



MODULE HANDBOOK MICROELECTRIC SYSTEM IN BIOMEDICAL APPLICATION



**BACHELOR DEGREE PROGRAM
DEPARTMENT OF BIOMEDICAL ENGINEERING
FACULTY OF INTELLIGENT ELECTRICAL AND INFORMATICS
TECHNOLOGY**

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

ENDORSEMENT PAGE



MODULE HANDBOOK
Microelectronic System in Biomedical Applications
DEPARTMENT OF BIOMEDICAL ENGINEERING
 INSTITUT TEKNOLOGI SEPULUH NOPEMBER
 Number : 6869/IT2.IX.5.1.2/B/PP.03.00.00/2023

Proses Process	Penanggung Jawab Person in Charge			Tanggal Date
	Nama Name	Jabatan Position	Tandatangan Signature	
Perumus <i>Preparation</i>	Dr. Rachmad Setiawan, S.T., M.T.	Dosen <i>Lecturer</i>		November 18, 2022
Pemeriksa dan Pengendalian <i>Review and Control</i>	Dr. Tri Arief Sardjono, S.T., M.T.	Tim kurikulum <i>Curriculum team</i>		November 20, 2022
Persetujuan <i>Approval</i>	Dr. Rachmad Setiawan, S.T., M.T.	Koordinator RMK <i>Course Cluster Coordinator</i>		April 13, 2023
Penetapan <i>Determination</i>	Dr. Achmad Arifin, S.T., M.Eng.	Kepala Departemen <i>Head of Department</i>		April 17, 2023


MODULE HANDBOOK

MICROELECTRIC SYSTEM IN BIOMEDICAL APPLICATION

Module name	Microelectric System in Biomedical Application	
Module level	Undergraduate	
Code	EB234501	
Course (if applicable)	Microelectric System in Biomedical Application	
Semester	Sixth Semester (Genap)	
Person responsible for the module	Nada Fitriyatul Hikmah, S.T., M.T.	
Lecturer	Dr. Rachmad Setiawan, S.T., M.T.	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory , 6 th semester.	
Type of teaching, contact hours	Lectures, <60 students	
Workload	<ol style="list-style-type: none"> 1. Lectures : 3 x 50 = 150 minutes per week. 2. Exercises and Assignments : 3 x 50 = 150 minutes per week. 3. Private learning : 3 x 50 = 150 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.	
Mandatory prerequisites	EB234401- Fundamentals of Microcontrollers and Microprocessor	
Learning outcomes and their corresponding PLOs	<p>Course Learning Outcome (CLO) after completing this module,</p> <p>CLO 1: Students are able to mention and explain various microelectronics application inside medical field</p> <p>CLO 2: Students are able to create and implement the simple embedded system for medical application</p> <p>CLO 3: Students are able to explain the work principle of Embedded Operation System and its application inside the microcontroller system</p> <p>CLO 4: Students are able to create digital architecture in hardware programming language</p> <p>CLO 5: Students have knowledge regarding Integrated Circuit design process</p>	

	SoC? CLO 6: Students are able to have the skills to create medical application in mobile devices	
Content	Microelectronic knowledge for medical application and microelectronic design skills with using the available tools	
Study and examination requirements and forms of examination	<ul style="list-style-type: none"> • In-class exercises • Assignment 1, 2 • Practice 1,2 • Presentation 1,2 • Mid-term examination • Final examination 	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.	
Reading list	Main : <ol style="list-style-type: none"> 1. Krzysztof Iniewski, <i>VLSI Circuits for Biomedical Applications</i>. Artech House, Inc., Norwood, 2008 2. Wanjun Wang, Steven A. Soper (Ed.), <i>Bio-MEMS: Technologies and Applications</i>. CRC Press, Boca Raton, 2007 3. Frank Vahid and Tony Givargis, <i>Embedded System Design: A Unified Hardware/Software Approach</i>. University of California Riverside, 1999 4. Jean J. Labrosse, <i>MicroC/OS-II The Real-Time Kernel</i>. Miller Freeman, Inc., Lawrence, 1999 5. Stephen Brown and Zvonko Vranesic, <i>Fundamentals of Digital Logic with VHDL Design (Second Edition)</i>. McGraw Hill, New York, 2005 	

I. Rencana Pembelajaran Semester / Semester Learning Plan

		INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS) FACULTY OF INTELLIGENT ELECTRICAL AND INFORMATICS TECHNOLOGY DEPARTMENT OF BIOMEDICAL ENGINEERING				Document Code
SEMESTER LEARNING PLAN						
MATA KULIAH (MK) COURSE	KODE CODE	Rumpun MK Course Cluster	BOBOT (sks) Credits		SEMESTER	Tgl Penyusunan Compilation Date
Sistem Mikroelektronika Biomedika <i>Microelectric System in Biomedical Application</i>	EB234501	Ilmu Dasar Teknik <i>Basic Engineering</i>	T=3	P=0	VI	Nov 19, 2022
OTORISASI / PENGESAHAN AUTHORIZATION / ENDORSEMENT	Dosen Pengembang RPS <i>Developer Lecturer of Semester Learning Plan</i>		Koordinator RMK <i>Course Cluster Coordinator</i>		Ka DEPARTEMEN <i>Head of Department</i>	
	(Dr. Rachmad Setiawan, S.T., M.T.)		(Dr. Rachmad Setiawan, S.T., M.T.)		(Dr. Achmad Arifin, S.T., M.Eng.)	
Capaian Pembelajaran	CPL-PRODI yang dibebankan pada MK PLO Program Charged to The Course					
Learning Outcomes	CPL-03	Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan				
	PLO-03	Able to design and implement laboratory experiment and / or field experiments, analyze and interpret data, and use objective assessments to draw conclusions				
	CPL-05	Mampu mendesain komponen, sistem, dan proses dalam bidang Teknik Biomedika yang sistematis, logis, dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi dengan mengenali/memanfaatkan sumber daya lokal dan nasional dengan wawasan global				

	PLO-05	<i>Able to design components, systems, and processes in the field of Biomedical Engineering that are systematic, logical, and realistic appropriate with specified specifications by considering aspects of safety, social, cultural, environmental, and economic by recognizing / utilizing local and national resources with global insight</i>
	CPL-08 PLO-08	Mampu bekerja dalam tim lintas disiplin dan budaya serta bertanggung jawab kepada masyarakat dan mematuhi hukum dan etika profesi dalam menyelesaikan masalah Teknik Biomedika <i>Able to work in interdisciplinary and intercultural teams and be responsible to the community and comply with legal and professional ethics in solving Biomedical Engineering problems</i>
	CPL-09 PLO-09	Mampu mengetahui/mengikuti perkembangan terkini dibidang ilmu pengetahuan dan teknologi serta menyikapinya secara obyektif dengan mengedepankan nilai-nilai kebenaran universal <i>Able to know / follow the latest developments in the field of science and technology and to react objectively by promoting the values of universal truth</i>
Capaian Pembelajaran Mata Kuliah (CPMK) Course Learning Outcome (CLO) - If CLO as description capability of each Learning Stage in the course, then CLO = LLO		
	CP MK 1 CLO 1	Mahasiswa dapat menyebutkan dan mampu menjelaskan berbagai aplikasi mikroelektronika didalam dunia medis. <i>Students are able to mention and explain various microelectronics application inside medical field</i>
	CP MK 2 CLO 2	Mahasiswa mampu mendesain dan mengimplementasikan sistem embedded sederhana untuk aplikasi medis. <i>Students are able to create and implement the simple embedded system for medical application</i>
	CP MK 3 CLO 3	Mahasiswa mampu menjelaskan prinsip kerja Sistem Operasi Embedded dan penerapannya dalam sistem mikrokontroler. <i>Students are able to explain the work principle of Embedded Operation System and its application inside the microcontroller system</i>
	CP MK 4 CLO 4	Mahasiswa mampu membuat arsitektur digital dalam bahasa pemrograman hardware. <i>Students are able to create digital architecture in hardware programming language</i>
	CP MK 5 CLO 5	Mahasiswa memiliki pengetahuan tentang proses desain Integrated Circuit (IC). <i>Students have knowledge regarding Integrated Circuit design process</i>
	CP MK 6 CLO 6	Mahasiswa memiliki keterampilan membuat aplikasi medis di perangkat bergerak <i>Students are able to have the skills to create medical application in mobile devices</i>

<p>Peta CPL – CP MK</p> <p><i>Map of PLO - CLO</i></p>	<table border="1"> <thead> <tr> <th></th> <th>CPL-01</th> <th>CPL-02</th> <th>CPL-03</th> <th>CPL-04</th> <th>CPL-05</th> <th>CPL-06</th> <th>CPL-07</th> <th>CPL-08</th> <th>CPL-09</th> <th>CPL-10</th> <th>CPL-11</th> <th>CPL-12</th> </tr> </thead> <tbody> <tr> <td>CPMK 1 / SUB CPMK 1 <i>CLO 1 / LLO 1</i></td> <td></td> <td></td> <td>√</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>CPMK 2 / SUB CPMK 2 <i>CLO 2 / LLO 2</i></td> <td></td> <td></td> <td>√</td> <td></td> <td>√</td> <td></td> <td></td> <td>√</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CPMK 3 / SUB CPMK 3 <i>CLO 3 / LLO 3</i></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>CPMK 4 / SUB CPMK 4 <i>CLO 4 / LLO 4</i></td> <td></td> <td></td> <td></td> <td></td> <td>√</td> <td></td> <td></td> <td>√</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CPMK 5 / SUB CPMK 5 <i>CLO 5 / LLO 5</i></td> <td></td> <td></td> <td></td> <td></td> <td>√</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CPMK 6 / SUB CPMK 6 <i>CLO 6 / LLO 6</i></td> <td></td> <td></td> <td>√</td> <td></td> <td>√</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		CPL-01	CPL-02	CPL-03	CPL-04	CPL-05	CPL-06	CPL-07	CPL-08	CPL-09	CPL-10	CPL-11	CPL-12	CPMK 1 / SUB CPMK 1 <i>CLO 1 / LLO 1</i>			√						√				CPMK 2 / SUB CPMK 2 <i>CLO 2 / LLO 2</i>			√		√			√					CPMK 3 / SUB CPMK 3 <i>CLO 3 / LLO 3</i>									√				CPMK 4 / SUB CPMK 4 <i>CLO 4 / LLO 4</i>					√			√					CPMK 5 / SUB CPMK 5 <i>CLO 5 / LLO 5</i>					√								CPMK 6 / SUB CPMK 6 <i>CLO 6 / LLO 6</i>			√		√							
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<p>Diskripsi Singkat MK</p> <p><i>Short Description of Course</i></p>	<p>Pengetahuan tentang teknologi mikroelektronika untuk aplikasi medis dan ketrampilan desain sistem mikroelektronika dengan menggunakan tool yang tersedia</p> <p><i>Microelectronic knowledge for medical application and microelectronic design skills with using the available tools</i></p>																																																																																											
<p>Bahan Kajian:</p> <p>Materi pembelajaran</p> <p>Course Materials:</p>	<ol style="list-style-type: none"> 1. Perancangan software akuisisi data dan metode sampling /<i>Data acquisitions software design and sampling method</i> 2. Metode kalibrasi sensor secara software/ <i>Sensor calibration method by software</i> 3. <i>Microcontroller for embedded biomedical signal processing/Microcontroller for embedded biomedical signal processing</i> 4. Metode komunikasi data sistem mikrokontroler untuk aplikasi elektronika medika /<i>Microcontroller system data communication method for medical electronic application</i> 5. Penyajian data dengan aplikasi dan perangkat bergerak /<i>Presentation of data with applications and mobile devices</i> 																																																																																											
<p>Pustaka</p>	<p>Utama / Main:</p>																																																																																											

References		<ol style="list-style-type: none"> 1. Krzysztof Iniewski, <i>VLSI Circuits for Biomedical Applications</i>. Artech House, Inc., Norwood, 2008 2. Wanjun Wang, Steven A. Soper (Ed.), <i>Bio-MEMS: Technologies and Applications</i>. CRC Press, Boca Raton, 2007 3. Frank Vahid and Tony Givargis, <i>Embedded System Design: A Unified Hardware/Software Approach</i>. University of California Riverside, 1999 4. Jean J. Labrosse, <i>MicroC/OS-II The Real-Time Kernel</i>. Miller Freeman, Inc., Lawrence, 1999 5. Stephen Brown and Zvonko Vranesic, <i>Fundamentals of Digital Logic with VHDL Design (Second Edition)</i>. McGraw Hill, New York, 2005 					
		Pendukung / Supporting:					
Dosen Pengampu Lecturers		Dr. Rachmad Setiawan, S.T., M.T.					
Matakuliah syarat Prerequisite		EB234401- Dasar Mikrokontroler dan Mikroprosesor <i>EB234401– Fundamentals of Microcontroller and Microprocessor</i>					
Mg ke/ Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) / <i>Final ability of each learning stage (LLO)</i>	Penilaian / <i>Assessment</i>		Bantuk Pembelajaran; Metode Pembelajaran; Penugasan Mahasiswa; <i>[Estimasi Waktu] / Form of Learning; Learning Method; Student Assignment; [Estimated Time]</i>		Materi Pembelajaran <i>[Pustaka] / Learning Material [Reference]</i>	Bobot Penilaian / <i>Assessment Load (%)</i>
		Indikator / <i>Indicator</i>	Kriteria & Teknik / <i>Criteria & Techniques</i>				
(1)	(2)	(3)	(4)	Tatap Muka / <i>In-class (5)</i>	Daring / <i>Online (6)</i>	(7)	(8)

1	<p>Mahasiswa dapat menyebutkan dan mampu menjelaskan berbagai aplikasi mikroelektronika di dalam dunia medis.</p> <p><i>Students are able to mention and explain various microelectronics application inside medical field</i></p>	<ul style="list-style-type: none"> • Mampu menyebutkan berbagai aplikasi mikroelektronika didalam dunia medis • Mampu menjelaskan berbagai aplikasi didalam dunia medis • <i>Able to mention various microelectronics application inside medical field</i> • <i>Able to explain various microelectronics application inside medical field</i> 	<p>Non-tes : Diskusi Tugas 1</p> <p>Non-test : Discussion Assignment 1</p>	<ul style="list-style-type: none"> • Kuliah dan brainstorming, tanya jawab. [TM : 3 x 50"] [BM : 3 x 50"] [PT : 3 x 50"] • <i>Presentation and brainstorming, ask and answer.</i> [FF : 3 x 50"] [SA : 3 x 50"] [SS : 3 x 50"] 	<ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. • <i>Chat and discussion in ITS platform forum.</i> 	<ul style="list-style-type: none"> • Pengantar mikroelektronika medika • <i>Introduction to Medical Microelectronics</i> 	5
2-3	<p>Mahasiswa mampu mendesain dan mengimplementasikan sistem embedded sederhana untuk aplikasi medis di mikrokontroler ARM.</p> <p><i>Students are able to create</i></p>	<ul style="list-style-type: none"> • Mampu mendesain sistem embedded sederhana untuk aplikasi medis • Mampu mengimplementasikan sistem embedded sederhana untuk aplikasi medis 	<p>Non-tes : Diskusi Praktikum 1</p> <p>Non-test : Discussion Practice 1</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 3 x 50"] [BM : 3 x 50"] [PT : 3 x 50"] 		<ul style="list-style-type: none"> • Perancangan software akuisisi data dan metode sampling • <i>Data acquisitions software design and sampling methods</i> 	20

	<p><i>and implement the simple embedded system for medical application in ARM microcontroller</i></p>	<ul style="list-style-type: none"> • <i>Able to create the simple embedded system for medical application</i> • <i>Able to implement the simple embedded system for medical application</i> 		<ul style="list-style-type: none"> • <i>Presentation, discussion, ask and answer, exercise, assignment</i> [FF : 3 x 50"] [SA : 3 x 50"] [SS : 3 x 50"] 			
4 - 7	<p>Mahasiswa mampu menjelaskan prinsip kerja Sistem Operasi Embedded dan penerapannya dalam sistem mikrokontroler ARM.</p> <p><i>Students are able to explain the work principle of Embedded Operation System and its application inside the ARM microcontroller system</i></p>	<ul style="list-style-type: none"> • Mampu menjelaskan prinsip kerja Sistem Operasi Embedded dan penerapannya dalam sistem mikrokontroler • <i>Able to explain the work principle of Embedded Operation System and its application inside the microcontroller system</i> 	<p>Non-tes : Diskusi Presentasi 1.</p> <p>Non-test : Discussion Presentation 1</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, latihan soal, tugas [TM : 3 x 50"] [BM : 3 x 50"] [PT : 3 x 50"] • <i>Presentation, discussion, ask and answer, exercise, assignment</i> [FF : 3 x 50"] [SA : 3 x 50"] [SS : 3 x 50"] 		<ul style="list-style-type: none"> • Metode kalibrasi sensor secara <i>software</i> • <i>Sensor calibration method by software</i> 	10
8	EVALUASI TENGAH SEMESTER MID-SEMESTER EXAM						15

<p>9 - 10</p>	<p>Mahasiswa mampu membuat arsitektur digital dalam bahasa pemrograman hardware (VHDL) di FPGA.</p> <p><i>Students are able to create digital architecture in FPGA hardware programming language (VHDL)</i></p>	<ul style="list-style-type: none"> • Mampu membuat arsitektur digital dalam bahasa pemrograman hardware • <i>Able to create digital architecture in hardware programming language</i> 	<p>Non-tes : Diskusi Tugas 2</p> <p>Non-test : Discussion Assignment 2</p>	<ul style="list-style-type: none"> • Kuliah, Diskusi, tanya jawab, latihan soal, tugas. [TM : 3 x 50"] [BM : 3 x 50"] [PT : 3 x 50"] • <i>Presentation, discussion, ask and answer, exercise, assignment.</i> [FF : 3 x 50"] [SA : 3 x 50"] [SS : 3 x 50"] 		<ul style="list-style-type: none"> • <i>Microcontroller for embedded biomedical signal processing</i> • <i>Microcontroller for embedded biomedical signal processing</i> 	<p>5</p>
<p>11 -12</p>	<p>Mahasiswa memiliki pengetahuan tentang proses desain Integrated Circuit (IC) di FPGA.</p> <p><i>Students have knowledge regarding Integrated Circuit design process in FPGA</i></p>	<ul style="list-style-type: none"> • Memiliki pengetahuan tentang proses desain Integrated Circuit (IC) • <i>Have knowledge regarding Integrated Circuit (IC) design process</i> 	<p>Non tes: Diskusi Presentasi 2</p> <p>Non-test: Discussion Presentation 2</p>	<ul style="list-style-type: none"> • Kuliah, Diskusi, tanya jawab, latihan soal, tugas. [TM : 3 x 50"] [BM : 3 x 50"] [PT : 3 x 50"] • <i>Presentation, discussion, ask and answer,</i> 		<ul style="list-style-type: none"> • Metode komunikasi data sistem mikrokontroler untuk aplikasi elektronika medika • <i>Microcontroller system data communication</i> 	<p>10</p>


				<p><i>exercise, assignment.</i></p> <p><i>[FF : 3 x 50"]</i> <i>[SA : 3 x 50"]</i> <i>[SS : 3 x 50"]</i></p>		<p><i>method for medical electronic application</i></p>	
13-14	<p>Mahasiswa memiliki ketrampilan membuat aplikasi medis tertanam di FPGA</p> <p><i>Students are able to have the skills to create embedded medical application in FPGA</i></p>	<ul style="list-style-type: none"> • Memiliki keterampilan membuat aplikasi medis di perangkat bergerak • <i>Able to have the skills to create medical application in mobile devices</i> 	<p>Non-Test: Diskusi, Praktikum 2</p> <p>Non-Test: Discussion Practice 2</p>	<ul style="list-style-type: none"> • Kuliah, Diskusi, tanya jawab, latihan soal, tugas. [TM : 3 x 50"] [BM : 3 x 50"] [PT : 3 x 50"] • <i>Presentation, discussion, ask and answer, exercise, assignment.</i> <p><i>[FF : 3 x 50"]</i> <i>[SA : 3 x 50"]</i> <i>[SS : 3 x 50"]</i></p>		<ul style="list-style-type: none"> • Penyajian data dengan aplikasi dan perangkat bergerak • <i>Presentation of data with applications and mobile devices</i> 	20
15-16	EVALUASI AKHIR SEMESTER						40

	FINAL-SEMESTER EXAM	
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TM=Tatap Muka, **PT**=Penugasan Terstruktur, **BM**=Belajar Mandiri.

FF = Face to Face, **SA** = Structured Assignment, **SS** = Self Study.

II. Rencana Asesmen & Evaluasi (RAE) / *Assessment & Evaluation Plan*

	ASSESSMENT & EVALUATION PLAN BACHELOR DEGREE PROGRAM OF BIOMEDICAL ENGINEERING - FTEIC ITS Course : Microelectric System in Biomedical Application		RA&E
			Write Doc Code
Kode/code: EB234501	Bobot sks/credits (T/P): 2/0	Rumpun MK: Ilmu Dasar Teknik Course Cluster: Basic Engineering	Smt: VI
OTORISASI AUTHORIZATION	Penyusun RA & E Compiler A&EP Nada Fitriyatul H, S.T, M.T	Koordinator RMK Course Cluster Coordinator Muhammad Hilman Fatoni, S.T., M.T.	Ka DEP Head of DEP Dr. Achmad Arifin, S.T., M.Eng.

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
1-2	Sub CP-MK 1: Mahasiswa dapat menyebutkan dan mampu menjelaskan berbagai aplikasi mikroelektronika didalam dunia medis. LLO 1: <i>Students are able to mention and explain various microelectronics application inside medical field</i>	Non-tes : Tugas 1: Tes: 1 Soal pada ETS Non-test : Task 1 Test: 1 Question on Mid-semester Exam	10
3-5	Sub CP-MK 2: Mahasiswa mampu mendesain dan mengimplementasikan sistem embedded sederhana untuk aplikasi medis. LLO 2:	Non-tes : Tugas Demo dan Laporan Tes: ETS 1 Soal Non-test : Demo Assignments and Reports	25

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	<i>Students are able to create and implement the simple embedded system for medical application</i>	Test: <i>1 Question on Mid-semester Exam</i>	
6-7	<p>Sub CP-MK 3: Mahasiswa mampu menjelaskan prinsip kerja Sistem Operasi Embedded dan penerapannya dalam sistem mikrokontroler.</p> <p>LLO 3: <i>Students are able to explain the work principle of Embedded Operation System and its application inside the microcontroller system</i></p>	<p>Non-tes : Tugas Presentasi dan Laporan</p> <p>Tes: ETS 1 Soal</p> <p>Non-test : Presentation Assignments and Reports</p> <p>Test: <i>1 Question on Mid-semester Exam</i></p>	15
8	<p>Evaluasi Tengah Semester</p> <p>Mid Exam</p>	<p>Tes: Ujian Tulis/Ujian Daring</p> <p>Test: <i>Writing Exams / Online Exams</i></p>	15
9-10	<p>Sub CP-MK 4: Mahasiswa mampu membuat arsitektur digital dalam bahasa pemrograman hardware.</p> <p>LLO 4: <i>Students are able to create digital architecture in hardware programming language</i></p>	<p>Non-tes : Tugas Presentasi dan Laporan</p> <p>Tes: 1 Soal pada EAS</p> <p>Non-test : Presentation Assignments and Reports</p> <p>Test: <i>1 Question On Final Exam</i></p>	10

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
11-12	<p>Sub CP-MK 5: Mahasiswa memiliki pengetahuan tentang proses desain Integrated Circuit (IC).</p> <p>LLO 5: <i>Students have knowledge regarding Integrated Circuit design process</i></p>	<p>Non-tes : Tugas 2</p> <p>Tes: 1 Soal pada EAS</p> <p>Non-test: Assignment 2</p> <p>Test: <i>1 Question On Final Exam</i></p>	15
13-14	<p>Sub CP-MK 6: Mahasiswa memiliki ketrampilan membuat aplikasi medis di perangkat bergerak.</p> <p>LLO 6: <i>Students are able to have the skills to create medical application in mobile devices</i></p>	<p>Non-Tes: Tugas Demo dan Laporan</p> <p>Tes: 1 Soal pada EAS</p> <p>Non-Test: Demo Assignments and Reports</p> <p>Test: 1 Question On Final Exam</p>	25
16	<p>Evaluasi Akhir</p> <p>Final Exam</p>	<p>Tes: Ujian Tulis/Ujian Daring</p> <p>Test: <i>Writing Exams / Online Exams</i></p>	15
Total bobot penilaian Total assessment load			100%

Indikator Pencapaian CPL Pada MK / *Indicator of PLO achievement charged to the course*

CPL yang dibebankan pada MK / <i>PLO charged to the course</i>	CPMK / <i>Course Learning Outcome (CLO)</i>	Minggu ke / <i>Week</i>	Bentuk Asesmen / <i>Form of Assessment</i>	Bobot / <i>Load (%)</i>
CPL-03/ <i>PLO-03</i>	CPMK 1 / <i>CLO 1</i>	<i>Week- 1</i>	<i>Task 1</i>	5
		<i>Week-8</i>	<i>Mid Exam 1 Question</i>	2.5
	CPMK 2 / <i>CLO 2</i>	<i>Week-3</i>	<i>Demo Assignment 1 and Reports</i>	8.3
		<i>Week-8</i>	<i>Mid Exam 1 Question</i>	2.5
	CPMK 6 / <i>CLO 5</i>	<i>Week- 13</i>	<i>Demo Assignment 2 and Reports</i>	12.5
		<i>Week- 16</i>	<i>Final Exam 1 Question</i>	3
CPL-05 / <i>PLO-05</i>	CPMK 2 / <i>CLO 2</i>	<i>Week-3</i>	<i>Demo Assignment 1 and Reports</i>	8.3
		<i>Week-8</i>	<i>Mid Exam 1 Question</i>	2.5
	CPMK 4 / <i>CLO 4</i>	<i>Week- 9</i>	<i>Presentation Assignment 2 and Reports</i>	5
		<i>Week-16</i>	<i>Final Exam 1 Question</i>	3
	CPMK 5 / <i>CLO 5</i>	<i>Week-11</i>	<i>Task 2</i>	15
		<i>Week-16</i>	<i>Final Exam 1 Question</i>	3
	CPMK 6 / <i>CLO 6</i>	<i>Week- 13</i>	<i>Demo Assignment 2 and Reports</i>	12.5
		<i>Week- 16</i>	<i>Final Exam 1 Question</i>	3
CPL-08 / <i>PLO-08</i>	CPMK 2 / <i>CLO 2</i>	<i>Week-3</i>	<i>Demo Assignment 1 and Reports</i>	8.3
		<i>Week-8</i>	<i>Mid Exam 1 Question</i>	2.5
	CPMK 4 / <i>CLO 4</i>	<i>Week- 9</i>	<i>Presentation Assignment 2 and Reports</i>	5

		Week-16	Final Exam 1 Question	3
CPL-09 / PLO -09	CPMK 1 / CLO 1	Week- 1	Task 1	5
		Week-8	Mid Exam 1 Question	2.5
	CPMK 3 / CLO 3	Week- 6	Presentation Assignment 1 and Reports	15
		Week- 8	Mid Exam 1 Question	2.5
				Σ = 100%

No	Form of Assessment	PLO-01	PLO-02	PLO-03	PLO-04	PLO-05	PLO-06	PLO-07	PLO-08	PLO-09	PLO-10	PLO-11	PLO-12	Total
1	Task 1			0.05						0.05				0.1
2	Task 2					0.15								0.15
3	Demo Assignment 1			0.083		0.083			0.083					0.25
3	Demo Assignment 2			0.125		0.125								0.25
4	Presentation Assignment 1									0.15				0.15
4	Presentation Assignment 2			0.05					0.05					0.1
5	Mid Exam			0.05		0.025			0.025	0.05				0.15
6	Final Exam			0.03		0.09			0.03					0.15
	Total													1

