TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

LABORATORY WORK OF ADVANCED PHYSICS

by

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PREFACE

The Teaching Instruction Design (BRP) for the Laboratory Work of Advanced Physics course is designed to be a teaching reference for the learning process for the Laboratory Work of Advanced Physics course in the Universitas Indonesia Faculty of Mathematics and Natural Sciences Undergraduate Program in Physics which is enrolled by 4^{th} term physics students under the condition that they have taken the Modern Physics course. In the Laboratory Work of Advanced Physics course, students will be taught to analyze advanced physics concepts and to operate measuring instruments in a laboratory. It is hoped this BRP can be a reference during the learning process, both for lecturers and for students so that the content of this course is delivered well, and the teaching goals of this course are achieved.

Depok, 14 November 2016

Dr. Arief Sudarmaji, M.T.

I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Laboratory Work of Advanced Physics
3.	Course Code	:	SCFI602122
4.	Semester	:	4
5.	Credit	:	1 credit
6.	Teaching Method(s)	:	Laboratory work, data processing, report writing, individual assignment, and written exam.
7.	Prerequisite course(s)	:	Modern Physics
8.	Requisite for course(s)	:	-
9.	Integration Between Other Courses	:	-
10.	Lecturer(s)	:	Dr. Arief Sudarmaji, M.T.
11.	Course Description	:	After finishing this course, 4th term physics students are expected to be able to analyze (C4) concepts in advanced physics and operate (P3) measuring instruments in daily life correctly to solve (A5) extant problems according to the applicable laws of Physics. The language of teaching in this course is Bahasa Indonesia.

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

A. CLO

It is hoped that after the completion of this course, students are able to analyze (C4) concepts in advanced physics and operate (P3) measuring instruments in daily life correctly to solve (A5) extant problems according to the applicable laws of Physics. (PLO(s) 1,2,5,6,8)

B. Sub-CLO

It is hoped that after the completion of this course students are able to:

1. analyze (C4) and demonstrate (P2) concepts in mechanics to solve (A5) problems in daily life,
2. analyze (C4) and demonstrate (P2) concepts in electricity and magnetism to solve (A5) problems in daily life,
3. analyze (C4) and demonstrate (P2) concepts in optics to solve (A5) problems in daily life.
4. analyze (C4) and demonstrate (P2) concepts in nuclear and particle physics to solve (A5) problems in daily life.
5. analyze (C4) dan demonstrate (P2) concepts in solid-state physics to solve (A5) problems in daily life.
6. use (C3) and operate (P3) measuring instruments in physics to solve (A5) problems in daily life.
7. investigate (C3) and report (P2) advanced physics phenomenon and make (A2) laboratory work reports according to existing guidelines.

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	**Introduction on course contract**							
2	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
3	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
4	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
5	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
6	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
7	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
8	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in	Leybold-Heraeus, Physics Experiment,

							a report according to existing guidelines.	vol. 1,2 & 3, Leybold GmBH, 1986.
9	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
10	1-7	One of the modules from the course material, according to group allocation	Laboratory work and report writing	200 minutes	20% O, 60% E, 20% F	15	Students can report laboratory work results in a report according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
11	**REMEDIAL**							
12	**REMEDIAL**							
13	1-5	Laboratory modules that have been done	Presentation of laboratory reports for modules that have been done	200 minutes	20% O, 60% E, 20% F	10	Students can explain laboratory work results in presentation form according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
14	1-5	Laboratory modules that have been done	Presentation of laboratory reports for modules that have been done	200 minutes	20% O, 60% E, 20% F	10	Students can explain laboratory work results in presentation form according to existing guidelines.	Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
15	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

1. J.P Holman, Experimental Method for Engineers, 7th ed., McGraw-Hill Book, Inc, 2001.
2. Ogawa Seiki, Instruction Manual: e/m Demonstration Apparatus, OGAWA SEIKI, Tokyo Central PO Box No.1618 Tokyo Japan, 1987

3. Leybold-Heraeus, Physics Experiment, vol. 1,2 & 3, Leybold GmBH, 1986.
4. Pasco Heat conduction Apparatus, Instruction Manual 012-09189A, www.pasco.com, 2012.
5. Teach Spin, Faraday Rotation, Guide to the experiment, Teach Spin.Inc., Tri-Main Centre-Suite 409, 2495 Main Street.Buffalo, NY 14214-2153, 2012

IV. Assignment Design

Week	Assignment Name	Sub-CLO	Assignment	Scope	Working Procedure	Deadline	Outcome
2-10	Laboratory report	SUB-CLO 1-7	Making laboratory reports	• Torsional Oscillator • Magnetic Torque • Microwaves • Thomson Tube • Thermal Radiation • Zeeman Effect • Radioactive Decay and Half-life • Franck-Hertz Effect • Nuclear Magnetic Resonance • Rutherford Scattering • Electron Spin Resonance • Hall Effect (Metal) • Hall Effect (Semiconductor) • Hysteresis	Individual Homework	1 Week	Submitted laboratory reports
2-10	Pre-test	SUB-CLO 1-7	Solving problem sets	• Torsional Oscillator • Magnetic Torque • Microwaves • Thomson Tube • Thermal Radiation • Zeeman Effect • Radioactive Decay and Half-life • Franck-Hertz Effect • Nuclear Magnetic Resonance • Rutherford Scattering	Answering the problem set	30 minutes	Submitted problem set answers

				• Electron Spin Resonance • Hall Effect (Metal) • Hall Effect (Semiconductor) • Hysteresis			
13-14	Presentation	SUB-CLO 1-5	Presentation of laboratory reports for modules that have been done	• Torsional Oscillator • Magnetic Torque • Microwaves • Thomson Tube • Thermal Radiation • Zeeman Effect • Radioactive Decay and Half-life • Franck-Hertz Effect • Nuclear Magnetic Resonance • Rutherford Scattering • Electron Spin Resonance • Hall Effect (Metal) • Hall Effect (Semiconductor) • Hysteresis	1. Making a presentation of laboratory work results 2. Presenting laboratory work results	1Week	Submitted presentation
15	Final Exam	SUB-CLO 1-5	Solving exam questions	All laboratory Work of Advanced Physics course materials	Answering final exam questions	100 minutes	Submitted final exam answers

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Laboratory work	1-7	1. Laboratory report 2. Pre-test 3. Laboratory work	1 each week	70
Presentation	1-5	Presentation	1	20
Final exam	1-5	Exam questions	1	10
Total				**100**

VI. Rubric

A. Criteria of Laboratory Reports Score

Score	Answer Quality
>90	Students can follow over 90% of laboratory report guidelines correctly
70-89	Students can follow between 70% to 89% of laboratory report guidelines correctly
60-69	Students can follow between 60% to 69% of laboratory report guidelines correctly
55-59	Students can follow between 55% to 59% of laboratory report guidelines correctly
50-54	Students can follow between 50% to 54% of laboratory report guidelines correctly

B. Criteria of Laboratory Reports Score

Criteria	A (90)	B (75)	C (60)	D (50)
Organization (Entirety of sequence, flow, and transition)	Information is presented in an effective order. The excellent structure of paragraphs and transitions improves readability and comprehension. The executive summary or abstract is presented first, allowing the reader to easily follow the rest of the report.	Information is logically ordered by paragraphs and transitions. Within a section, the order in which ideas are presented may be confusing at times.	Information is scattered and needs further development.	There is no clear sequence of paragraphs, resulting in no progressive flow of ideas. The details and examples are disorganized, difficult to follow and understand.
Information Quality	Supporting details are specific to the topic and provide relevant information.	Several details are not relevant to the report topic.	Details are vague	Unable to find specific details.
Introduction	The introductory paragraph is clearly stated, has a sharp focus, is different, and increases the impact of the report.	The introductory paragraph is clearly stated and focused.	The introductory paragraph is unclear.	The introductory paragraph is unclear.
Conclusion	The closing paragraph summarizes the prior paragraphs clearly and succinctly. The closing paragraph draws	The closing paragraph summarizes the prior paragraphs, report discussion, and draws	Closing paragraph distantly connected with the report topic.	Closing paragraph unclear.

	conclusions that are effective and increase the impact of the report.	conclusions.		
Use of language: choice of words, grammar, and sentence structure	Sentences are complete and grammatical, and they flow together easily. The word is chosen for its proper meaning.	For the most part, sentences are complete and grammatical, and they flow together easily. Every mistake is minor and does not distract the reader. Repetition of the same words and phrases is avoided.	Minor mistakes in sentence structure and grammar are frequent enough that they detract from the reader and distract from meaning. There are unnecessary repetitions of the same words and phrases.	Major mistakes in sentence structure and grammar are frequent enough that they distract the reader and interfere with meaning. There are unnecessary repetitions of the same words and phrases.
Use of pictures: numbers, graphs, and pictures	All numbers, graphics, and images used are accurate, consistent with the text, and of good quality. Appropriate and consistent labeling.	For the most part, the numbers, graphics, and images used are accurate, consistent with the text, and of good quality. Some labels are imprecise and consistent.	Few of the numbers, graphics, and images used are accurate, consistent with the text, and of good quality. They are not properly labeled.	Numbers, graphics, and images are of poor quality, have lots of inaccuracies & mislabelling, or none at all.

C. Pre-test and Final Exam

Students can:

1) express ideas in solving problems (25%),
2) decide the correct basic concepts in solving problems (35%),
3) formulate the solutions to problems without language errors (30%),
4) use the appropriate significant units and figures (10%).

D. Criteria of Laboratory Work Peer Review Form

Criteria	5	4	3	2	1
Communication	Laboratory participant gave specific and easy to understand explanations and utilized the various tools or methods to facilitate understanding	Laboratory participant gave specific and moderately understandable explanations and utilized the various tools or methods to facilitate understanding	Laboratory participant gave less specific and hard to understand explanations, and less utilized the various tools or methods to facilitate understanding	Laboratory participant gave unspecific and hard to understand explanations, and less utilized the various tools or methods to facilitate understanding	Laboratory participant gave unspecific and ununderstandable explanations and did not use the various tools or methods to facilitate understanding
Work Atmosphere	Laboratory participant used respectful language in their interaction, contributed actively, and did not dominate the discussion	Laboratory participant used respectful language in their interaction, partially contributed, and slightly dominated the discussion	Laboratory participant used disrespectful language in their interaction, partially contributed, and dominated the discussion	Laboratory participant used disrespectful language in their interaction, contributed little, and strongly dominated the discussion	Laboratory participants used disrespectful language in their interaction, did not contribute, and overwhelmingly dominated the discussion
Openness	Laboratory participant provided feedback and respected other people's opinions	Laboratory participant provided partial feedback and respected other people's opinions	Laboratory participant provided little feedback and sightly disrespected other people's opinions	Laboratory participants provided little feedback and disrespected other people's opinions	Laboratory participants did not provide feedback and disrespected other people's opinions
Behavior	Laboratory participant fully cooperated in conducting experiments and accepted	Laboratory participant fully cooperated in conducting experiments and accepted specific roles	Laboratory participants cooperated in conducting experiments and accepted specific roles	Laboratory participants cooperated in conducting experiments but refused to accept specific roles	Laboratory participants did not cooperate in conducting experiments and refused to accept specific roles

	specific roles responsibly	albeit irresponsibly	albeit irresponsibly		

E. Criteria of Psychomotor Scoring for Laboratory Work

Criteria	5	4	3	2	1
Work	Laboratory participant followed all procedures properly and in order	Laboratory participant followed some procedures properly and in order	Laboratory participant followed some procedures properly but not in order	Laboratory participant followed some procedures poorly and out of order	Laboratory participant did not follow procedures correctly
Safety	Laboratory participant was careful and was aware of their surroundings	Laboratory participant was careful and was slightly unaware of their surroundings	Laboratory participant was slightly careless and was slightly unaware of their surroundings	Laboratory participant was careless and was not aware of their surroundings	Laboratory participant was completely careless and was not aware of their surroundings
Report	Laboratory participant wrote their laboratory results completely and in an understandable manner	Laboratory participant wrote their laboratory work results incompletely but in an understandable manner	Laboratory participant wrote their laboratory work results incompletely and in a hard to understand manner	Laboratory participant wrote portions of their laboratory work results incompletely and in a hard to understand manner	Laboratory participant did not write their laboratory work results
Activeness	Laboratory participant actively worked, showed interest in the experiment, and frequently discussed or asked questions	Laboratory participant actively worked but showed little interest in the experiment, although was frequent to discuss or ask question	Laboratory participant less actively worked and showed little interest in the experiment, although was frequent to discuss or ask questions	Laboratory participants less actively worked, showed no interest in the experiment, and seldom discussed or asked questions	Laboratory participants did not actively work, showed no interest in the experiment, and did not discuss or ask questions