

### Module Description

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Module name</b>                               | Instrumentation Based Internet of Things Laboratory                                                                                                                                                                                                                                                                                                                                    |
| <b>Module level, if applicable</b>               | Bachelor of Science                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Code, if applicable</b>                       | 23H02132301                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Subtitle, if applicable</b>                   | -                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Course, if applicable</b>                     | -                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Semester(s) in which the module is taught</b> | 6 <sup>th</sup>                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Person responsible for the module</b>         | Prof. Dr. Arifin, M.T.                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Lecturer</b>                                  | <ol style="list-style-type: none"> <li>1. Prof. Dr. Arifin, M.T.</li> <li>2. Prof. Dr. Bualkar Abdullah, M.Eng.Sc.</li> </ol>                                                                                                                                                                                                                                                          |
| <b>Language</b>                                  | Indonesian Language [Bahasa Indonesia]                                                                                                                                                                                                                                                                                                                                                 |
| <b>Relation to Curriculum</b>                    | Bachelor degree program, elective, 6 <sup>th</sup> semester                                                                                                                                                                                                                                                                                                                            |
| <b>Type of teaching, contact hours</b>           | <p>Teaching methods: [focus group discussion], [simulation], [<del>case study</del>], [collaborative learning], [<del>project-based learning</del>], [problem-based learning].</p> <p>Teaching forms: [lecture], [<del>tutorial</del>], [<del>seminar</del>], [practicum], [<del>research</del>], [<del>internship</del>], [<del>community service</del>]</p> <p>CH: 08.00 - 16.00</p> |
| <b>Workload</b>                                  | <p>For this course, students are required to meet a minimum of 45.33 hours in one semester, which consist of:</p> <ul style="list-style-type: none"> <li>- 13.33 hours for practice in classroom,</li> <li>- 32.00 hours for private study</li> </ul>                                                                                                                                  |
| <b>Credit points</b>                             | 1 credit points (equivalent with 1.7 ECTS)                                                                                                                                                                                                                                                                                                                                             |

|                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Requirements according to the examination regulations</b> | Students have participated in at least 80% of the learning activities (Academic Regulations, Chapter VII)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Recommended prerequisites</b>                             | Basic Physics 1 and Basic Physics 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Module objectives/intended learning outcomes</b>          | <p>After completing the course, Students are able:</p> <p><b>Intended Learning Outcomes (ILO):</b></p> <p><b>ILO 1:</b> Students will have relatively deep understood in classical and basic quantum physics. [ILO 1] – Kn</p> <p><b>ILO 2:</b> Students will be able to use the fundamental principles of physics in modeling and computation to solve the complex physical problem. [ILO 2] – Kn</p> <p><b>ILO 4:</b> Students will have capability to operate the physical instrumentation in the laboratory and conduct experiments and interpret the result. [ILO 4] – Ab</p> <p><b>Course Learning Objective (CLO):</b></p> <ol style="list-style-type: none"> <li>1. Able to explain the scope of Internet of Things.</li> <li>2. Able to complete Internet of Things-based circuits that can be applied in daily life.</li> </ol> <p><b>Sub CLO:</b></p> <p>ILO 1 ⇒ CLO-1: Able to explain IoT-based system instrumentation.</p> <p>ILO 2 ⇒ CLO-1: Able to comprehend and utilize Arduino software and hardware.</p> <p>ILO 2 ⇒ CLO-1: Able to understand and create basic Arduino programming to support IoT-based system instrumentation.</p> <p>ILO 2 ⇒ CLO-1: Able to understand and create a web framework for IoT-based instrumentation.</p> <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based body temperature monitoring system circuitry.</p> <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based respiratory monitoring system circuitry.</p> <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based heart rate and oxygen level monitoring system circuitry.</p> <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based sunlight intensity and rainfall monitoring system circuitry.</p> |

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based water turbidity and flow rate monitoring system circuitry.</p> <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based water level and depth monitoring system circuitry.</p> <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based wind speed and direction monitoring system circuitry.</p> <p>ILO 4 ⇒ CLO-2: Able to understand, design, create, and analyze IoT-based air temperature and humidity monitoring system circuitry.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Content</b>             | <p>Students will learn about:</p> <ol style="list-style-type: none"> <li>1. IoT System Instrumentation</li> <li>2. Arduino Hardware and Software</li> <li>3. Basic Arduino Programming</li> <li>4. Django Framework</li> <li>5. DS18B20 Temperature Sensor and MLX90614 Sensor</li> <li>6. Fiber Optic Sensor and KY-037 Sensor</li> <li>7. Pulse Heart Sensor and MAX30102 Sensor</li> <li>8. MAX44009 Light Intensity Sensor and Rainfall Sensor</li> <li>9. TS-300B Turbidity Sensor and YF-S201 Flow Meter Sensor</li> <li>10. HC-SR04 Ultrasonic Sensor and IR GP2Y0A02YK0F Water Level Sensor</li> <li>11. Wind Speed Sensor and Wind Direction Sensor</li> <li>12. DHT11 Air Temperature and Humidity Sensor</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Forms of Assessment</b> | <p>Assessment techniques: [observation], [<del>participation</del>], [<del>performance</del>], [written test], [<del>oral test</del>], [<del>skill test</del>], [<del>portfolio assessment</del>]</p> <p>Assessment forms: [<del>quiz</del>], [<del>midterm exam</del>], [<del>final term exam</del>], [practice] [<del>practice examination</del>] [assignment], [report], [<del>presentation</del>]</p> <p>Assignment = 36% Practice = 80%</p> <p>CLO 1 ⇒ ILO 1: Assignment 1 (6%) (Assignment: written test)</p> <p>CLO 1 ⇒ ILO 2: Assignment 2 (10%) (Assignment: observation)</p> <p>CLO 1 ⇒ ILO 2: Assignment 3 (10%) (Assignment: observation)</p> <p>CLO 1 ⇒ ILO 2: Assignment 4 (10%) (Assignment: observation)</p> <p>CLO 2 ⇒ ILO 4: Practice 1 (10%) (Practice: observation)</p> <p>CLO 2 ⇒ ILO 4: Practice 2 (10%) (Practice: observation)</p> <p>CLO 2 ⇒ ILO 4: Practice 3 (10%) (Practice: observation)</p> <p>CLO 2 ⇒ ILO 4: Practice 4 (10%) (Practice: observation)</p> <p>CLO 2 ⇒ ILO 4: Practice 5 (10%) (Practice: observation)</p> <p>CLO 2 ⇒ ILO 4: Practice 6 (10%) (Practice: observation)</p> <p>CLO 2 ⇒ ILO 4: Practice 7 (10%) (Practice: observation)</p> |

|                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                    | CLO 2 ⇒ ILO 4: Practice 8 (10%) (Practice: observation)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Study and examination requirements and forms of examination</b> | <b>Laboratory</b> <ul style="list-style-type: none"> <li>- Students are required to be present 15 minutes before the start of the laboratory session.</li> <li>- Students must turn off all electronic devices.</li> <li>- Students should inform the instructor if they cannot attend the laboratory session due to illness or other reasons.</li> <li>- Students must submit laboratory assignments before the deadline.</li> <li>- Students must submit laboratory reports before the deadline.</li> </ul> |
| <b>Media employed</b>                                              | LED, Whiteboard, Learning Management System (SIKOLA), Laboratory Component                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Reading list</b>                                                | <b>Main:</b> <ol style="list-style-type: none"> <li>1. Adeel Javed, Building Arduino Project for the Internet of Things, Apress 2016.</li> <li>2. Samuli Natri, Django the Easy Way, 2nd Edition 2018.</li> <li>3. Perry Xiao, Designing Embedded System and the Internet of Things (IoT) with the ARM MBED, John Wiley 2018.</li> </ol> <b>Support:</b> <ol style="list-style-type: none"> <li>1. John C. Shovic, Raspberry Pi IoT Project, Apress 2016.</li> <li>2. Various research journals.</li> </ol>   |