**UNIVERSITAS GADJAH MADA**
Faculty of Mathematics and Natural Sciences
Department of Computer Science and Electronics
Sekip Utara Bulaksumur Yogyakarta 55281 Telp: +62 274 546194 Email: dep-ike.mipa@ugm.ac.id Website: http://dcse.fmipa.ugm.ac.id

**Bachelor in Electronics and Instrumentation**
Telp : +62 274 546194
Email : kaprodi-s1-elins.mipa@ugm.ac.id
Website : http://dcse.ugm.ac.id/

**MODULE HANDBOOK**

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|---|---|
| Module name | **Experiment on Control System** |
| Module level, if applicable | Undergraduate |
| Code, if applicable | MII-2316 |
| Courses, if applicable | NA |
| Semester(s) in which the module is taught | Even Semester |
| The person responsible for the module | Muhammad Auzan S.Si.,M.Cs. |
| Lecturer(s) | Muhammad Auzan S.Si.,M.Cs. |
| Language | Bahasa Indonesia and English |
| Relation to curriculum | 1. It is a mandatory course for the undergraduate degree program in 4th semester.<br>2. It is a mandatory course for the international undergraduate degree program in 4th semester. |
| Teaching methods | 1. Undergraduate degree program delivered using lectures and practicum instruction with students less than 30.<br>2. International undergraduate degree program delivered using lectures and practicum instruction with students less than 30. |
| Workload (incl. contact hours, self-study hours) | 1. Lectures: 1 x 100 = 100 minutes per week.<br>2. Exercises and Assignments: 1 x 50 = 50 minutes per week.<br>3. Self-study: 1 x 50 = 50 minutes per week. |
| Credit points | 1 Credit Points |
| Requirements according to the examination regulations | A student must have attended at least 75% of the lectures to sit in the exams. |
| Required and recommended prerequisites for joining the module | Students must complete Control System (MII-2311) course. |
| Learning outcomes and their corresponding PLOs | After completing this module, a student is expected to:<br>CO1. Understand the basics of software utilization for control system analysis and design<br>CO2. Understand software utilization techniques for physical system modelling<br>CO3. Mastering the basic techniques in the analysis of stability and notability in closed-loop systems |

<table>
<tr><td></td><td>CO4. Mastering the basic techniques of system control through frequency analysis of system functions<br>CO5. Mastering the basic techniques of system control through frequency analysis of system functions<br><br><table>
<tr><th colspan="2">PLO</th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th><th>CO5</th></tr>
<tr><td rowspan="5">Program Learning Outcome (PLO)</td><td>PLO1</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PLO2</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PLO3</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>PLO4</td><td></td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>PLO5</td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>1. Introduction<br>a. Matlab Introduction<br>b. Polynomials in Matlab<br>c. Redirect function representation<br>2. Simulink<br>a. System modeling<br>b. Analysis of system characteristics<br>c. Simplification of system models<br>3. State Space Representation<br>a. State space representation<br>b. System responsiveness<br>c. Analysis of system characteristics<br>4. Interconnection and Attitude of the Order-1 and Order-2 Systems<br>a. Subsystem interconnection<br>b. Simplification of the redirect function<br>5. System characteristics<br>6. Pole Placement Methods<br>a. Stability analysis of the representation of state space<br>b. The principle of the notability of a system<br>c. Control of the system through the amplifier matrix<br>7. Root-Locus Analysis<br>a. The influence of the amplifier in system feedback<br>b. Root-locus graph for closed loop system<br>c. Control of the system through reinforcement from root-locus analysis<br>8. Plot Nyquist<br>a. Bode diagram<br>b. Diagram Nyquist<br>c. Nyquist stability criteria<br>d. Modification of reinforcement of the closed-loop system based on Nyquist analysis<br>9. PID Control<br>a. Influence of P, I, and D components in system control<br>b. Tuning of the PID control coefficient through the Ziegler-Nichols method</td></tr>
<tr><td>Study and examination</td><td>The evaluation is done in three forms, namely:<br>1. Final exam<br>2. Case Study</td></tr>
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<tr><td>requirements and examination forms</td><td>3. Ten practicum assignments are to be completed within a specific timeframe, and<br><br>Assessment is done using a rubric to measure student understanding related to the target and class rank.</td></tr>
<tr><td>Media employed</td><td>e-learning Platform (ELOK), projector, whiteboard, and presentation.</td></tr>
<tr><td>Assessments and evaluation</td><td>
<table>
<tr><th>Type</th><th>Percentage</th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th><th>CO5</th></tr>
<tr><td>Practicum 1</td><td>7</td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Practicum 2</td><td>7</td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Practicum 3</td><td>7</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Practicum 4</td><td>7</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Practicum 5</td><td>7</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Practicum 6</td><td>7</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Practicum 7</td><td>7</td><td></td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>Practicum 8</td><td>7</td><td></td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>Practicum 9</td><td>7</td><td></td><td></td><td></td><td>√</td><td></td></tr>
<tr><td>Practicum 10</td><td>7</td><td></td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>Case Study</td><td>10</td><td></td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>Final Exam</td><td>20</td><td></td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>Total</td><td>100</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Reading list</td><td>1. Ogata, K., 2010, Modern Control Engineering, 5th edition, New Jersey, USA, Prentice Hall.<br>2. Distefano, J. J. , Stubberud, A. R., Williams, W. J., 2013, Schaum’s Outline of Feedback and Control Systems, 2nd Edition (Schaum's Outline Series), McGraw-Hill.<br>3. Dorf, R.C. dan Bishop,R.H., 2011, Modern Control System,12th Edition, Prentice Hall<br>4. Astorm, K.J. dan Murray,R.M., 2008, Feedback Systems, Princeton University Press.</td></tr>
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