



**TEACHING INSTRUCTIONAL DESIGN (BRP)**  
**COURSE**  
**ELEKTRONICS 2**

**by**

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**Mei 2017**

## **PREFACE**

Teaching Instructional Design (BRP) contains lesson plans for one semester. BRP was arranged to be used as a reference for learning in Electronics 2 at the Department of Physics, Faculty Mathematics and Natural Science, University of Indonesia.

The Electronics 2 course is scheduled to be followed by 4th semester physics students who take as basic knowledge of the Physics study program, on the condition that the student has taken the Electronics 1 course.

In the Electronics 2 course, students will learn the basic concepts of Digital Electronics, then learn in more detail their application for Decoder / Encoder, Multiplexer, ALU (Arithmetic Logic Unit) systems, registers, counters, ADC, DAC and microprocessors. At the end of the lecture, students will present the assignment given by the lecturer according to the lecture topic. Like Elektronik 1, the Elektronik 2 teaching method also uses eLearning which can be accessed through the [scele.ui.ac.id](http://scele.ui.ac.id) page or commonly called SCeLe

We hope, this BRP can be used as a reference for learning process for lecturers and students, as well as people who wish to learn about this course.

Depok, Mei 2017

**Drs. Sastra Kusuma Wijaya, MSc. PhD**

**Dr. Prawito**

**Dr. rer.nat. Martarizal**

## I. General Information

1. Name of Program / Study Level : Physics / Undergraduate
2. Course Name : Elektronik 2
3. Course Code : SCFI602312
4. Semester : 4
5. Credits : 3 Credits
6. Teaching Method(s) : Self Directed Learning, Case Study, Simulation, Problem Based Learning, Project Based Learning
7. Prerequisite course(s) : Elektronik 1
8. Requisite for course(s) : -
9. Integration Between Other Course : Laboratory Work of Electronics 2
10. Lecture(s) :
  1. Drs. Sastra Kusuma Wijaya, MSc. PhD
  2. Dr. Prawito
  3. Dr. rer.nat. Martarizal
11. Course Description : Understand the principles digital electronics and able to apply them in the design of electronic systems.

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

### A. CLO

Students are able to solve the problems and apply digital electronics (C3) (ELO: 2, 5, 6,7)

### B. Sub-CLOs

1	To explain Digital Number, Signal and Switch Systems and able to apply them in simple electronic circuits for troubleshooting (C2, C3)	1
2	To explain basic logic gates and be able to simulate them using MultiSIM for troubleshooting (C2, C3)	1
3	To explain combination logic circuits and their simplification methods and be able to apply them to simple electronic circuits for troubleshooting (C2, C3)	1
4	To explain arithmetic sequence and the circuits and be able to implement it by designing a series of simple calculators (additive multiplier and divisor) for troubleshooting (C2, C3)	1
5	To design IC MSI Circuits: Decoder, Encoder, Multiplexer, Demultiplexer, Comparator (C3)	1
6	To explain Digital Electronics Family (DDL, TTL, CMOS, ECL), characteristic and interface for Troubleshooting (C2, C3)	1
7	To explain PLD (Programmable Logic Device: CPLDs, FPGAs) for troubleshooting (C2, C3)	1
8	To design digital electronics circuits using VHDL (C3)	1
9	To explain Flip-flop and the application: Shift Register, Counter and able to apply them to simple electronic circuits (digital clock, traffic light) for troubleshooting (C2, C3)	1
10	To explain Menjelaskan Algoritmik State Machines (ASM) atau Finite State Machines (FSM) untuk troubleshooting (C2, C3)	1
11	To explain ADC and DAC and able to apply them in simple electronic circuits for troubleshooting (C2, C3)	1
12	To design digital system in project assignment (C3)	3

### III. Teaching Plan

Week	Sub-CLO	Study Materials	Teaching Method	Time Required	Learning Experiences (*O-E-F)	Sub-CLO Weight on Course (%)	Sub-CLO Achievement Indicator	References
1	1	Signal Number System and Digital Switch	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) Binary Number System, Oktal and Heksa b) Serial Signal and Paralel Signal c) Switch Relay, Dioda, Transistor	No. 1 Chapter 1, 2
2	2	Basic Logic Gate	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) AND gate, and OR b) Gerbang inverter, NAND, NOR c) Troubleshooting technique	No. 1 Chapter 3
3	3	Combination Logic Circuit and Simplification	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) Boolean Algebra b) de'Morgen Theorm c) Kernaugh Mapping	No. 1 Chapter 5
4	4	Arithmetic Operation and The Circuit	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) Biner arithmetic, BCD and Heksa b) Complement 2 c) Aritmethic Circuits	No. 1 Chapter 7

							d) Simple calculation application	
5	5	Circuit with IC MSI	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) Comparator b) Decoder, Encoder c) Multiplexer, Demultiplexer	No. 1 Chapter 8
6	6	Digital Electronics Family	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) Characteristic of DDL, TTL, CMOS, ECL b) Inter-face	No. 1 Chap 9
7	7	PLD	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) PLD design flow b) Arsitektur PLD c) PLD application for finish the basic logic design d) FPGA application	No. 1 Chap 4
8	<b>Mid Term Exam</b>							
9	8	Use of VHDL	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of r: a) FPGA Design b) VHDL State Machine	No. 1 Chapter 6, 12, 13
10	9	Flip flop and the application	Self-Directed Learning, Case Study, Simulation,	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) S-R flipflop b) D flipflop c) Master Slave	No. 1 Chapter 10

			Problem Based Learning				d) J-K Flipflop e) Microcontroller Application	
11	10	Algorithmic State Machine (ASM) and Finite State Machine (FSM)	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	a)	No. 1 Chapter
12	11	ADC and DAC	Self-Directed Learning, Case Study, Simulation, Problem Based Learning	150 minutes	O: Introduction (10%) E: Quiz (30%) F: Feedback (60%)	8	To explain the concept of : a) ADC b) DAC	No. 1 Chapter 15
13	12	Project Task	Project Based Learning	150 minutes	O: Introduction (10%) E: Presentation (80%) F: Feedback (10%)	12	To construct a kit	
14	12	Project Task	Project Based Learning	150 minutes	O: Introduction (10%) E: Presentation (80%) F: Feedback (10%)			
15	12	Project Task	Project Based Learning	150 minutes	O: Introduction (10%) E: Presentation (80%) F: Feedback (10%)			
16	<b>Final Exam</b>							

\*) O : Orientation  
E : Exercise  
F : Feedback

Reference:

1. W. Kleitz, *Digital Electronics, 9<sup>th</sup> ed*, Prentice Hall, 2012
2. J. Bignell, R. Donovan, *Digital Electronics, 5<sup>th</sup> ed*, Delmar Cengage Learning, 2006

#### IV. Assignment Design

Week	Assignment	Sub-CLO	Assignment	Scope	Working Procedure	Deadline	Outcome
1	Online Quiz & quiz in class, homework and simulation	1	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
2	Online Quiz & quiz in class, homework and simulation	2	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
3	Online Quiz & quiz in class, homework and simulation	3	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
4	Online Quiz & quiz in class, homework and simulation	4	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
5	Online Quiz & quiz in class, homework and simulation	5	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
6	Online Quiz & quiz in class, homework and simulation	6	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan



7	Online Quiz & quiz in class, homework and simulation	7	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
9	Online Quiz & quiz in class, homework and simulation	8	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
10	Online Quiz & quiz in class, homework and simulation	9	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
11	Online Quiz & quiz in class, homework and simulation	10	Problem set	Writing resume of a topic Working on essay Doing a simulation	Individual Assignment & Online Task	150 minutes	Online quiz results and quiz in class. Upload scan
12	Online Quiz & quiz in class, homework and simulation	11	Problem set	Doing a simulation	Individual Assignment	150 minutes	Presentation file in <i>power point</i> format
13-15	Design Project	12	Final Project	Design a kit	Individual Assignment	150 minutes	Presentation file in <i>power point</i> format

## V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Online quiz (first and last material)	1 - 11	SceLe	11	20
Quiz in class (first and last material)	1 - 11	Evaluation Sheet	11	
Homework and simulation	1 - 11	SceLe	11	10
Project assignment	12	Evaluation Sheet	1	10
Mid-Term Exam	1 - 7	Problem Set Essay	1	30
Final Exam	8 - 11	Problem Set Essay	1	30
<b>Total</b>				<b>100</b>

## VI. Rubric(s)

### A. Criteria of Presentation Score

Score	Presentation Delivery
85-90	Group is able to deliver the explanation logically, fluently, and punctual and be able to answer the questions from other students and lecturer
75-84	Group is able to deliver the explanation logically and fluently and be able to answer the questions from other students and lecturer, but be less punctual on delivering the explanation
65-74	Group is able to deliver the explanation fluently, but be less able to deliver the reasoning logic of the explanation
55-64	Group is less able to deliver the explanation fluently and punctual and be less able to deliver the reasoning logic of the explanation
<55	


### B. Criteria of Essay Score

Score	Answer Quality
100	Answer is very precise and all the concept and main component are explained completely
76-99	Answer is fairly precise and the concept and main component are explained fairly complete
51-75	Answer is less precise and the concept and main component are explained less complete


26-50	Answer is poorly precise and the concept and main component are explained poorly complete
<25	Answer is wrong

## VII. Appendix: Example of Exam Problems

### Appendix 1 . Example of Pre Test

 Note: This quiz is not currently available to your students

Page: (Previous) 1 2 3 4 5 6 7 8 (Next)


**7**  Treating a connecting wire as a conductor with zero resistance is an example of the

Marks: --/1

Choose one answer.

- a. Higher approximation
- b. Second approximation
- c. Ideal approximation
- d. Exact model

Submit

**8**  The voltage out of an ideal voltage source

Marks: --/1

Choose one answer.

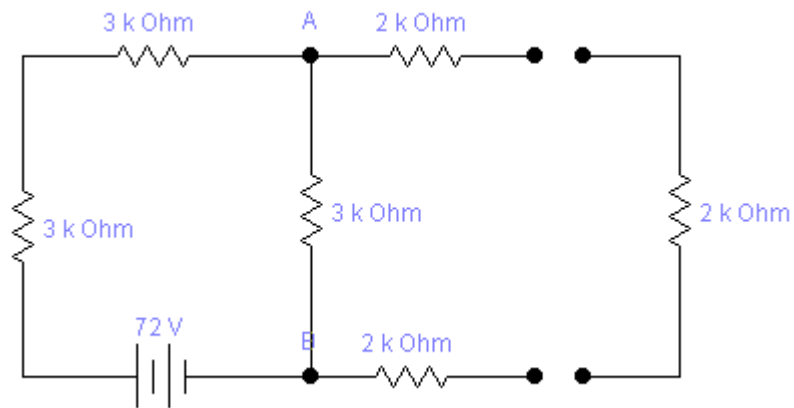
- a. Depends on the value of load resistance
- b. Is zero
- c. Depends on the internal resistance
- d. Is constant

Submit

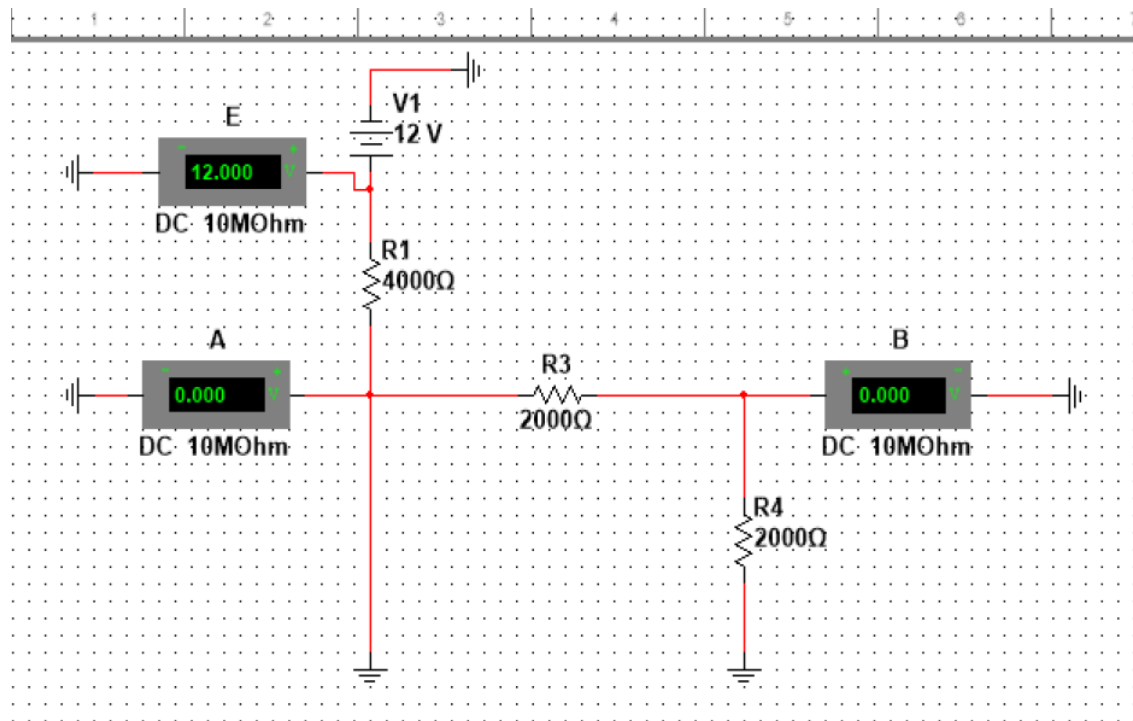
Save without submitting   Submit page   Submit all and finish

### Appendix 2 . Example of Quizzes

1. Beda Voltage source dan Current Source
2. Grafik stiff
3. Bgmn menentukan  $V_{th}$   $R_{th}$  bila ada blackbox
4. Hitung IL untuk rangkaian sederhana, gunakan  $V_{th}$  dan  $R_{th}$



### Appendix 3 . Simulation Program with Multisim



## **Appendix 4 . Examination**

3. Design a zener regulator to meet these specifications: Load voltages are +12V and -12V and load current 20 mA. Please use a transformer 10:1 and a bridge rectifier. Proof your design, whether regulator works still well, if the ac line voltage of PLN in your area varies 10 %

## **Appendix 5 . Final Project**

1. Create a 4 to 7 encoder to turn on 7 segments
2. Create digital clock 24 in form minutes.