TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

PHYSICS OF ENERGY

by

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PREFACE

The Teaching Instructional Design (BRP) of the Physics of Energy course was prepared to be used as a guideline for Physics of Energy course in the Physics Undergraduate Study Program of the Faculty of Mathematics and Natural Sciences Universitas Indonesia, which was attended by 6th semester physics students that had taken the Introduction to Nuclear Physics and Thermodynamics courses. In this course, students will be taught about new and renewable energy sources as well as the ability to apply physics concepts to the analysis of power generation systems to identify and solve problems faced in everyday life. It is hoped that this guideline can become helpful in the learning process for both lecturers and student so that the material is conveyed properly and perfectly.

Depok, 16 November 2016

Dr. Eng. Yunus Daud,
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I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Physics of Energy
3.	Course Code	:	SCFI602116
4.	Semester	:	6
5.	Credit(s)	:	2 Credits
6.	Teaching Methods(s)	:	Interactive learning, self-directed study, assignment, and written exams.
7.	Prerequisite Course(s)	:	Introduction to Nuclear Physics, Thermodynamics
8.	Requisite Course(s)	:	None
9.	Integration Between Other Courses	:	None
10.	Lecturer(s)	:	Dr. Eng. Yunus Daud, Dipl.Geotherm Tech., M.Sc.
11.	Course Description	:	After completing this course, 6th semester physics student will be able to apply physics concepts to the analysis of power generation systems in everyday life appropriately to solve existing problems in accordance with the laws of physics. This course will be taught in Indonesian.

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

A. CLO

Students are able to apply physics concepts to the analysis of power generation systems in everyday life to solve existing problems (ELO(s) 1, 2, 5, 6).

B. Sub-CLOs

1. Able to apply thermodynamics concepts to the analysis of power generation systems in everyday life to solve existing problems
2. Able to apply modern physics concepts to the analysis of power generation systems in everyday life to solve existing problems
3. Able to apply mechanics and heat concepts to the analysis of power generation systems in everyday life to solve existing problems
4. Able to apply fluid mechanics concepts to the analysis of power generation systems in everyday life to solve existing problems

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 to course**							
2	1	• Energy Regulations in Indonesia	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.5	Able to explain energy regulations of Indonesia	Related books and articles
3	1	• Fossil Energy and Energy Crisis	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.5	Able to explain energy sources of Indonesia	Related books and articles
4	1	• New and Renewables Energy	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.5	Able to mention new and renewable energy sources	Related books and articles
5	2	• Nuclear Energy	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	11.25	Able to explain the mechanism of nuclear power plant	Related books and articles
6	3	• Geothermal Energy	Interactive learning, question-based learning, self-	100 minutes	20% O, 60% E, 20% F	11.25	Able to explain the mechanism of geothermal power plant	Related books and articles

			directed study					
7	2	• Solar Energy	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	11.25	Able to explain the mechanism of solar panel	Related books and articles
8	**Mid-Term Exam**							
9	4	• Hydro Energy	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	11.25	Able to explain the mechanism of hydro power plant	Related books and articles
10	4	• Wind Energy	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.5	Able to explain the mechanism of wind turbines	Related books and articles
11	3	• Biomass Energy	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	11.25	Able to explain the mechanism of biomass power plant	Related books and articles
12	4	• Waves Enery	Interactive learning, question-based learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.5	Able to explain the mechanism of wave power plant.	Related books and articles
13	1-4	• Application of Physics of Energy	Group discussion	100 minutes	20% O, 60% E, 20% F	3.33	Able to explain the methods of using renewables	Related books and articles

							as main source of energy	
14	1-4	• Application of Physics of Energy	Group discussion	100 minutes	20% O, 60% E, 20% F	3.33	Able to explain the methods of using renewables as main source of energy	Related books and articles
15	1-4	• Application of Physics of Energy	Group discussion	100 minutes	20% O, 60% E, 20% F	3.33	Able to explain the methods of using renewables as main source of energy	Related books and articles
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

1. Abdul Kadir, Energi, UI Press.1982.
2. John A. Duffie and William A. Beckman. Solar Engineering of Thermal Processes, John Willey and Sons.1980.
3. Sze, S. M. Physics of Semiconductor Devices, John Willey and Sons. 1981

IV. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
2-7, 9-15	Individual Assignment	Sub-CLOs 1-4	Homework	• Energy Regulations in Indonesia • Fossil Fuel and Energy Crisis • New and Renewables Energy • Nuclear Energy • Geothermal Energy • Solar Energy • Hydro Energy • Wind Energy • Biomass Energy • Wave Energy • Application of Physics of Energy	At home	1 week	Answer sheet
8	Mid-Term Exam	Sub-CLOs 1-3	Problem sets	• Energy Regulations in Indonesia • Fossil Fuel and Energy Crisis • New and Renewables Energy • Nuclear Energy • Geothermal Energy • Solar Energy	Exam	100 minutes	Answer sheet
13-15	Group Discussion	Sub-CLOs 1-4	Discussion	• Application of Physics of Energy	Discussion	100 minutes	Discussion report submission

16	Final Exam	Sub-CLOs 3-4	Problem sets	• Hydro Energy • Wind Energy • Biomass Energy • Wave Energy • Application of Physics of Energy	Exam	100 minutes	Answer sheet

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLOs	Assessment Type	Frequency	Evaluation Weight (%)
Individual Assignment	1-4	Answer sheet	1 each week	40
Group Discussion	1-4	Discussion report	1	10
Mid-Term Exam	1-3	Answer sheet	1	25
Final Exam	3-4	Answer sheet	1	25
Total				**100**

VI. Rubric(s)

A. Criteria of Assignment and Exam Score

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 Presentation Score

Criteria	A (90)	B (75)	C (60)	D (50)
Organization (Order, flow, and transition)	Information is presented in an effective order. The excellent structure of paragraphs and transitions	Information is logically ordered by paragraphs and transitions. Within sections, the order in	Information is scattered and needs further development.	There is no clear sequence of paragraphs, so there is no progressive flow of ideas. The details and

	improves readability and comprehension. The executive summary or abstract is presented first, allowing the reader to easily follow the rest of the report.	which ideas are presented may be confusing at times.		examples are disorganized, difficult to follow or understand.
Information Quality	Supporting details are specific to the topic and provide the necessary information.	Some details do not support the topic of the report.	Details are a bit vague.	No details on the information given.
Introduction	Paragraph is clearly stated, has a sharp focus, and increases the impact of the report.	Paragraph is clearly stated.	Paragraph is not structured correctly.	Paragraph is unclear and vague.
Conclusion	Paragraphs summarize concisely and draw a clear and effective conclusion that increase the impact of the report.	Paragraphs summarize the entire topic concisely.	Paragraphs does not draw the correct conclusion.	Paragraph is unclear and vague
Use of language: words choice, grammar, and sentence structure	Sentences are complete, grammatical, and flow together easily. The word is chosen for its proper meaning.	Most sentences are complete, grammatical, and flow together. Mistakes are minor and does not distract reader.	Minor mistakes in sentence structure and grammar are frequent. Unnecessary repetition of words and phrases.	Major mistakes in sentence structure and grammar. Frequent repetition of words and phrases.

Use of pictures: numbers, graphs & images	All numbers, graphics and images used are accurate, consistent with text, and of good quality. Appropriate and consistent labeling.	Most numbers, graphics, and images used are accurate. A few inconsistencies in labeling.	Some inaccurate graphics and images are used. Labeling is not consistent.	Numbers, graphs, and images used are not accurate, bad quality, and not properly labeled.

C. Criteria of 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%);

D. Affective Domain Rubric

Criteria	**5**	**4**	**3**	**2**	**1**
Communication	Students provide specific and easy to understand explanations in the discussion and use various tools or methods to facilitate understanding.	Students provide specific explanations that are mostly easy to understand in discussions and use various tools or methods to facilitate understanding.	Students provide unspecific explanations that are mostly difficult to understand in discussions and do not use various tools or methods to facilitate understanding.	Students provide explanations that are not specific and difficult to understand in discussions and do not use various tools or methods to facilitate understanding.	Students provide explanations that are not specific and cannot be understood in the discussion and do not use various tools or methods to facilitate understanding.
Class Atmosphere	Students use polite language in their interactions, contribute actively, and do not dominate the discussion.	Students use polite language in their interactions, contribute in part, and do not dominate the discussion.	Students use language that is not polite in their interactions, contributes in part, and dominates the discussion a lot.	Students sometimes use language that is disrespectful in interacting, does not contribute, and dominates discussions.	Students use language that is disrespectful in interacting, does not contribute, and dominates the discussion.

Openness	Students provide feedback and value the opinions of others.	Students give partial feedback and value the opinions of others	Students give little feedback and sometimes do not respect the opinions of others	Students do not provide feedback and sometimes do not respect other people's opinions	Students do not provide feedback and do not respect the opinions of others
Behaviour	Students listen very well and behave politely in class.	Students listen well and behave politely in class.	Students listen improperly but still behave politely in class.	Students do not pay attention and behave casually in class.	Students do not listen and behave disrespectfully in class.