** Discusses the prototype created by the group. In this meeting, each group will present the results of their prototype. **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance	Offline (2 x 50 minutes)			11%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	49.5%
2.	Project Results Assessment / Product Assessment	16%
3.	Portfolio Assessment	11.5%

4.	Practice / Performance	23%
		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.