TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

INTRODUCTION TO MEDICAL INSTRUMENTATION

by

Drs. Sastra Kusuma Wijaya Ph.D.

Undergraduate Program in Physics
Faculty of Mathematics and Natural Sciences
Universitas Indonesia
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PREFACE

The Teaching Instructional Design (BRP) of the Introduction to Medical Instrumentation course was prepared to be used as a guideline for Introduction to Medical Instrumentation course in the Physics Undergraduate Study Program of the Faculty of Mathematics and Natural Sciences Universitas Indonesia, which was attended by 7th semester medical physics and biophysics elective physics students that had taken the Electronics 2 course. In this course, students will be taught about basic concepts of electronics for medical instrumentation like biopotential amplifier and medical machine and equipment such as radiotherapy machine and radiology diagnostic machine. Students are expected to understand about medical instrumentation so that they can identify and solve problems faced in everyday life as a medical physicist. 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.

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Drs. Sastra Kusuma Wijaya Ph.D.

I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Introduction to Medical Instrumentation
3.	Course Code	:	SCFI604919
4.	Semester	:	7
5.	Credit(s)	:	2 Credits
6.	Teaching Methods(s)	:	Interactive learning, self-directed study, individual assignment, and exams
7.	Prerequisite Course(s)	:	Electronics 2
8.	Requisite Course(s)	:	None
9.	Integration Between Other Courses	:	None
10.	Lecturer(s)	:	Drs. Sastra Kusuma Wijaya Ph.D.
11.	Course Description	:	After completing this course, 7th semester medical physics and biophysics elective physics student will be able to apply physics concepts of advanced electronics on measurement instruments and medical instrument in their everyday life appropriately to solve existing problems in accordance with the law 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 of advanced electronics on measurement instruments and medical instruments in their everyday life appropriately to solve existing problems (ELO(s) 3, 5, 6, 8).

B. Sub-CLOs

1. Able to apply basic instrumentation concepts to measurement instruments and medical equipment in everyday life to solve existing problems.
2. Able to apply the concept of a biopotential signal amplifier to measurement instruments and medical equipment in everyday life to solve existing problems.
3. Able to apply the concepts of impedance, capacitance and tomography methods to measurement instruments and medical equipment in everyday life to solve existing problems.
4. Able to apply medical imaging concepts to measurement instruments and medical equipment in everyday life to solve existing problems.
5. Able to apply biophysical concepts to physiotherapy instruments and prosthetic equipment in everyday life to solve existing problems.
6. Able to apply radiotherapy concepts to therapeutic instruments and radiation equipment 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	• Basic concept of medical instrumentation	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to apply basic electronics concept on medical instrument	[1]
3	1	• Basic concepts and principle of sensors	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to apply basic electronics concept on medical measurement instrument	[1]
4	2	• Signal amplifier and processing	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to apply concepts of electronics to filter and biopotential signal amplifier	[1]
5	2	• Biopotential	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to apply basic electronics concept on medical instrument	[1]
6	3	• Blood pressure and sound measurement	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to apply basic physics concept on medical instrument	[1]
7	3	• Blood flow and volume measurement and respiratory measurement	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to apply basic physics concept on medical instrument	[1]

8	**Mid-Term Exam**							
9	4	• Clinical medical instruments	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to explain about clinical medical instrument procedure	[1]
10	4	• Medical imaging system	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to identify types of medical imaging systems	[1]
11	5	• Therapy instrument and prosthetics	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to apply basic concept of biophysics on therapy instrument and prosthetics	[1]
12	5	• Electric safety	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to identify the danger and risk of electricity for medical instrument	[1]
13	6	• Radiation detector	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to explain the methods and principle of radiation detector	Related articles and papers
14	6	• Radiotherapy machine	Interactive learning, self-directed study	100 minutes	20% O, 60% E, 20% F	7.69	Able to explain the methods and principle of radiotherapy and radiology diagnostic machine.	Related articles and papers
15	6	• Particle accelerator	Interactive learning, self-	100 minutes	20% O, 60% E, 20% F	7.69	Able to explain the methods and principle of	Related articles and papers

			directed study				particle accelerator such as LINAC, Cyclotron, and Synchrotron	
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

1. J. G. Webster, Medical Instrumentation: Application and Design, John Wiley & Sons, New York, 1998.

IV. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
2-7, 9-15	Individual Assignment 1-13	1-6	Homework	• All study materials	Homework	1 week	Answer sheet
8	Mid-Term Exam	1-3	Problem sets	• Basic concept of medical instrumentation • Basic concepts and principle of sensors • Signal amplifier and processing • Biopotential • Blood pressure and sound measurement • Blood flow and volume measurement and respiratory measurement	Exam	100 minutes	Answer sheet
16	Final Exam	4-6	Problem sets	• Clinical medical instruments • Medical imaging system • Therapy instrument and prosthetics • Electric safety • Radiation detector • Radiotherapy machine • Particle accelerator	Exam	100 minutes	Answer sheet

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLOs	Assessment Type	Frequency	Evaluation Weight (%)
Individual Assignment	1-6	Answer sheet	1 each week	40
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 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 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%);

C. Affective Domain Rubric

Criteria	5	4	3	2	1
Communication	Students provide specific and easy to understand explanations in the discussion and use various	Students provide specific explanations that are mostly easy to understand in discussions and	Students provide unspecific explanations that are mostly difficult to understand in discussions and	Students provide explanations that are not specific and difficult to understand in discussions and	Students provide explanations that are not specific and cannot be understood in the discussion

	tools or methods to facilitate understanding.	use various tools or methods to facilitate understanding.	do not use various tools or methods to facilitate understanding.	do not use various tools or methods to facilitate understanding.	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.