TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

LABORATORY WORK OF EMBEDDED SYSTEM

by

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PREFACE

Teaching Instructional Design (BRP) of Laboratory Work of Embedded System is designed as a reference for the studying process in the course Laboratory Work of Embedded System in the Undergraduate Physics Program at FMIPA UI who can be followed by students taking the concentration of Instrumentational Physics in the 6^{th} term and has taken the pervious courses of Electronics 2. In this course, students will analyze concepts on embedded systems and operational systems using the Assembly and C programming language. We hope this BRP can be used as a reference both for the teacher and the student and anyone who hopes to learn Embedded Systems.

Depok, November 2016

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I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Laboratory Work of Embedded System
3.	Course Code	:	SCFI604723
4.	Semester	:	7
5.	Credit	:	1 credit
6.	Teaching Method(s)	:	Laboratory Work, Circuit Simulations, Writing Reports, Individual Tasks, Presentation, and Hand-Written Exam
7.	Prerequisite course(s)	:	Electronics 2
8.	Requisite for course(s)	:	-
9.	Integration Between Other Courses	:	-
10.	Lecturer(s)	:	Surya Darma, M.Si.
11.	Course Description	:	After finishing this course, students taking the concentration of Instrumentational Physics in the 7^{th} 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.

II. Course Learning Outcome (CLO) and Sub-CLOs

1. 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)

2. Sub-CLOs

1. Able to modify (C3) and apply (P4) the Assembly programming language to solve (A5) problems in a day-to-day basis.
2. Able to modify (C3) and apply (P4) the C programming language to solve (A5) problems in a day-to-day basis.
3. Able to analyze (C4) and demonstrate (P2) embedded system concepts to solve problems (A5) in a day-to-day basis.
4. Able to analyze (C4) and demonstrate (P2) operating system concepts to solve problems (A5) in a day-to-day basis.
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.

III. Teaching Plan

Week	Sub-CLO	Study Materials	Teaching Method	Time Required	Learning Experiences (*O-E-F)	Sub-CLO Weighton Course (%)	Sub-CLO Achievement Indicator	References
1	**Introduction towards the contract of the course**							
2	1, 5	Input and Output (I/O) Programming using microcontrollers with the assembly language	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
3	1, 5	Microcontroller interrupt programming using the assembly language	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
4	2, 5	Input and Output (I/O) Programming using microcontrollers with the C language	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
5	2, 5	LCD (Liquid Crystal Display)	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
6	3, 5	Interrupt	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on	The Specific Module

							the rules that apply	
7	3, 5	Timers and Counters	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
8	3, 5	The Analog to Digital Converter (ADC)	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
9	4, 5	RS-232 serial communication between the microcontroller and the PC (Personal Computer)	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
10	4, 5	1-Wire and I2C (Inter-Integrated Circuit)/TWI (2-Wire Interface)	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
11	4, 5	SPI (Serial Peripheral Interface)	Laboratory work, simulations, creating a report	200 minutes	20% O, 60% L, 20% U	12	Able to report the result of the experiment and simulate it in a report based on the rules that apply	The Specific Module
12	**Remedial**							
13	**Remedial**							
14	**Ujian Akhir Semester**							

*) O : Orientation
E : Exercise (Quiz)
F : Feedback

Refences:

1. Mazidi, M.A, Naimi, S., *The AVR Microcontroller and Embedded Systems Using Assembly and C*, Prentice Hall, 2011.
2. Barnett, R.H, Cox, S, O'Cull, L, *Embedded C Programming and The Atmel AVR, 2nd edition*, Thomson Delmar Learning, 2007
3. Noergaard, T., Embedded Systems Architecture: A Comprehensive Guide for Engineers and Prgrammers, Newnes Elsevier, 2005.
4. Catsoulis, J., Designing Embedded Hardware, O'Reilly, 2005

IV. Assignment Design

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 PC (Personal Computer) • 1-Wire and I2C (Inter-Integrated Circuit)/TWI (2-Wire Interface) • SPI (Serial Peripheral Interface)	Individual Tasks at home	1 week	Laboratory Work Report submitted in EMAS

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

V. Assessment Criteria (Learning Outcome Evaluation)

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 3. Final Report	1 every week	70
Final Project	1-5	1. Proposal 2. Paper 3. Presentation 4. Demonstration	1 in the whole term	25
Total				**100**

VI. 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	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 understandabl e 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	The partner uses polite words while interactive,	The partner sometimes uses impolite words while	The partner uses impolite words while interacting,	The partner uses impolite words while interactive,

	is contributing actively while not dominating the discussion.	actively contributes but sometimes dominate the discussion.	interacting, contributes less while dominating the discussion.	contributes less while highly dominating the discussion.	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 while accepting a specific task and is responsible towards it.	The partner cooperates throughout the experiment while accepting a specific task but is not very responsible towards it.	The partner is less likely to cooperate throughout the experiment even though he/she still accepts a certain specific task but is not very responsible	The partner rarely cooperates, does not want to accept a certain task.	The partner does not cooperate at all and 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	The student follows parts of the procedure correctly and consecutively.	The student follows parts of the procedure correctly but	The student follows most of the procedure incorrectly and inconsecutively.	The student doesn't follow the procedures at all.

	correctly and consecutively.		not very consecutive.		
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.