Lecture

<table>
<tr><td>Module designation</td><td colspan="3">CE631 Embedded System Design</td></tr>
<tr><td>Semester(s) in which the module is taught</td><td colspan="3">5</td></tr>
<tr><td>Person responsible for the module</td><td colspan="3">Dareen Kusuma Halim</td></tr>
<tr><td>Language</td><td colspan="3">English & Indonesian</td></tr>
<tr><td>Relation to curriculum</td><td colspan="3">Compulsory</td></tr>
<tr><td>Teaching methods</td><td colspan="3">Lecture</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td colspan="3">Total workload: 90.72 hours
- 23.34 hours of synchronous lecture & demonstration.
- 56.04 hours of self-study and assignments in the form of mini projects.
- 11.34 hours related to exam and self study</td></tr>
<tr><td>Credit points</td><td colspan="3">2 SKS (3.36 ECTS)</td></tr>
<tr><td>Required and recommended prerequisites for joining the module</td><td colspan="3">Required:
- CE432 Microprocessor System
- CE439 Interfacing & Instrumentation
- EEM411 Electronic Fundamentals</td></tr>
<tr><td rowspan="4">Module objectives/intended learning outcomes</td><td rowspan="2">Course Learning outcome</td><td colspan="2">Related ELOs</td></tr>
<tr><td>ELO</td><td>Performance Indicator</td></tr>
<tr><td>Students are able to apply the proper embedded system design steps according to the given problems</td><td>G</td><td>Understand the concept of electronics, analog systems, and digital systems in designing embedded systems.</td></tr>
<tr><td>Students are able to analyze system requirements in relation to system design.</td><td>G</td><td>Understand the concept of electronics, analog systems, and digital systems in designing embedded systems.</td></tr>
<tr><td>Students are able to optimize an embedded system by its hardware and software.</td><td>I</td><td>Understand the concept of software and hardware integration, distributed system, and computer communication protocols.</td></tr>
<tr><td>Content</td><td colspan="3">This course covers the principles of embedded system design and modeling, emphasizing on efficient integration of hardware and software, as well as system robustness.</td></tr>
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	Specifically, this course contain these topics: 1. Introduction to embedded systems 2. Embedded systems architecture 3. Hardware and software design of embedded systems 4. Testing methods for embedded systems 5. Hardware drivers 6. System flow management 7. Inter-devices communications 8. Firmware update 9. Architecture breakdown of a specific processor 10. Embedded software optimization 11. Managing power consumption
Examination forms	Written test
Study and examination requirements	Total score ≥ 55 must be satisfied. The total score is the weighted average of the assignments (30%), the midterm exam (30%), and the final exam (40%).
Reading list	1. White, E. 2011. Making Embedded Systems: Design patterns for Great Software. O'Reilly Media, Inc. 2. A Wicaksana, DK Halim, D Hartono, F Lokananta, SW Lee, MS Ng and CM Tang. 2018. Case Study: First-Time Success ASIC Design Methodology Applied to a Multi-Processor System-on-Chip. DOI: 10.5772/intechopen.79855 (InTech) 3. D.K. Halim, C.M. Tang, M.S. Ng., and D. Hartono, "Software-based turbo decoder implementation on low power multi-processor system-on-chip for Internet of Things," 2017 4th International Conference on New Media Studies (CONMEDIA), Yogyakarta, 2017, pp. 137-141, doi: 10.1109/CONMEDIA.2017.8266045.

Lab

Module designation	CE631L Embedded System Design Lab
Semester(s) in which the module is taught	5
Person responsible for the module	Dareen Kusuma Halim
Language	English & Indonesian
Relation to curriculum	Compulsory
Teaching methods	Demonstration, Cooperative Learning
Workload (incl. contact hours, self-study hours)	Total workload: 45.36 hours - 23.35 hours of group project (in-class assistance) - 16.34 hours of self-conducted group project and assignments related to the group project

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<tr><td></td><td colspan="3">- 5.67 hours related to exam and self study</td></tr>
<tr><td>Credit points</td><td colspan="3">1 SKS (1.68 ECTS)</td></tr>
<tr><td>Required and recommended prerequisites for joining the module</td><td colspan="3">Required:
- CE432 Microprocessor System
- CE439 Interfacing & Instrumentation
- EEM411 Electronic Fundamentals</td></tr>
<tr><td rowspan="3">Module objectives/intended learning outcomes</td><td rowspan="2">Course Learning outcome</td><td colspan="2">Related ELOs</td></tr>
<tr><td>ELO</td><td>Performance Indicator</td></tr>
<tr><td>Students are able to design an embedded system as a solution for particular problems, with the proper methodology</td><td>G

I</td><td>Ability to develop embedded systems by means of appropriately combining software and hardware as a solution for user problems.

Ability to develop and integrate software and hardware as scalable distributed systems that incorporate various device types for the purpose of solving engineering problems.</td></tr>
<tr><td>Students are able to plan and execute embedded system tasks in a group</td><td>D</td><td>Ability to operate and coordinate (if necessary) on technical working tasks in a team.</td></tr>
<tr><td>Content</td><td colspan="3">This course covers the basics of developing a functional embedded system with focus on modularity, usability, and maintenance.

Specifically, this course contain these topics:
1. Embedded system as a solution
2. Embedded system constraints and requirements
3. Modularity (hardware)
4. Modularity (software)
5. Modularity (testing)
6. System communication flow
7. Power circuitry
8. Embedded system usability</td></tr>
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	9. Embedded system documentation
Examination forms	Project, Observation
Study and examination requirements	Total score ≥ 55 must be satisfied. The total score is the weighted average of the assignments (30%), the midterm exam (30%), and the final exam (40%).
Reading list	1. White, E. 2011. Making Embedded Systems: Design patterns for Great Software. O'Reilly Media, Inc.