TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

BASIC PHYSICS

by

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PREFACE

The Basic Physics course contains basic concepts of Physics related to mechanics, electricity and magnetism, vibration, waves, optics, and the basics of Modern Physics. Conventionally, this subject is taught in class using through lecture (teacher centered learning). The lecturer explains the basic concepts and provides some related examples. Meanwhile, students listen and take notes from the explanations. Students are expected to grasp and understand the course material through an independent study and completing homework assignments.

The current world is growing at a rapid pace accompanied by huge development of knowledge and also the needs of educational stakeholders, necessitates a change in the educational paradigm from a transfer of knowledge paradigm to a knowledge building paradigm. In accordance with this paradigm shift, students will study this Basic Physics courses with a combination of several active learning methods (student centered learning), namely interactive lectures, computer assisted learning, and project-based learning. With these methods, in addition to learning basic physics concepts, students can train and hone their soft skills through activities during lectures such as during group assignments. In addition, students can also develop skills using information technology and computers through e-learning system.

This Teaching Instructional Design book was prepared as a complement to teaching in the Department of Physics, Faculty of Mathematics and Natural Sciences at the University of Indonesia. This book is a guideline for activities during the learning process. Thus, the learning process carried out by students can be directed and, in the end, the learning objectives can be achieved.

Depok, 26 November 2016

Djati Handoko, Ph.D.

I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Basic Physics
3.	Course Code	:	SCFI601110
4.	Semester	:	1
5.	Credit(s)	:	2 Credits
6.	Teaching Methods(s)	:	Interactive learning, computer assisted learning, and project-based learning
7.	Prerequisite Course(s)	:	None
8.	Requisite Course(s)	:	Electricity and Magnetism, Vibrations, Waves, and Optics, Laboratory Work of Basic Physics 1
9.	Integration Between Other Courses	:	None
10.	Lecturer(s)	:	Djati Handoko, Ph.D.
11.	Course Description	:	The Basic Physics course covers basic topics of Physics, namely mechanics, electricity and magnetism, heat physics, waves, and optics, as well as the basics of modern physics. Students learn through a combination of several active learning methods, namely interactive lectures. Students have the opportunity to learn to integrate basic conceptual understanding, analytical skills, and numerical skills in studying these topics. Students also learn to explain and analyze the natural phenomena and human engineering around them by using basic physics concepts and applying them to everyday life. In addition, students can develop the ability to synthesize and evaluate both qualitatively and quantitatively the natural phenomena and human engineering by using basic physics concepts. After attending this course, 1st year students are expected to be able to formulate solutions to basic physics problems. This course will be taught in Indonesian.

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

A. CLO

Students are able to apply the principle and concepts of basic physics to formulate a solution for a given problems (ELO(s) 1, 2, 5, 6, 7).

B. Sub-CLOs

1. Able to apply mechanics, fluid mechanics, and heat concepts in everyday life.
2. Able to apply waves and vibrations concepts in everyday life.
3. Able to apply electricity and magnetism concepts in everyday life.
4. Able to apply optics concept in everyday life.
5. Able to apply basic modern physics concepts in everyday life.

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	• Motion law, translation, and rotation	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the law of motion for translation and rotation	[1], [2], and [3]
2	1	• Mechanics, Conservation of Energy, Momentum and Energy	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept and calculation of energy and momentum	[1], [2], and [3]
3	1	• Static and Dynamic Fluid	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept of fluid mechanics	[1], [2], and [3]
4	1	• Heat, Expansion, Calor, Termodynamic and Heat Engine	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept of heat and thermodynamics	[1], [2], and [3]
5	2	• Vibrations and Waves	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept of vibrations and waves	[1], [2], and [3]
6	2	• Mechanical Waves and Sound Waves	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain mechanical waves and its principle	[1], [2], and [3]
7	**Mid-Term Exam**							
8	3	• Static Electricity and Capacitor	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept of charge, Gauss law, and electric field	[1], [2], and [3]
9	3	• Current and Dynamic Electricity	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept of current,	[1], [2], and [3]

							electric circuit, and power	
10	3	• Magnetostatic, Induction, and AC Circuit	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the mechanism of induction and its application on RLC circuit	[1], [2], and [3]
11	4	• Electromagnetic Waves	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept of electromagnetic wave and Maxwell equation	[1], [2], and [3]
12	4	• Light Waves and Optics	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the concept of light as wave and optics device	[1], [2], and [3]
13	5	• Basic Modern Physics and Atom	Interactive learning	100 minutes	20% O, 60% E, 20% F	8.33	Able to explain the history of modern physics and atomic theory	[1], [2], and [3]
14	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

1. Ostdiek, Inquiry into Physics 7th Edition, John Wiley & Sons, Inc., 2013.
2. Cutnell and Johnson, Physics 9th, Wiley, 2012
3. E. R. Huggins, Physics 2000, Moose Mountain Digital Press 2000.

IV. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
2, 5, 6, 8, 11, 12, 13,	Individual Assignment 1-7	1, 2, 3, 5	Homework	• Motion law, translation, and rotation • Static and Dynamic Fluid • Heat, Expansion, Calor, Thermodynamic and Heat Engine • Mechanical Waves and Sound Waves • Static Electricity and Capacitor • Current and Dynamic Electricity • Basic Modern Physics and Atom	At home	1 week	Answer sheet
3-4, 7	Group Assignment 1 & 2	1, 2	Group Assignment	• Mechanics, Conservation of Energy, Momentum and Energy • Vibrations and Waves	At home	1 week	Submitted file
7	Mid-Term Exam	1-2	Problem sets	• Mechanics, Conservation of Energy, Momentum and Energy • Static and Dynamic Fluid • Heat, Expansion, Calor, Termodynamic and Heat Engine • Vibrations and Waves • Mechanical Waves and Sound Waves	Exam	100 minutes	Answer sheet

14	Final Exam	3-5	Problem sets	• Static Electricity and Capacitor • Current and Dynamic Electricity • Magnetostatic, Induction, and AC Circuit • Electromagnetic Waves • Light Waves and Optics • Basic Modern Physics and Atom	Exam	100 minutes	Answer sheet

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLOs	Assessment Type	Frequency	Evaluation Weight (%)
Pretest & Posttest	1-5	Answer sheet	1+1 each week	10
Quiz	1-5	Answer sheet	4	10
Individual Assignment	1-4	Answer sheet	7	8
Group Assignment	1-2	Submitted file	2	7
Attendance	1-5	Attendance list	1 each week	5
Mid-Term Exam	1-2	Answer sheet	1	30
Final Exam	3-5	Answer sheet	1	30
Total				**100**

VI. Rubric(s)

A. Criteria of Individual Assignment

Score	Answer Quality
>90	Student able to answer 90% of the problem sets correctly
70-89	Student able to answer 70-89% of the problem sets correctly
60-69	Student able to answer 60-69% of the problem sets correctly
55-59	Student able to answer 55-59% of the problem sets correctly
50-54	Student able to answer 50-54% of the problem sets correctly
<50	Students able to answer <50% of the problem sets correctly

B. Criteria of Group Assignment

Score	Answer Quality
90-100	Students are able to apply basic concepts in explaining natural phenomena and technology with an accuracy of 80-90%, have a clear order, and appropriate wording.
70-89	Students are able to apply basic concepts in explaining natural phenomena and technology with an accuracy of 60-79% accuracy with appropriate wording.
60-69	Students are able to apply basic concepts in explaining natural phenomena and technology with an accuracy of 59% or less with appropriate wording.

C. Criteria of Pretest, Posttest, Quiz, Mid-Term Exam, and Final Exam

1) Able to write down their ideas and use it to solve a problem (25%);

2) Able to use the correct concept in solving the problem (35%);

3) Able to formulate the final result correctly (30%);

4) Able to use the appropriate dimension, units, and significant figures (10%);