Module Description

Module name	Instrumentation System
Module level, if applicable	Bachelor of Physics
Code, if applicable	18H02121502
Subtitle, if applicable	-
Course, if applicable	Instrumentation System
Semester(s) in which the module is taught	4th
Person responsible for the module	Prof. Dr. Arifin, M. T.
Lecturer	1. Prof. Dr. Arifin, M.T. 2. Dr. Bidayatul Arminah, M. T.
Language	Indonesian Language [Bahasa Indonesia]
Relation to Curriculum	This course is a compulsory course and offered in the 4th semester.
Type of teaching, contact hours	Teaching methods: [group discussion], [project based learning], [problem-based learning]. Teaching forms: [lecture] CH : 10.30 - 13.00
Workload	For this course, students are required to meet a minimum of 91.20 hours in one semester, which consist of: - 27.20 hours for lecture, - 32.00 hours for structured assignments, - 32.00 hours for private study
Credit points	2 credit points (equivalent with 3.4 ECTS)
Requirements	Students have participated in at least 80% of the learning activities

according to the examination regulations	
Recommended prerequisites	Basic Physics 1 and Basic Physics 2
Module objectives/intended learning outcomes	After completing the course, Students are able: **Intended Learning Outcomes (ILO):** **ILO 2 :** Students are able to use the fundamental principles of physics in modeling and computation to solve the complex physical problem **ILO 3 :** Students are able to use the basic principles of physics in technology application. **ILO 7 :** Students are able to identify the physical problems based on the experimental results. **Course Learning Objective (CLO):** After completing this course, students are expected to be able to: 1. Mastering the principles and applications of physics & instrumentation in measurement systems and instrumentation tools 2. Mastering the introduction of instrument types, performance characteristics and instrument functions 3. Mastering knowledge of physics-based technology and its application in the process of measuring errors and calibrating measurement sensors and instruments 4. Mastering knowledge of physics-based technology and its application in the process of error measurement & signal processing as well as experimental data analysis and measurement of system reliability & security 5. Apply logical, critical, systematic, and innovative thinking in variable conversion elements and electrical measurement systems 6. Apply concepts in electrical circuits based on their properties and benefits through the creation of simple assignments and papers either independently or in teams by upholding professional ethics 7. Analyze the measurement system of temperature, humidity, noise, viscosity, pressure, strain, vibration, flow, level, mass, force, torque, shift, area, position, motion, speed, acceleration, pH, gas diffusion and air pollution. **Sub CLO :**

	ILO 2 ⇒ CLO 1 : Able to explain the principles and applications of physics & instruments in measurement systems and instrumentation tools ILO 2 ⇒ CLO 2 : Able to recognize the types, characteristics and functions of instruments. ILO 3 ⇒ CLO 3 : Able to understand the knowledge of technology and its application in the process of error measurement and calibration of measurement sensors and instruments. ILO 7 ⇒ CLO 4 : Able to understand the knowledge of technology and its application in the process of error measurement & signal processing as well as experimental data analysis and measurement of system reliability & security. ILO 7 ⇒ CLO 5 : Able to analyze variable conversion elements and electrical measurement systems. ILO 7 ⇒ CLO 6 : Able to analyze temperature, humidity, noise, viscosity, pressure, strain & vibration measurement instruments ILO 7⇒ CLO 7 : Able to analyze measurement instruments of flow, level, mass, force, torque, shift, area, position, motion, speed & acceleration. ILO 7 ⇒ CLO 8 : Able to analyze pH measurement instruments, gas diffusion, and various kinds of air pollution.
Content	Students will learn about : 1. Introduction to measurement systems 2. Instrument type and performance characteristics 3. Error during the measurement process 4. Calibration of measurement sensors and instruments 5. Error measurement and signal processing 6. Experimental data analysis and measurement of system reliability and safety 7. Variable conversion element 8. Electrical measurement system 9. Temperature, humidity, noise & viscosity measurement 10. Pressure, Strain and Vibration Measurement 11. Flow and level measurement 12. Mass, force and torque measurement 13. Measurement of displacement, area, position and motion, speed and acceleration 14. pH measurement and diffusion of gas and air pollution

Forms of Assessment	Assessment techniques: [observation], [participation], [written test] Assessment forms: [quiz], [midterm exam], [final term exam], [assignment], [presentation] Quiz = 12%, Midterm exam = 24% Final term exam = 24%, Assignment = 14%, Presentation = 26% CLO 1 => ILO 2: 2% Presentation CLO 2 => ILO 2: 4% Presentation, 12 % Mid examination number 1 CLO 3 => ILO 3: 8% Assignment 1, 12 % Mid examination number 2 CLO 4 => ILO 7: 8% Presentation CLO 5 => ILO 3: 6% Assignment, 6% Final examination number 1 CLO 6 => ILO 7: 8% Presentation, 6% Final examination number 2 CLO 7 => ILO 7: 6% Final examination number 3, 12% Quiz CLO 8 => ILO 7: 4% Presentation, 6% Final examination number 4
Study and examination requirements and forms of examination	**Study and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade. **Form of examination:** Written exam: Essay
Media employed	Text book, Learning Management System (SIKOLA), Zoom and Power Point Presentation, Whiteboard, LED.
Reading list	**Main :** ● Alan S. Moris, 2001, *Measurement and Instrumentation Principles*, Third edition, Butterworth Heineman. ● J.P. Holman, 2001, *Experimental Method for Engineers*, Eighth edition, Mc Graww Hill. ● Alexius J. Hebra, 2010, *The Physics Metrology*, Springer.

	● Bela G. Liptak, 1982, *Process Measurement and Analysis Instrument Engineers Book,* Fourth edition, Chilton Book Company. ● Robert B. Northrop, 2005, *Instrumentation and Measurements,* Second edition, Taylor and Francis. **Support :** ● John S. Wilson, 2005, *Sensor Technology Handbook*, Elsevier.