



# UNIVERSITAS GADJAH MADA

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## Bachelor in Electronics and Instrumentation

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## MODULE HANDBOOK

| Module name                                                      | <b>SCADA and DCS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|--|-----|-----|-----|--------------------------------|------|--|--|--|------|---|--|--|------|---|---|--|------|--|---|---|------|--|--|---|
| Module level                                                     | Undergraduate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Code                                                             | MII-3309                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Courses (if applicable)                                          | SCADA and DCS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Semester                                                         | Fall (Odd)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Contact person                                                   | Jazi Eko Istiyanto                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Lecturer                                                         | Jazi Eko Istiyanto<br>Danang Lelono                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Language                                                         | Bahasa Indonesia & English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Relation to curriculum                                           | 1. Undergraduate degree program, compulsory, 5th semester.<br>2. International undergraduate program, compulsory, 5th semester.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Type of teaching, contact hours                                  | 1. Undergraduate degree program: lectures, < 60 students,<br>2. International undergraduate program: lectures, < 30 students.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Workload                                                         | 1. Lectures: 3 x 50 = 100 minutes (1 hours 10 menit) per week.<br>2. Exercises and Assignments: 3 x 50 = 100 minutes per week.<br>3. Private study: 3 x 50 = 100 minutes per week.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Credit points                                                    | 3 credit points (sks).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Requirements according to the Examination regulations            | A student must have attended at least 75% of the lectures to sit in the exams.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Recommended prerequisites                                        | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Learning outcomes (course outcomes) and their corresponding PLOs | <p>After completing this module, a student is expected to:</p> <p>CO1 know and understand HMI/SCADA and DCS</p> <p>CO2 Understand and understand the basic concepts of programming HMI/SCADA and DCS</p> <p>CO3 Able to apply HMI/SCADA and DCS concepts</p> <table border="1"> <thead> <tr> <th colspan="2">PLO</th><th>CO1</th><th>CO2</th><th>CO3</th></tr> </thead> <tbody> <tr> <td rowspan="5">Program Learning Outcome (PLO)</td><td>PLO1</td><td></td><td></td><td></td></tr> <tr> <td>PLO2</td><td>√</td><td></td><td></td></tr> <tr> <td>PLO3</td><td>√</td><td>√</td><td></td></tr> <tr> <td>PLO4</td><td></td><td>√</td><td>√</td></tr> <tr> <td>PLO5</td><td></td><td></td><td>√</td></tr> </tbody> </table> |     |     |     | PLO |  | CO1 | CO2 | CO3 | Program Learning Outcome (PLO) | PLO1 |  |  |  | PLO2 | √ |  |  | PLO3 | √ | √ |  | PLO4 |  | √ | √ | PLO5 |  |  | √ |
| PLO                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | CO1 | CO2 | CO3 |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
| Program Learning Outcome (PLO)                                   | PLO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
|                                                                  | PLO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | √   |     |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
|                                                                  | PLO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | √   | √   |     |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
|                                                                  | PLO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     | √   | √   |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |
|                                                                  | PLO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |     | √   |     |  |     |     |     |                                |      |  |  |  |      |   |  |  |      |   |   |  |      |  |   |   |      |  |  |   |

| Contents                                                    | 1. Introduction<br>2. Basics of SCADA & DCS systems, Hardware and firmware<br>3. Basic concepts of SCADA and DCS programming<br>4. SCADA and DCS with PLC and graphics<br>5. Interfacing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |     |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------|-----|-----|-----|------|-----|--|---|--|-----------------|------|---|---|---|--------------|------|--|--|--|--------------|------|---|---|---|------------|------|--|--|---|--------------|------|--|--|--|
| Study and examination requirements and forms of examination | <p>The evaluation is done in 3 forms, namely:</p> <ol style="list-style-type: none"><li>1. Trial, either midterm or semester test,</li><li>2. Four tasks, individual assignments to be completed within a certain timeframe, and</li><li>3. Two quizzes, held on face-to-face, once before midterm exam and once after midterm exam, with a short answer form.</li></ol> <p>Assessment is done using benchmark assessment, with the aim of measuring the level of student understanding related to the target and class rank.</p>                                                                                                                                                                                                                                                                               |      |            |     |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Media employed                                              | LCD, blackboard, and websites.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |            |     |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Assessments and Evaluation                                  | <table><tr><th>Type</th><th>Percentage</th><th>CO1</th><th>CO2</th><th>CO3</th></tr><tr><td>Quiz</td><td>5 %</td><td></td><td>√</td><td></td></tr><tr><td>Individual Task</td><td>20 %</td><td>√</td><td>√</td><td>√</td></tr><tr><td>Project Task</td><td>15 %</td><td></td><td></td><td></td></tr><tr><td>Midterm Exam</td><td>30 %</td><td>√</td><td>√</td><td>√</td></tr><tr><td>Final Exam</td><td>30 %</td><td></td><td></td><td>√</td></tr><tr><td><b>Total</b></td><td>100%</td><td></td><td></td><td></td></tr></table>                                                                                                                                                                                                                                                                                | Type | Percentage | CO1 | CO2 | CO3 | Quiz | 5 % |  | √ |  | Individual Task | 20 % | √ | √ | √ | Project Task | 15 % |  |  |  | Midterm Exam | 30 % | √ | √ | √ | Final Exam | 30 % |  |  | √ | <b>Total</b> | 100% |  |  |  |
| Type                                                        | Percentage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CO1  | CO2        | CO3 |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Quiz                                                        | 5 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | √          |     |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Individual Task                                             | 20 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | √    | √          | √   |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Project Task                                                | 15 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |            |     |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Midterm Exam                                                | 30 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | √    | √          | √   |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Final Exam                                                  | 30 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |            | √   |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| <b>Total</b>                                                | 100%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |            |     |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |
| Reading List                                                | <p>[1] Bailey, D. dan Wright, E., 2003, Practical SCADA for Industry, Newnes, Linacre House, Jordan Hill, Oxford OX2 8DP 200 Wheeler Road, Burlington, MA 01803</p> <p>[2] McCrady, S., 2013, Designing SCADA Application Software: A Practical Approach, Elsevier 32 Jamestown Road, London NW1 7BY, UK</p> <p>[3] Travis, J. dan Kring J., 2006, LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Third Edition, Prentice Hall, USA</p> <p>[4] Singh, R., Gehlot, A., Singh, B., Choudhury, S., 2018, Arduino-Based Embedded Systems Interfacing, Simulation, and LabVIEW GUI, CRC Press Taylor &amp; Francis Group, 6000 Broken Sound Parkway NW 300 Boca Raton USA.</p> <p>[5] Schwartz, M. dan Manickum, O., 2015, Programming Arduino with LabVIEW, PACKT Publishing, Brimingham Mumbai</p> |      |            |     |     |     |      |     |  |   |  |                 |      |   |   |   |              |      |  |  |  |              |      |   |   |   |            |      |  |  |   |              |      |  |  |  |