TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

THERMODYNAMICS

by

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December 2017

PREFACE

The book of Teaching Instructional Design or abbreviated as BRP contains lesson plans for one semester. BRP compiled to be used as a reference for learning Thermodynamics courses in Departemen Physics, Faculty Mathematics and Natural Science, University of Indonesia, for third semester physics students, provided that the students have taken Basic Physics 3 and Basic Mathematics 2 courses.

This book is structured as a document to complement the 2016 Curriculum. With the drafting of this BRP, it is hoped that become a reference to the learning process for lecturers and student participants in particular as well and also people who want to learn it.

Depok, 22 Desember 2017

Dedi Suyanto, Ph.D.

I. General Inforamation

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Thermodynamic
3.	Course Code	:	SCFI602112
4.	Semester	:	3
5.	Credits	:	3 Credits
6.	Teaching Method(s)	:	Podium Lectures, Individual and Group Assignments, Written Examination
7.	Prerequisite course(s)	:	Basic Physics 3, Basic Mathematics 2
8.	Requisite for course(s)	:	Statical Physics
9.	Integration Between Other Course	:	-
10.	Lecture(s)	:	Dedi Suyanto, Ph.D.
11.	Course Description	:	Thermodynamics course is a compulsive course for Departement of Physics, explaining basic concepts thermodynamics (0 to 3 thermodynamics laws) from empirical review and expand mathematical formulations, and their use in various thermodynamics system .

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

A. CLO

After students complete the learning process of this course, if they are faced with thermodynamic problems, they are able to handle it so that they can understand phenomena in the fields of solids, nuclear and particles, techniques, and their applications.

B. Sub-CLOs

1. To understand and apply the concept of temperature and zeroth law of thermodynamics (C3)
2. To understand and apply the concept of work and reversible process thermodynamics (C3)
3. To understand and apply the concept first law of thermodynamics (C3)
4. To understand and apply the concept second law of thermodynamics (C3)
5. To understand and apply the concept of Entropy(C3)
6. To understand and apply the concept of Thermodynamic Potential and relation Maxwell equation (C3)
7. To understand and apply the concept transition of phase (C3)
8. To understand and apply the concept of open thermodynamic system and chemical potential (C3)
9. To understand and apply the concept third law of thermodynamics III(C3)
10. To understand and apply the concept kinetic theory of gases (C3)

III. Teaching Plan

Week	Sub-CLO	Study Material	Teaching Method	Time Required	Learning Experiences (*O-E-F)	Sub-CLO Weight on Course (%)	Sub-CLO Achievement Indicator	Reference
1	1	Understand the concept of temperature and thermal equilibrium	Podium Lectures	150 minutes	70% O, 30% F	6	Students can understand the concept of temperature and thermal equilibrium	1) Chapter 1 1) Chapter 2 3) Chapter 1 3) Chapter 2
2	1	Zeroth law of thermodynamics	Podium Lectures	150 minutes	70% O, 30% F	6	Students can understand zeroth law of thermodynamics	1) Chapter 1 1) Chapter 2 3) Chapter 1 3) Chapter 2
3	2	Understand the concept of process in thermodynamic	Podium Lectures	150 minutes	70% O, 30% F	6	Students can understand the concept of process in thermodynamic	1) Chapter 1 1) Chapter 2 3) Chapter 1 3) Chapter 2
4	2	Understand and apply the concept of work reversible process	Podium Lectures	150 minutes	70% O, 30% F	6	Students can understand and apply the concept of work reversible process	1) Chapter 3
5	2	Understand the concept of work in thermodynamic process	Podium Lectures	150 minutes	70% O, 30% F	6	Students can understand the concept of work in thermodynamic process	1) Chapter 4 3) Chapter 3
6	3	Understand heat, work, and internal energy	Podium Lectures	150 minutes	70% O, 30% F	10	Students can understand heat, work, and internal	1) Chapter 4 3) Chapter 3

							energy	
7	3	Understand thermodynamic equilibrium and first law of thermodynamic	Podium Lectures	150 minutes	70% O, 30% F	10	Students can understand thermodynamic equilibrium and first law of thermodynamic	1) Chapter 4 3) Chapter 3
8	**Mid Term Exam**							
9	4	Understand the second law of thermodynamic and Carnot Machine	Podium Lectures	150 minutes	70% O, 30% F	10	Students can understand the second law of thermodynamic and Carnot Machine	1) Chapter 6 1) Chapter 7 3) Chapter 4
10	5	Understand the second law of thermodynamic and Entropy	Podium Lectures	150 minutes	70% O, 30% F	10	Students can understand the second law of thermodynamic and Entropy	1) Chapter 8 3) Chapter 5
11	6	Understand the concept of thermodynamic potential and relation Maxwell equation	Podium Lectures	150 minutes	70% O, 30% F	10	Students can understand the concept of thermodynamic potential and relation Maxwell equation	3) Chapter 3 3) Chapter 7
12	7	Understand and apply the concept transition phase	Podium Lectures	150 minutes	30% O, 40% E, 30% F	6	Students can understand and apply the concept transition phase	3) Chapter 10
13	8	Understand and apply the concept open thermodynamic system and chemical potential	Podium Lectures	150 minutes	30% O, 40% E, 30% F	4	Students can understand and apply the concept open thermodynamic system and chemical potential	3) Chapter 11

14	9	Understand and apply the concept third law of thermodynamic	Podium Lectures	150 minutes	30% O, 40% E, 30% F	6	Students can understand and apply the concept third law of thermodynamic	3) Chapter 12
15	10	Understand and apply the concept kinetic theory of gases	Podium Lectures	150 minutes	30% O, 40% E, 30% F	4	Students can understand and apply the concept kinetic theory of gases	2) Chapter
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feed Back

Reference:

1. Zemansky, Dittman: Heat and Thermodynamics 7th ed Mc Graw-Hill 1997
2. Sears,Salinger : Thermodynamics,Kinetics Theory and Statistical Thermodynamics Addison Wesley 1975.
3. C.J Adkin: Equilibrium Thermodynamics 3rd ed 1984 Cambridge University Press.
4. M.C Potter, C.W Somerton: Theory and Problem of Engineering Thermodynamics, Mc Graw Hill 1993.

IV. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedur	Deadline	Outcome
3	Individual assignment 1	1	Problem set	Temperature and zeroth law of thermodynamic. Work system and reversible process thermodynamic	Individual assignment at home	1 week	Answer sheet
5	Individual assignment 2	2	Problem set	First law of thermodynamic	Individual assignment at home	1 week	Answer sheet
7	Individual assignment 3	3	Problem set	Second law of thermodynamic	Individual assignment at home	1 week	Answer sheet
11	Individual assignment 4	4	Problem set	Entropy	Individual assignment at home	1 week	Answer sheet
12	Group assignment 1	5	Refers to refrences	Thermodynamic potential	Group discussion consist of 3-4 students	2 week	Presentation in *power point*
13	Individual assignment 5	5	Problem set	Transition phase	Individual assignment at home	1 week	Answer sheet
13	Group assignment 2	6	Refers to refrences	Multi-component system thermodynamic	Group discussion consist of 3-4 students	2 week	Presentation in *power point*
15	Individual assignment 6	6	Problem set	Third law of thermodynamic and kinetic theory of gases	Individual assignment at home	1 week	Answer sheet

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Individual assignment	1-4	Answer Sheet	6	20
Group assignment	5-6	Assessment Sheet	2	20
Mid-Term Exam	1-3	Answer Sheet	1	30
Final Exam	4-6	Answer Sheet	1	30
Total				**100**

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