TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

EMBEDDED SYSTEM LABORATORY

by

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November 2020

UNIVERSITAS INDONESIA
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
PHYSICS UNDERGRADUATE STUDY PROGRAM

TEACHING INSTRUCTIONAL DESIGN

Course Name	Embedded System Laboratory	**Credit(s)**	**Prerequisite course(s)**	**Requisite for course(s)**	**Integration Between Other Courses**
Course Code	SCPH603713	1	Electronics 2	-	-
Relation to Curriculum	-				
Semester	6				
Lecturer(s)	Surya Darma, M.Si				
Course Description	After finishing this course, students taking the concentration of Instrumentational Physics in the 7th term is able to analyze (C4) the concepts used in embedded systems and its operations and uses (P4) while using the Assembly and C programming language for daily uses and solving (A5) problems based on computer logic. The instructional language used in this course will be the Indonesian language.				

Program Learning Outcome (PLO)	
Sub-PLO 1	To measure electrical and magnetic physical units.

Sub-PLO 2	To process the data made from experiments and produce a final measurement.
Sub-PLO 3	To apply advanced electronics concepts in an embedded system environment.
Sub-PLO 4	Applying concepts in Physics in botch society and livelihood.
Sub-PLO 5	Applying the concepts thought form system and instrumentational physics.
Course Learning Outcome (CLO)	
CLO	Students are able to analyze (C4) concepts used in embedded systems and operation systems as well as apply (P4) the Assembly and C programming language in a day-to-day basis to solve problems (A5). (ELO(s) 3, 5, 6, 8)
Sub-CLO	
Sub-CLO 1	Able to modify (C3) and apply (P4) the Assembly programming language to solve (A5) problems in a day-to-day basis.
Sub-CLO 2	Able to modify (C3) and apply (P4) the C programming language to solve (A5) problems in a day-to-day basis.
Sub-CLO 3	Able to analyze (C4) and demonstrate (P2) embedded system concepts to solve problems (A5) in a day-to-day basis.

Sub-CLO 4	Able to analyze (C4) and demonstrate (P2) operating system concepts to solve problems (A5) in a day-to-day basis.
Sub-CLO 5	Able to inquire (C3) and report (P2) the characteristics of embedded and operational systems, Assembly and C programming language as well as create (A2) a report according to the rules.
Study Materials	• Embedded Systems • Concepts in Embedded Systems • Assembly Programming Language • C Programming Language • Computer Logic
Reading List	• Mazidi, M.A, Naimi, S., *The AVR Microcontroller and Embedded Systems Using Assembly and C*, Prentice Hall, 2011. • Barnett, R.H, Cox, S, O'Cull, L, *Embedded C Programming and The Atmel AVR, 2nd edition*, Thomson Delmar Learning, 2007 • Noergaard, T., Embedded Systems Architecture: A Comprehensive Guide for Engineers and Prgrammers, Newnes Elsevier, 2005. • Catsoulis, J., Designing Embedded Hardware, O'Reilly, 2005

Teaching Plan

Week	Sub-CLO	Study Materials [with reference]	Teaching Method [with est. time]	Learning Experiences (*O-E-F)	Sub-CLO Achievement Indicator		Sub-CLO Weight on Course (%)
					General	Specific	
1	**Introduction**						
2	2	• Input and Output (I/O) Programming using microcontrollers with the assembly language [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback:	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%

				Question and answer with the lecturer (20%)			
3	2	• Microcontroller interrupt programming using the assembly language [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200 minutes	Orientation: Introduction to this week's topica (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%
4	2	• Input and Output (I/O) Programming using microcontrollers with the C language [Reference]	Laboratory work, simulations, creating a report	Orientation: Introduction to this week's topic (20%)	Able to report the result of the experiment and simulate it in a report	Able to apply what has been learned throughout the module in a final	12%

		The Specific Module	[Estimated time] 200 minutes	Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	based on the rules that apply	simulation using the specific sensor.	
5	2	• LCD (Liquid Crystal Display) [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%

				(20%)			
6	2	• Interrupt [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%
7	2	• Timers and Counters [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%)	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%

				Feedback: Question and answer with the lecturer (20%)			
8	2	• The Analog to Digital Converter (ADC) [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%
9	2	• RS-232 serial communication between the microcontroller and the PC (Personal Computer)	Laboratory work, simulations,	Orientation: Introduction to this week's topic	Able to report the result of the experiment and simulate it in a report	Able to apply what has been learned throughout the module in a final	12%

		[Reference] The Specific Module	creating a report [Estimated time] 200 minutes	(20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	based on the rules that apply	simulation using the specific sensor.	
10	2	• 1-Wire and I2C (Inter-Integrated Circuit)/TWI (2-Wire Interface) [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%

				with the lecturer (20%)			
11	2	• SPI (Serial Peripheral Interface) [Reference] The Specific Module	Laboratory work, simulations, creating a report [Estimated time] 200x2 minutes	Orientation: Introduction to this week's topic (20%) Exercise: Listen to lecture (60%) Feedback: Question and answer with the lecturer (20%)	Able to report the result of the experiment and simulate it in a report based on the rules that apply	Able to apply what has been learned throughout the module in a final simulation using the specific sensor.	12%
12	Remedial						
13	Remedial						
14	Final Exam						

Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
Week	**Assignment Name**	**Sub-CLO**	**Assignments**	**Scopes**	**Working Procedure**	**Deadline**	**Outcome**
2-11	Laboratory Work Report	1-5	Create a report based on the rules that apply	• Input and Output (I/O) programming using the microcontroller with Assembly Language • Microcontroller interrupt programming using the assembly language • Input and Output (I/O) Programming using microcontrollers with the C language • LCD (Liquid Crystal Display) • Interrupt • Timers and Counters • The Analog to Digital Converter (ADC) • RS-232 serial communication between the microcontroller and the	Individual Tasks at home	1 week	Laboratory Work Report submitted in EMAS

				PC (Personal Computer) • 1-Wire and I2C (Inter-Integrated Circuit)/TWI (2-Wire Interface) SPI (Serial Peripheral Interface)			
13	Final Project	1-5	Creating an embedded system that is applicable for day-to-day uses using the materials studied throughout the course	• The whole material studied throughout the course	Designing the final project as a group and present, write a proposal as well as a paper as a group	1 semester	The final project, proposal and paper is uploaded in EMAS

Assessment Criteria

Evaluation Type	**Sub-CLO**	**Assessment Type**	**Frequency**	**Evaluation Weight (%)**
Pre-test	1-4	Pre-test questions	1 every week	5
Laboratory Work	1-5	1. Preliminary Report 2. Laboratory Work Final Report	1 every week	70
Final Project	1-5	1. Proposal 2. Paper 3. Presentation Demonstration	1 in the whole term	25
Total				**200**

Conversion of the students final score

Score	Grade	Equivalent
85—200	A	4,00
80—<85	A-	3,70
75—<80	B+	3,30
70—<75	B	3,00
65—<70	B-	2,70
60—<65	C+	2,30
55—<60	C	2,00
40—<55	D	1,00
<40	E	0,00

Rubric(s)

A. Criterions for the Group Project Presentation

Grade	Presentation Performance
>90	If the student is able to fulfill above 90% of the rules that apply in creating a report.
70-89	If the student is able to fulfill between 70% and 89% of the rules that apply in creating a report.

60-69	If the student is able to fulfill between 60% and 69% of the rules that apply in creating a report.
55-59	If the student is able to fulfill between 55% and 59% of the rules that apply in creating a report.
50-54	If the student is able to fulfill between 50% and 54% of the rules that apply in creating a report.

B. Criterions for the Proposal and Paper for the Final Project

Criteria	**A (90)**	**B (75)**	**C (60)**	**D (50)**
Workflow (Keseluruhan urutan, aliran, dan transisi)	Information being given is explained effectively with a good structure from how the paragraphs is written and the transitions between information hence being able to understand the context easily. A brief summary is given first so that the reader is able to continuously understand the report easily.	The information is provided logically in the paragraphs and transitions. Throughout the report, information is once or twice confusing to the reader.	Information is widely spread hence needing a more compact structure.	There is no obvious order that is written from the paragraphs and the transitions hence the reader is not able to find an ideal flow of how the system works. The details are unorganized and very difficult to comprehend.
Quality of Information	The details provided are compact and very specific, not wasting any space or words, providing only important details about the project.	There are a few details that is unimportant towards the project.	The details are vague and quite difficult to understand.	Unable to find a structured explanation that provides the details of the project.

Introduction	The preliminary paragraph's written are very focused towards the subject and increases the quality of the report.	The preliminary paragraph is stated with focus.	The preliminary paragraph is unclear.	The preliminary paragraph is unclear and does not give any impact towards the report.
Conclusion	The conclusion is able to provide the end result of the project effectively while being interesting and providing clear information.	Able to conclude the important information provided in the report.	The final concluding paragraph has important information but as a whole, does not provide substantial information that concludes the report.	The concluding paragraph is unclear.
Use of Language: **Words Chosen** **Grammar** **Sentence Structuring**	Sentences used are grammatically complete and correct while providing a flow that is easily understandable for the reader. The words used in the sentences provide the exact information needed.	For a major part of the report, the sentences used are grammatically correct and provides a flow that is easily understandable but there are minor mistakes that can take the readers attention away. There are repetitive words and phrases used in the report.	Small mistakes in the structuring and grammar of the sentences are pretty common hence distraction the reader and taking the information away from the reader. There are repetitive words and phrases used commonly.	Major structural and grammar mistakes can commonly be found in the report hence distracting the reader from finding the meaning behind the report. Repetitive words and phrases are more commonly used in the report.
Usage of Pictures: **Numbers** **Graphs** **Pictures**	Every number, graph, and picture are used accurately, consistent with the text provided and has good quality. The labeling of the pictures are used precisely.	Most of the numbers, graphs and pictures are accurate, consisted with the text and has good quality but a few labels are not precise and consistent.	Only a few numbers, graphs, and pictures are used accurately and consistently with the text. The labels are not correctly used in the report.	The numbers, graphs, and pictures have bad quality, inaccurate and has incorrect label usage or no labels at all.

C. Pre-test, Post-test, and Final Exam

1. Able to provide an opinion towards the answer of the question (25%)
2. Able to determine the basic concepts used to answer the question (35%)
3. Able to formulate the final answer towards the question (30%)
4. Able to use the correct units (10%)

D. Criterions for the Peer Review Form

Kriteria	**5**	**4**	**3**	**2**	**1**
Communication	The partner in the course is able to give an explanation that is specific and easy to understand while using helping instruments to explain the concepts easily.	The partner in the course is able to give specific and some are easy to understand explanations while using helping instruments to explain the concepts.	The partner in the course is not able to give a precise and specific explanation towards the concept. Rarely uses instruments to explain the concept.	The explanation given by the partner is not specific and hard to understand while infrequently using instruments to explain the concept.	The explanation given by the partners are incomprehensible and does not use any instruments to provide better explanation towards the concept.

Work Atmosphere	The partners uses polite words while interacting and is contributing actively while not dominating the discussion.	The partner uses polite words while interactive, actively contributes but sometimes dominate the discussion.	The partner sometimes uses impolite words while interacting, contributes less while dominating the discussion.	The partner uses impolite words while interacting, contributes less while highly dominating the discussion.	The partner uses impolite words while interactive, does not contribute at all towards the discussion while fully dominating the discussion.
Openness	The partner actively gives feedback while appreciating other people's opinion.	Most of the time, the partner gives feedback while appreciating other people's opinion.	The partner infrequently gives feedback while most of the times appreciates other people's opinion.	The partner rarely gives feedback while also rarely appreciates other people's opinion.	The partner does not give feedback while not appreciating other people's opinion.
Behavior	The partner cooperates throughout the experiment	The partner cooperates throughout the experiment	The partner is less likely to cooperate	The partner rarely cooperates, does not	The partner does not cooperate at all and

	while accepting a specific task and is responsible towards it.	while accepting a specific task but is not very responsible towards it.	throughout the experiment even though he/she still accepts a certain specific task but is not very responsible	want to accept a certain task.	denies any work given.

E. Criterions for the Psychometric Work throughout the Course

Criteria	**5**	**4**	**3**	**2**	**1**
Work	The student follows the whole procedure of the experiment correctly and consecutively.	The student follows parts of the procedure correctly and consecutively.	The student follows parts of the procedure correctly but not very consecutive.	The student follows most of the procedure incorrectly and inconsecutively.	The student doesn't follow the procedures at all.
Safety	The student is proceeds with caution throughout the whole experiment and is aware of their surroundings.	The student is proceeds with caution throughout the whole experiment and is not fully aware of their surroundings.	The student is proceeds with less caution throughout the whole experiment and is not fully aware of their surroundings	The student rarely proceeds with caution throughout the whole experiment and is not aware of their surroundings	The student is not cautious at all hence endangering their surroundings.

Report	The student is able to write the final results of the experiment completely and is easy to understand.	The student writes the final result of the experiment less completely but is still easily understandable.	The student writes the final result of the experiment less completely but is hard to comprehend.	The student only writes parts of the final result of the experiment and is very hard to comprehend.	The student does not write any of the results found throughout the experiment.
Student Activity	The student actively works while showing interest towards the experiment and actively discusses with others.	The student is less active but shows interest towards the experiment and still actively discuss about the experiment.	The student is sometimes active and shows interest towards the experiment and still actively discuss about the experiment.	The student is rarely active, shows less interest towards the experiment, and rarely discusses about the experiment.	The student is inactive and shows no interest towards the experiment.