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## SYLLABUS

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<b>Date/ Revision</b>	25 August 2016/Rev. 1
<b>Faculty</b>	Engineering
<b>Approval</b>	Dean of Engineering Faculty

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### SUBJECT : INTRODUCTION TO MEASUREMENT

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#### 1. Identification of Subject:

Name of Subject	: Introduction to Measurement
Code of Subject	: MEAS-2100
SKS	: 3
Semester	: 3
Study Program	: B-ELE,B- MTE
Lecturer	: Dr. Pinardi Kuncoro

#### 2. Competency

After having the course, students are expected to:

- Have basic knowledge of measurements systems, that consist of sensors and signal conditioning;
- distinguish between error and accuracy;
- differentiate the type of measurement system such as null-method, deflection-method, and compensation-method;
- calculate the uncertainty in any laboratory measurements by using the error propagation regression;
- Have knowledge and understanding in the analog signal conditioning, signal filters and signal amplifier;
- Analyse and design an analog signal conditioning system;
- use the Boolean Algebra and the Karnaugh Map in simplification of Logic / Boolean function;
- to calculate the error in Analog to Digital Converter, and in the Digital to Analog Converter;
- Have knowledge and understanding in the digital signal conditioning
- Analyse and design a digital signal conditioning system;

#### 3. Description of Subject:

The Introduction to Measurement course is delivered in the third semester. This course is introducing the main purpose of measurement system in any engineering processes. The uncertainty of measurement will be correctly expressed by using of the error propagation technique. The measurement null-mode, deflection-mode, and compensation-mode are explained as well. The course covered the Analog Signal Conditioning, and the Digital Conditioning. In the fourth semester this course will be continued in the subject "Sensor and Instrumentation".

#### 4. Learning Approach

Approach	: Combination of Expository - inquiry and collaborative
Method	: Discussion, question answer, sample problem, group work
Student Task	: Home work, presentation
Media	: LCD projector, film.

#### 5. Evaluation

a) Absence maximum	: 25%
b) Participation in discussion	: 5 points
c) Homework, Classwork	: 10 points
d) Daily Quiz	: 25 points
e) Final Examination	: 60 points

Total : 100 points

#### 6. Contents/ Topics of Lecturing:

Week	Content/ Topics of Lecturing	Text Book Chapter	Remark
1	<b>Introduction to Measurement: Statics and dynamics characteristics of Instrumentation.</b> Static characteristics of Instrument systems, dynamic characteristics of Instrument systems, Measurement accuracy: <ul style="list-style-type: none"> <li>• Error: The Normal distribution and the Uniform distribution</li> <li>• Uncertainty / accuracy</li> <li>• Measurement of uncertainty / accuracy:</li> </ul>	Ch-1	
2	<b>Measurement characteristics:</b> <ul style="list-style-type: none"> <li>• Simple Instrumentation Model,</li> <li>• Passive and Active Sensors,</li> <li>• Calibration,</li> <li>• Accuracy and Errors</li> </ul>	Ch-1	
3-4	<b>Operation Modes of Instrumentation</b> <ul style="list-style-type: none"> <li>• Null Instrument,</li> <li>• Deflection Instrument,</li> <li>• Analog- and Digital sensors,</li> <li>• Analog- and Digital read-out instruments</li> </ul>	Ch-4	
5	<b>Analog signal conditioning,</b> <ul style="list-style-type: none"> <li>• Analog passive- and active filters : Low pass Filter, High Pass Filter, Band Pass Filter, Band Rejected Filter and Notch Filter;</li> </ul>	Ch-2 Ch-3	
6	<b>Analog signal conditioning,</b> <ul style="list-style-type: none"> <li>• Operational Amplifier circuit: Inverting Amplifier, Noninverting Amplifier, Voltage Follower, Summing Amplifier, Difference Amplifier, Instrumentation Amplifier , Differentiator, Integrator</li> </ul>	Ch-2 Ch-3	

7	<b>Analog signal conditioning:</b> <ul style="list-style-type: none"> <li>• Current to voltage- and voltage to current converter</li> <li>• Design guidelines of analog signal conditioning</li> <li>• CASE study</li> </ul>	Ch-2 CH-3 Ch-13	
8	<b>MID-SEMESTER BREAK</b>		
9	<b>Digital Signal Conditioning</b> <ul style="list-style-type: none"> <li>• Review of Digital System: Digital Information, Binary Number, Hexadecimal number, Boolean Algebra, Digital gates and circuits</li> </ul>	Ch-10	
10	<b>Digital Signal Conditioning</b> <ul style="list-style-type: none"> <li>• Comparator</li> <li>• Analog to Digital Converter (ADC)</li> <li>• Digital to Analog Converter (DAC)</li> <li>• Digital Data Acquisition system</li> </ul>	Ch-10	
11	<b>Digital Signal Conditioning:</b> <ul style="list-style-type: none"> <li>• Computer software and Interface</li> <li>• Microcontroller based measurement</li> </ul>	Ch-9	
12	<b>Digital Signal Conditioning:</b> <ul style="list-style-type: none"> <li>• Design guidelines of digital signal conditioning</li> <li>• CASE study</li> </ul>	Ch-9, Ch-10, Ch- 13	
13	<b>CASE study</b>	Ch-13	
14	<b>CASE study</b>	Ch-13	
15	<b>REVIEW the Semester</b>		
16	<b>Final Examination</b>		

## 7. Book Reference:

### Main Text Book:

“Introduction to Instrumentation and Measurement, 3<sup>rd</sup> Edition”, **Authors:** Robert B. Northrop,  
**Publisher:** CRC – Press – Taylor and Francis Group, **ISBN:** 13: 978-1-4665-9679

### Supplementary Text Books:

- “Process Control Instrumentation Technology, 6<sup>th</sup> Edition”, **Author:** Curtis D. Johnson,  
**Publisher:** Prentice Hall International Edition, **ISBN:** 0-13-978-200-3
- “Measurement, Instrumentation, and Sensors Handbook”, **Author/Chief Editor:** John G. Webster., **Publisher:** CRC – Press – Taylor and Francis Group, **ISBN:** xxx-xxx-xxxx