MODULE HANDBOOK

Course	Sensor and Measurements
Module Level	Undergraduate
Code	FIE310
Sub-heading, if applicable	-
Courses included in the module, if applicable	-
Semester/Term	5th /Third Year
Module Coordinator	Winarno, S.Si., M.T.
Lecturer(s)	Winarno, S.Si., M.T., Yhosep Gita Yhun Yhuwana, S.Si., M.T.
Language	Bahasa Indonesia
Classification within the curriculum	~~Compulsory Course~~ / Elective Course
Teaching format/class hours per week during the semester	2 hours of lectures (50 min/hour)
Workload	2 hours of lectures, 2 hours of tutorial and structured activities, 2 hours of individual study, 13 weeks per semester, and a total of 78 hours per semester
Credit Points	2
Requirement(s)	(FIE212) Electronics II
Learning Goals/Competencies	General Competence (Knowledge): Students are able to explain the basic principles of sensors and measurements, sensor interfaces, sensor usage, characteristics and errors in measurement systems, various measuring devices, and calibration standards. Specific Competence: 1. Students are able to explain the concepts and how the sensors work 2. Students are able to mention and explain sensor characteristics 3. Students are able to explain the sensor variables physically 4. Students are able to explain the sensor interface with other electronic devices 5. Students are able to mention and explain the types of sensors and their use 6. Students are able to explain the basic principles of measurement and their elements 7. Students are able to formulate static characteristics and accuracy of measurement system elements 8. Students are able to formulate dynamic characteristics of the measurement system 9. Students are able to show the effects of loading and noise in the measurement system 10. Students are able to use calibration techniques in measurement systems
Contents	**1. Data Acquisition:** Sensors, Signals and Systems, Sensor Classification, Unit of Measurement. **2. Sensor Characteristics:** Transfer Function, Accuracy,

	Calibration, Hysteresis, Repeatability, Dead Band, Resolution, Output Impedance, Reliability, Application Characteristics, Uncertainty. 3. **Physical Principles of Sensing:** Capacitance, Magnetism, Induction, Resistance, Pyroelectric Effect, Hall Effect, Seebeck and Peltier Effects, Sound Waves. 4. **Interface Electronic Circuits:** Amplifiers, Excitation Circuits, Analog-to-Digital Converters, Data Transmission, Noise in Sensors and Circuits. 5. **Types of Sensors:** Motion Detectors, Position, Displacement, and Level, Velocity and Acceleration, Force, Strain, and Tactile Sensors, Pressure Sensors, Flow Sensors, Light Detectors, Temperature Sensors 6. **Measurement Fundamentals:** Terms and definitions, The structure of an instrumentation system, Measurement Units, Measurements Standards, Traceability, Measurement terminology 7. **Static and Dynamic Characteristics:** Systematic characteristics, Statistical characteristics, Identification of static characteristics, Identification of the dynamics of an element, Dynamic errors in measurement systems, Techniques for dynamic compensation 8. **Error/uncertainty:** Sources of systematic error, Reduction of systematic error, Quantification of systematic error, Random errors, aggregation of measurement system errors 9. **Meters:** Analog Meters-Classifications and Symbols, Types of Analog Instruments, Voltmeters, Ammeters, Wattmeters, Ohmmeters. 10. **Calibration:** SNI and ISO Standard
Study/Exam Achievements	Students are considered competent and eligible to pass the course upon obtaining at least 50% of maximum mark of the exams and homework. The final score is calculated as follows: 20% Homework + 20% Quizzes + 30% Exam I (Midterm Test) + 30% Exam II (Final Exam) A final grade is defined as follows: A : 75 - 100 AB : 70 - 74.99 B : 65 - 69.99 BC : 60 - 64.99 C : 55 - 59.99 D : 40 - 54.99 E : 0 - 39.99
Forms of Media	PowerPoint slides, LCD projectors and whiteboards
Learning Methods	Lecture, assessment, and group discussion
Literature(s)	1. Jacob Fraden, Handbook of Modern Sensors: Physics, Design, and Applications, Springer, 2004, New York 2. Alan S Morris, Measurement and Instrumentation Principles, Butterworth-Heinmann, 2001, England

	3. John P. Bentley, Principles of Measurement Systems, Pearson Education Limited, 2005, England
Notes	*Total ECTS = {(total hours workloadx50 min) /60 min} /25 hours Each ECTS has equalled with 25 hours