TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

PHYSICS OF MEASUREMENTS

by

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PREFACE

This Teaching Instructional Design (BRP) contains teaching plan for one semester. It is used as a guideline for Physics of Measurement course in the Department of Physics, Faculty of Mathematics and Natural Sciences at Universitas Indonesia.

Physics of Measurements course is taken by 5th semester physics student that had taken Electronics 2 course.

In this course, students will learn about the physics of measuring current, voltage, and other physical quantities with the correct instrument. At the end of the course, students will present their assignment to the lecturer according to their given topic.

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.

Jakarta, 29 August 2016

Dr. Santoso S.

I. General Information

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Physics of Measurement
3.	Course Code	:	SCFI603310
4.	Semester	:	5
5.	Credit(s)	:	2 Credits
6.	Teaching Methods(s)	:	Collaborative learning
7.	Prerequisite Course(s)	:	Electronics 2
8.	Requisite Course(s)	:	None
9.	Integration Between Other Courses	:	None
10.	Lecturer(s)	:	Dr. Santoso S.
11.	Course Description	:	Provide an overview of the basics of the measurement system; type of instrumentation and its characteristics; measurement of analog physical quantities: time dependent characteristics; calibration of sensors and measuring instruments; standard units and dimensions of measurement; measurement uncertainty; measurement reliability and security systems; signal conditioning; digital techniques in mechanical measurement; data reading and processing. This course will be taught in Indonesian.

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

A. CLO

Students are able to design a good measurement instrument system that can measure physical quantities.

B. Sub-CLOs

1. Able to apply learning methods.
2. Able to explain basics of physics of measurement.
3. Able to explain measurement system.
4. Able to explain types of instrumentation and its characteristics.
5. Able to explain time dependent characteristics.
6. Able to explain standard units and dimension of measured quantities.
7. Able to explain measurement uncertainties.
8. Able to explain measurement reliability and security systems.
9. Able to solve mid-term exam problems.
10. Able to explain signal conditioning.
11. Able to explain digital measurement.
12. Able to calibrate sensor and measurement instrument.
13. Able to measure analog physical quantities.
14. Able to read and process data.
15. Able to design measurement instrument device.
16. Able to solve final exam 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**							
2	2	• Introduction to physics of measurement	Collaborative learning	100 minutes	70% O, 0% E, 30% F	7.5	Able to choose measurement instrument	[2] and [4]
3	3	• Measurement system	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to explain standard of measurement	[1]
4	4	• Types of instruments and its characteristics	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to explain types of instrument	[2] and [3]
5	5	• Time-dependent characteristics	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to use characteristics equation	[2], [3], and [4]
6	6	• Standard unit and dimension	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to explain the standard units and dimensions	[3] and [4]
7	7	• Measurement uncertainties	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to explain the normal and uniform distributions	[3]
8	**Mid-Term Exam**							
9	9	• Measurement reliability and security system	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to explain the principle of reliability	[2]
10	10	• Signal conditioning	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to use noise reduction technique	[1], [2], and [4]

11	11	• Digital measurement	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to use sampling theorem and ADC or DAC	[1], [3], and [4]
12	12	• Sensor and measurement instrument calibration	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to explain the principle of calibration	[2]
13	13	• Analog quantities measurement	Collaborative learning	100 minutes	20% O, 50% E, 30% F	7.5	Able to measure distance, movement, and thickness	[3]
14	14	• Data reading and processing	Collaborative learning	100 minutes	10% O, 50% E, 40% F	7.5	Able to show measured and record data signal	[2], and [4]
15	15	• Measurement instrument system	Collaborative learning	100 minutes	10% O, 50% E, 40% F	10	Able to design a measurement instrument system	[1]
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feedback

References:

1. Robert B. Northrop, Introduction to Instrumentation and Measurements, CRC Press, Taylor Francis Group, 2ed ,2005
2. Alan S Morsis, Measurement & Instrumentation Principles, Butterworth Heinemann, 3rd , 2001.
3. J. G Webster, The Measurement, Instrumentation and Sensors Handbook, A CRC Handbook Published in Cooperation with IEEE Press, 1999
4. T. G. Beckwith, R. D. Marangoni, dan J. H. Lienhard V, Mechanical Measurements (I. Fundamentals of Mechanical Measurement, II. Applied Mechanical Measurements), Addison-Wesley Publishing Company, 5ed , 1993.

IV. Assignment Design

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedure	Deadline	Outcome
1-16	Papers	1-16	Collaborative Scientific Writings	• All materials	Group assignment	1 semester	Article/Papers
1-16	Individual Assignment	1-16	Individual Report	• All materials	Individual Assignment	1 semester	Written report
1-16	Presentation	1-16	Group Presentation	• All materials	Group Assignment	1 semester	Presentation

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLOs	Assessment Type	Frequency	Evaluation Weight (%)
Attendance	1-16	Attendance list	Each week	10
Papers Assignment	1-16	Written papers	1	10
Presentation	1-16	Group presentation	1	20
Individual Assignment	1-16	Individual report	3	10
Group Assignment	1-16	Group report	3	10
Mid-Term Exam	1-7	Answer sheet	1	20
Final Exam	9-15	Answer sheet	1	20
Total				**100**

VI. Rubric(s)

A. Criteria of Presentation

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.

B. Criteria of 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%);