



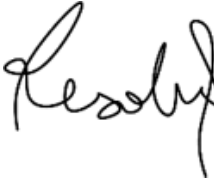
Bachelor Degree Program Department of Biomedical Engineering

Faculty of Intelligent Electrical Technology and Informatics
Institut Teknologi Sepuluh Nopember



MODULE HANDBOOK
Basic Electronics and Laboratory
DEPARTMENT OF BIOMEDICAL ENGINEERING
 INSTITUT TEKNOLOGI SEPULUH NOPEMBER
 Number : 6820/IT2.IX.5.1.2/B/PP.03.00.00/2023

ENDORSEMENT PAGE

Proses <i>Process</i>	Penanggung Jawab <i>Person in Charge</i>			Tanggal <i>Date</i>
	Nama <i>Name</i>	Jabatan <i>Position</i>	Tandatangan <i>Signature</i>	
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>	Eko Agus Suprayitno, S.Si, 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

BASIC ELECTRONICS AND LABORATORY

Module name	Basic Electronics and Laboratory	
Module level	Undergraduate	
Code	EB234302	
Course (if applicable)	Basic Electronics and Laboratory	
Semester	Third Semester	
Person responsible for the module	Fauzan Arrofiqi, S.T., M.T., Ph.D.	
Lecturer	Dr. Rachmad Setiawan, S.T., M.T. M. Yazid, B.Eng., M.Eng. Dr. Ir. Hendra Kusuma, M.Eng. Sc Fauzan Arrofiqi, S.T., M.T., Ph.D. Muhammad Adib Syamlan, S.T., M.T. Rasyida Shabihah Zukro Aini, S.T., M.T. Dr. Norma Hermawan, S.T., M.T., M.Sc. Prof. Dr. Tri Arief Sardjono, S.T., M.T.	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory , 3 rd semester.	
Type of teaching, contact hours	Lectures, <60 students Tuesday, 08.00-10.50 (GMT+7)	
Workload	1. Lectures : 4 x 50 = 200 minutes per week. 2. Exercises and Assignments : 4 x 50 = 200 minutes per week. 3. Private learning : 4 x 50 = 200 minutes per week.	
Credit points	4 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	-	
Learning outcomes and their corresponding PLOs	Course Learning Outcome (CLO) after completing this module, CLO 1: Students are able to understand and explain basic theories about semiconductor materials and diode components, and are able to identify diode characteristics.	PLO-04

	CLO 2: Students are able to understand a series of diode applications and are able to design, analyze, and realize a series of diode applications with the correct methodology. CLO 3: Students are able to understand the basic theory of the BJT transistor and are able to explain the basic operations of the BJT transistor. CLO 4: Students are able to understand dc bias circuits and switching and are able to design, analyze, and realize dc bias circuits and switching with the correct methodology. CLO 5: Students are able to understand the stages of amplifier circuit design using BJT transistors and are able to design, analyze, and realize single stage and multistage amplifier circuits with the correct methodology. CLO 6: Students are able to understand the basic theory of the FET transistor and explain the stages of amplifier design using a FET transistor. CLO 7: Students are able to understand power amplifier circuits and are able to design, analyze and realize power amplifier circuits using the correct methodology. CLO 8: Students understand and are able to explain the PNP component application.	PLO-08 PLO-04 PLO-08 PLO-06 PLO-06 PLO-06
Content	Basic Electronics and Laboratory is a mandatory courses that discuss the basic science of electronics, both theoretically and practically. This course aims to make students understand the characteristics of electronic components such as diodes, BJT transistors, FET transistors, and others. In addition, this course also aims to enable students to conduct experiments on theories that have been studied and understood, so that students can be trained and skilled in using components and equipment with the correct procedures. With this understanding and skills, students are expected to be able to apply it on biomedical engineering field.	
Study and examination requirements and forms of examination	● In-class exercises ● Assignment 1, 2, 3, 4, 5, 6, 7, 8, 9 ● Lab Work 1, 2, 3, 4, 5 ● Mid-term examination ● Final examination	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.	
Reading list	Main : 1. Floyd, Thomas L., "Electronic Devices : Electron Flow Version 9th Ed", Prentice-Hall, 2013.	

	2. S.M. Sze, "Semiconductor Devices Physics and Technology", John Wiley & Sons, 1985. 3. David A. Bell, "Solid State Pulse Circuit", Prentice-Hall, 1976. Supporting : 1. Floyd, Thomas L., and David B., "Fundamentals of Analog Circuit", Prentice-Hall, 2002. 2. Malvino, A. P., "Electronic Principles", McGraw-Hill Education, 2015.
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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
Dasar Elektronika dan Laboratorium Basic Electronics and Laboratory	EB234302	Ilmu Dasar Teknik Basic Engineering	T=3	P=1	III	27 Oktober 2023
OTORISASI / PENGESAHAN AUTHORIZATION / ENDORSEMENT	Dosen Pengembang RPS Developer Lecturer of Semester Learning Plan		Koordinator RMK Course Cluster Coordinator		Ka DEPARTEMEN Head of Department	
	(Fauzan Arrofiqi, S.T., M.T., Ph.D.)		(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-04 PLO-04	Mampu menerapkan Ilmu Pengetahuan Alam dan Matematika pada bidang Teknik Biomedika. Able to apply Natural Sciences and Mathematics in the field of Biomedical Engineering.				
	CPL-06 PLO-06	Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan. Able to design and implement laboratory experiment and / or field experiments, analyze and interpret data, and use objective assessments to draw conclusions.				
	CPL-08	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-08	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.
	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 memahami dan mampu menjelaskan teori dasar tentang bahan semikonduktor dan komponen dioda, serta mampu mengidentifikasi karakteristik dioda. <i>Students are able to understand and explain basic theories about semiconductor materials and diode components, and are able to identify diode characteristics.</i>
	CP MK 2 CLO 2	Mahasiswa memahami rangkaian aplikasi dioda dan mampu merancang, menganalisa serta merealisasikan rangkaian aplikasi dioda dengan metodologi yang benar. <i>Students are able to understand a series of diode applications and are able to design, analyze, and realize a series of diode applications with the correct methodology.</i>
	CP MK 3 CLO 3	Mahasiswa memahami teori dasar transistor BJT dan mampu menjelaskan operasi dasar dari transistor BJT. <i>Students are able to understand the basic theory of the BJT transistor and are able to explain the basic operations of the BJT transistor.</i>
	CP MK 4 CLO 4	Mahasiswa memahami rangkaian <i>bias dc</i> dan <i>switching</i> dan mampu merancang, menganalisa serta merealisasikan rangkaian <i>bias dc</i> dan <i>switching</i> dengan metodologi yang benar. <i>Students are able to understand dc bias circuits and switching and are able to design, analyze, and realize dc bias circuits and switching with the correct methodology.</i>
	CP MK 5 CLO 5	Mahasiswa memahami tahapan perancangan rangkaian penguat (<i>amplifier</i>) menggunakan transistor BJT dan mampu merancang, menganalisa serta merealisasikan rangkaian <i>amplifier single stage</i> dan <i>multistage</i> dengan metodologi yang benar. <i>Students are able to understand the stages of amplifier circuit design using BJT transistors and are able to design, analyze, and realize single stage and multistage amplifier circuits with the correct methodology.</i>
	CP MK 6 CLO 6	Mahasiswa memahami teori dasar transistor FET dan mampu menjelaskan tahapan perancangan penguat menggunakan transistor FET. <i>Students are able to understand the basic theory of the FET transistor and explain the stages of amplifier design using a FET transistor.</i>
	CP MK 7	Mahasiswa memahami rangkaian penguat daya dan mampu merancang, menganalisa serta merealisasikan rangkaian penguat daya dengan metodologi yang benar.

	CLO 7	<i>Students are able to understand power amplifier circuits and are able to design, analyze and realize power amplifier circuits using the correct methodology.</i>																																																																																																																																
	CP MK 8 CLO 8	Mahasiswa memahami dan mampu menjelaskan aplikasi komponen PNP. <i>Students understand and are able to explain the PNP component application.</i>																																																																																																																																
Peta CPL – CP MK Map of PLO - CLO	<table><tr><td></td><td>CPL-01</td><td>CPL-02</td><td>CPL-03</td><td>CPL-04</td><td>CPL-05</td><td>CPL-06</td><td>CPL-07</td><td>CPL-08</td><td>CPL-09</td><td>CPL-10</td><td>CPL-11</td><td>CPL-12</td></tr><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><tr><td>CPMK 7 / SUB CPMK 7 <i>CLO 7 / LLO 7</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 8 / SUB CPMK 8 <i>CLO 8 / LLO 8</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></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>						✓							CPMK 7 / SUB CPMK 7 <i>CLO 7 / LLO 7</i>						✓							CPMK 8 / SUB CPMK 8 <i>CLO 8 / LLO 8</i>				✓								
	CPL-01	CPL-02	CPL-03	CPL-04	CPL-05	CPL-06	CPL-07	CPL-08	CPL-09	CPL-10	CPL-11	CPL-12																																																																																																																						
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Diskripsi Singkat MK Short Description of Course	Mata kuliah Dasar Elektronika dan Laboratorium merupakan mata kuliah wajib yang membahas mengenai ilmu dasar elektronika baik secara teori maupun praktek. Mata kuliah ini bertujuan agar mahasiswa memahami karakteristik dari komponen-komponen elektronika seperti diode, transistor BJT, transistor FET, dan lain-lain. Selain itu, mata kuliah ini juga bertujuan agar mahasiswa mampu melakukan eksperimen tentang teori-teori yang sudah dipelajari dan dipahami, sehingga mahasiswa bisa terlatih dan terampil dalam menggunakan komponen dan peralatan dengan prosedur yang benar. Dengan pemahaman dan keterampilan tersebut mahasiswa diharapkan mampu menerapkannya.																																																																																																																																	

	<i>Basic Electronics and Laboratory is a mandatory courses that discuss the basic science of electronics, both theoretically and practically. This course aims to make students understand the characteristics of electronic components such as diodes, BJT transistors, FET transistors, and others. In addition, this course also aims to enable students to conduct experiments on theories that have been studied and understood, so that students can be trained and skilled in using components and equipment with the correct procedures. With this understanding and skills, students are expected to be able to apply it on biomedical engineering field.</i>
Bahan Kajian: Materi pembelajaran Course Materials:	1. Dasar semikonduktor dan dioda / <i>Basic semiconductors and diodes.</i> 2. Keterampilan identifikasi karakteristik dioda / <i>Diode characteristic identification skills.</i> 3. Keterampilan perancangan rangkaian aplikasi dioda / <i>Diode application circuit design skills.</i> 4. Pengenalan disain <i>amplifier</i> BJT / <i>Introduction to the BJT amplifier design.</i> 5. Keterampilan proses <i>bias dc</i> dan <i>switching</i> / <i>DC bias and switching process skills.</i> 6. Keterampilan perancangan dan analisis <i>amplifier single stage</i> dan <i>multistage</i> / <i>Single stage and multistage amplifier design and analysis skills.</i> 7. Keterampilan perancangan dan analisis penguat daya / <i>Power amplifier design and analysis skills.</i> 8. Pengenalan disain <i>amplifier</i> FET / <i>Introduction to the FET amplifier design.</i> 9. Aplikasi komponen PNP / <i>PNP component applications.</i>
Pustaka References	Utama / Main: 1. Floyd, Thomas L., "Electronic Devices : Electron Flow Version 11th Ed", Prentice-Hall, 2013. 2. S.M. Sze, "Semiconductor Devices Physics and Technology", John Wiley & Sons, 1985. 3. David A. Bell, "Solid State Pulse Circuit", Prentice-Hall, 1976. Pendukung / Supporting: 1. Floyd, Thomas L., and David B., "Fundamentals of Analog Circuit", Prentice-Hall, 2002. 2. Malvino, A. P., "Electronic Principles", McGraw-Hill Education, 2015.
Dosen Pengampu Lecturers	Dr. Rachmad Setiawan, S.T., M.T. M. Yazid, B.Eng., M.Eng.

Dr. Ir. Hendra Kusuma, M.Eng. Sc Fauzan Arrofiqi, S.T., M.T., Ph.D. Muhammad Adib Syamlan, S.T., M.T. Rasyida Shabihah Zukro Aini, S.T., M.T. Dr. Norma Hermawan, S.T., M.T., M.Sc. Prof. Dr. Tri Arief Sardjono, S.T., M.T.							
Matakuliah syarat Prerequisite		-					
Mg ke/ Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) / Final ability of each learning stage (LLO)	Penilaian / Assessment		Bantuk Pembelajaran; Metode Pembelajaran; Penugasan Mahasiswa; [Estimasi Waktu] / Form of Learning; Learning Method; Student Assignment; [Estimated Time]		Materi Pembelajaran [Pustaka] / Learning Material [Reference]	Bobot Penilaian /Assessment Load (%)
		Indikator / Indicator	Kriteria & Teknik / Criteria & Techniques				
(1)	(2)	(3)	(4)	Tatap Muka / In-class (5)	Daring / Online (6)	(7)	(8)
1	Mahasiswa memahami dan mampu menjelaskan teori dasar tentang bahan semikonduktor dan komponen dioda, serta mampu mengidentifikasi karakteristik dioda. <i>Students are able to understand and explain basic theories about semiconductor materials and diode components, and are able to identify diode characteristics.</i>	- Mampu mengenali tentang elektronika, simulator, dan perkembangan teknologi IC. - Mampu mengetahui dasar semikonduktor seperti sifat kelistrikan pada bahan dan bagiannya. - Mampu merepresentasikan apa saja yang	Non-tes : Tugas 1 Mencari aplikasi <i>PN Junction</i> seperti <i>Photovoltaic (PV) Cell</i> , operasi dan aplikasinya. Tugas 2 Mencari datasheet dioda Ge dan Si, menjelaskan	- Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"] [PT : 4 x 50"] - Presentation, discussion, ask and answer,	- Chatting dan diskusi dalam forum platform ITS. - Chat and discussion in ITS platform forum.	- Kontrak kuliah: - Motivasi belajar - Rencana pembelajaran - Aturan-aturan perkuliahan - Tujuan perkuliahan - Sistem penilaian, buku ajar/sumber pustaka - Pengenalan tentang	13

		termasuk dalam pengenalan dioda seperti karakteristik komponen, pembiasan pada dioda, dan rangkaian ekivalen dioda. • <i>Able to recognize about electronics, simulators, and developments in IC technology.</i> • <i>Able to know semiconductor basics such as its electrical properties of materials and their distribution.</i> • <i>Be able to represent anything that is included in the introduction of a diode such as component characteristics, diode refraction, and diode equivalent circuits.</i>	parameter-parameter dioda berdasarkan datasheet, Macam-macam dioda dan aplikasinya. Praktikum 1 : Identifikasi karakteristik dioda. Non-test : Task 1: <i>Search PN Junction applications such as Photovoltaic (PV) Cell, operations and the applications.</i> Task 2: <i>Search Ge and Si diode datasheet, explain diode parameters based on the datasheet, diode types and the applications.</i>	<i>exercise, assignment.</i> <i>[FF : 4 x 50"]</i> <i>[SA : 4 x 50"]</i> <i>[SS : 4 x 50"]</i>		elektronika dan simulator untuk analisa dan perancangan rangkaian elektronika, perkembangan teknologi IC. • Dasar semikonduktor : atom (elektron, shell, elektron bebas), sifat kelistrikan pada bahan dan pembagiannya (insulator, konduktor dan semikonduktor), bahan semikonduktor (Ge, Si, GaAs), ikatan kovalen, bahan intrinsik, level energi, bahan ekstrinsik (tipe N dan tipe P) • Dioda : pengenalan komponen dioda (PN Junction),	
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			Lab Work 1: <i>Characteristics of the diode identification</i>			pembiasan pada dioda (bias mundur, bias maju), karakteristik dioda (ideal dan tidak ideal), level resistansi (<i>dc, ac, ac average</i>), rangkaian ekivalen dioda (<i>ideal, simplified, piecewise-linear, transition and diffusion capacitance, reverse recovery time</i>, datasheet dioda, notasi dioda, pengujian dioda, pengenalan dioda zener dan <i>light emitting diode</i> (LED) [Link materi di MyITSClassroom] • <i>Course contract:</i> - <i>Motivation to learn</i>	
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						- Lesson plan - Lecture rules - Course objective - Assessment system, textbooks / library resources ● Introduction to electronics and simulators for the analysis and design of electronic circuits, developments in IC technology. ● Semiconductor basics: atoms (electrons, shells, free electrons), electrical properties of materials and their distribution (insulators, conductors and semiconductors), semiconductor materials (Ge, Si, GaAs), covalent bonds, intrinsic materials, energy levels, extrinsic	
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						<i>materials (N type and P type)</i> • <i>Diodes: introduction of diode components (PN Junction), diode refraction (reverse bias, forward bias), diode characteristics (ideal and non-ideal), resistance level (dc, ac, ac average), diode equivalent circuit (ideal, simplified, piecewise-linear), transition and diffusion capacitance, reverse recovery time, diode datasheet, diode notation, diode testing, introduction of zener diodes and light emitting diode (LED)</i>	
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2-3	Mahasiswa memahami rangkaian aplikasi dioda dan mampu merancang, menganalisa serta merealisasikan rangkaian aplikasi dioda dengan metodologi yang benar. <i>Students are able to understand a series of diode applications and are able to design, analyze, and realize a series of diode applications with the correct methodology.</i>	● Mampu mengetahui karakteristik dan mengerjakan perhitungan permasalahan rangkaian aplikasi dioda seperti analisa rangkaian dioda dan konfigurasinya. ● <i>Able to know the characteristics and do some calculation of diode application circuits such as diode circuit analysis and its configuration problems.</i>	Non-tes : Tugas 3: Mengerjakan soal perhitungan mengenai analisa rangkaian dasar diode, rangkaian penyearah, <i>clipper, clamper</i>, pengali tegangan dan rangkaian dioda zener. Praktikum 2 : Perancangan rangkaian aplikasi dioda Non-test : Task 3: <i>Solving calculation problems regarding diode basic circuit analysis, rectifier circuits, clipper, clampers, voltage multipliers and zener diode circuits</i>	● Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"] [PT : 4 x 50"] ● <i>Presentation, discussion, ask and answer, exercise, assignment</i> [FF : 4 x 50"] [SA : 4 x 50"] [SS : 4 x 50"]		● Rangkaian aplikasi dioda : metode analisa rangkaian dioda menggunakan karakteristik aktual, pemodelan dan analisa garis beban (<i>load-line analysis</i>), konfigurasi rangkaian dasar dioda (seri, parallel, kombinasi), penyearah, <i>clipper, clamper</i>, pengali tegangan, rangkaian dioda zener, rangkaian aplikasi dioda yang lain. ● <i>Diode application circuit: the diode circuit analysis method uses actual characteristics, load-line design and analysis,</i>	10.5
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			Lab Work 2: <i>Diode application circuit design.</i>			<i>diode basic circuit configuration (series, parallel, combination), rectifier, clipper, clamper, voltage multiplier, zener diode circuit, and other diode applications circuit.</i>	
4-5	Mahasiswa memahami teori dasar transistor BJT dan mampu menjelaskan operasi dasar dari transistor BJT dan FET <i>Students are able to understand the basic theory of the BJT transistor and are able to explain the basic operations of the BJT and FET transistors.</i>	● Mampu mengenali tentang transistor BJT dan menjelaskan datasheetnya. ● Mampu mengerjakan perhitungan konfigurasi bias dasar dan analisa titik kerja batasan operasi pada BJT dan FET. ● <i>Able to recognize about BJT transistors and explain the datasheet.</i> ● <i>Able to perform basic bias configuration calculations and analysis of operating</i>	Non-tes : Tugas 4: Mencari datasheet transistor BJT, menjelaskan parameter-parameter transistor BJT berdasarkan datasheet, mengerjakan soal perhitungan mengenai analisa karakteristik BJT (penentuan titik kerja BJT untuk konfigurasi bias dasar). Non-test :	● Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"] [PT : 4 x 50"] ● <i>Presentation, discussion, ask and answer, exercise, assignment</i> [FF : 4 x 50"] [SA : 4 x 50"] [SS : 4 x 50"]		● Transistor BJT : konstruksi (NPN, PNP), operasi BJT. ● Konfigurasi bias dasar dan analisa titik kerja (<i>common-base, common-emitter, common-collector</i>) , batasan operasi pada BJT. ● Datasheet transistor BJT. ● <i>BJT transistor: construction (NPN, PNP), BJT operation.</i> ● <i>Basic bias configuration and</i>	2.5

		limit work point on BJT and FET.	Task 4: Searching for the BJT transistor datasheet, explain the parameters of the BJT transistor based on the datasheet, solve calculation problems regarding the characteristic analysis of the BJT (determining the working point of the BJT for basic bias configurations).			working point analysis (common-base, common-emitter, common-collector), operating limits on the BJT. ● BJT transistor datasheet.	
6-7	Mahasiswa memahami <i>modelling</i> dari BJT dan FET, mampu merancang, menganalisa serta merealisasikan rangkaian <i>modelling</i> dengan metodologi yang benar. <i>Students are able to understand modelling of BJT and FET, are able to design, analyze, and realize</i>	● Mampu mengenali tentang modelling BJT dari beberapa konfigurasi. ● Mampu mengenali tentang modelling FET dari beberapa konfigurasi. ● Able to recognize modelling BJT from some configurations.	Non-tes : Tugas 5: Mengerjakan soal perhitungan mengenai analisa dan perancangan modelling BJT dan FET. Praktikum 3 : Exercise to calculate in	● Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"] [PT : 4 x 50"] ● Presentation, discussion, ask and answer,		● Rangkaian pemodelan BJT : macam-macam konfigurasi. ● Rangkaian pemodelan FET : macam-macam konfigurasi.	10.5

	modelling circuit with the correct methodology.	• Able to recognize modelling FET from some configurations.	analyzing and design modelling of BJT and FET. Non-test : Task 5: Solve calculation problems regarding the analysis and design of dc bias circuits and switching then search for some examples of the application. Lab Work 3: Modelling circuit of BJT and FET.	exercise, assignment [FF : 4 x 50"] [SA : 4 x 50"] [SS : 4 x 50"]		• Modelling circuit of BJT: the types of configuration • Modelling circuit of FET: the types of configuration	
8	EVALUASI TENGAH SEMESTER MID-SEMESTER EXAM						17.5
9 - 10	Mahasiswa memahami tahapan perancangan rangkaian penguat (<i>amplifier</i>) menggunakan transistor BJT dan FET beserta efek beban yang diberikan pada rangkaian,	• Mampu menjelaskan rangkaian penguat (<i>amplifier</i>) menggunakan transistor BJT dan FET.	Non-tes : Tugas 6: Mengerjakan soal perhitungan mengenai analisa	• Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"]		• Rangkaian penguat (<i>amplifier</i>) menggunakan transistor BJT : penguatan dalam	10.5

	mampu merancang, menganalisa serta merealisasikan rangkaian <i>amplifier single stage</i> dan <i>multistage</i> dengan metodologi yang benar. <i>Students understand the steps of designing an amplifier circuit using BJT and FET transistors taking into account the effects of circuit loads. Students can design, analyze, and implement single-stage and multistage amplifier circuits with the right methodology.</i>	• Mampu menghitung <i>two port system</i> dan parameternya. • Mampu merancang dan menganalisa macam-macam konfigurasi rangkaian <i>amplifier single stage</i> dan <i>amplifier multi stage</i>. • Mampu mengenali tentang model hybrid. • <i>Able to explain amplifier circuit using BJT and FET transistors.</i> • <i>Able to calculate two port system and its parameters.</i> • <i>Able to design and analyze various single stage amplifier and multi stage amplifier circuit configurations.</i> • <i>Able to recognize about the hybrid model.</i>	dan perancangan rangkaian <i>amplifier single stage</i> dan <i>multistage</i> serta mencari contoh aplikasinya. Praktikum 4 : Perancangan dan analisis <i>amplifier single stage</i> dan <i>multistage</i>. Non-test : Task 6: <i>Solving calculation problems regarding the analysis and design of single stage and multistage amplifier circuits and find examples of the application.</i>	[PT : 4 x 50"] • <i>Presentation, discussion, ask and answer, exercise, assignment.</i> [FF : 4 x 50"] [SA : 4 x 50"] [SS : 4 x 50"]		<i>domain ac, pemodelan transistor BJT (r_e model, hybrid π model, hybrid equivalent model)</i> • <i>Two port system dan parameternya : input impedance (Z_i), output impedance (Z_o), voltage gain (A_v), current gain (A_i).</i> • Teknik perancangan, analisa dan macam-macam konfigurasi rangkaian <i>amplifier single stage</i> (CE <i>fixed-bias</i>, CE <i>voltage-divider bias</i>, CE <i>emitter-bias</i>, <i>emitter-follower</i>, <i>collector feedback</i>, <i>collector DC feedback</i>, CB), efek RL dan RS.	
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			Lab Work 4: <i>Design and analysis of single stage and multistage amplifiers.</i>			• Tahapan perancangan dan analisa amplifier multi stage. • Pengenalan model hybrid. • <i>The amplifier circuit uses BJT transistors: amplification in the ac domain, BJT transistor modeling (r_e model, hybrid π model, hybrid equivalent model).</i> • <i>Two port system and its parameters: input impedance (Z_i), output impedance (Z_o), voltage gain (A_v), current gain (A_i).</i> • <i>Design techniques, analysis and various single stage amplifier circuit configurations (CE</i>	
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						<i>fixed-bias, CE voltage-divider bias, CE emitter-bias, emitter-follower, collector feedback, collector DC feedback, CB), RL and RS effects.</i> • <i>Stages of design and analyze multi stage amplifiers.</i> • <i>Introduction of the hybrid model.</i>	
11-12	Mahasiswa memahami aplikasi dari respon frekuensi rendah dan respon frekuensi tinggi dari BJT dan FET. <i>Students understand the application of low-frequency and high-frequency responses of BJT and FET.</i>	• Dapat menjelaskan respon frekuensi rendah dari BJT dan FET. • Dapat menjelaskan respon frekuensi rendah dari BJT dan FET. • <i>Able to explain low-frequency responses of BJT and FET.</i> • <i>Able to explain high-frequency</i>	Non tes: Tugas 7: Mengerjakan soal perhitungan mengenai analisa dan perancangan rangkaian pada aplikasi respon frekuensi rendah dan respon frekuensi tinggi dari BJT dan FET. Non-test: Task 7:	• Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"] [PT : 4 x 50"] • <i>Presentation, discussion, ask and answer, exercise, assignment.</i> [FF : 4 x 50"] [SA : 4 x 50"] [SS : 4 x 50"]		• Pengenalan transistor FET, kontruksi, karakteristik dasar, karakteristik transfer, dan data sheet FET. • Hubungan parameter BJT dan FET. • Pengenalan E-MOSFET dan D-MOSFET. • Metode bias FET dan konfigurasinya: <i>fixed-bias,</i>	2.5

		<i>responses of BJT and FET</i>	<i>Solve calculation problems regarding analysis and design of circuits implementing low frequency and high frequency responses of BJT and FET.</i>			<i>self-bias, common gate.</i> ● Analisa dan perancangan <i>amplifier</i> menggunakan FET : <i>small signal model, fixed-bias configuration, self-bias configuration, voltage-divider configuration, common gate configuration, source-follower.</i> ● Aplikasi <i>amplifier</i> FET. ● Introduction to FET transistor, including construction, basic characteristics, transfer characteristics, and datasheet of FET.	
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						● Relations between BJT and FET parameters. ● Introduction to E-MOSFET D-MOSFET. ● Methods and circuit configuration for FET biasing: <i>fixed-bias, self-bias, common gate.</i> ● Analysis and design of amplifier circuit using FET: <i>small signal model, fixed-bias configuration, self-bias configuration, voltage-divider configuration, common gate configuration, source-follower.</i> ● Application of FET based amplifier circuit.	
13	Mahasiswa memahami rangkaian catu daya dan mampu merancang,	● Mampu merepresentasikan	Non tes: Tugas 8:	● Kuliah, diskusi, tanya		● Pengenalan rangkaian penguat	10.5

	menganalisa serta merealisasikan rangkaian penguat daya dengan metodologi yang benar. <i>Students are able to understand power supply circuits and are able to design, analyze and realize power amplifier circuits using the correct methodology.</i>	rangkaian penguat daya dan tipe-tipe catu daya. ● Mampu menganalisa dan merancang rangkaian catu daya. ● <i>Able to represent the power supply circuit and the types of power amplifier.</i> ● <i>Able to analyze and design power supply circuit.</i>	Mengerjakan soal perhitungan mengenai analisa dan perancangan rangkaian catu daya serta mencari contoh aplikasinya Praktikum 5 : Perancangan dan analisis catu daya. Non-test : Task 8: <i>Solve calculation problems regarding the analysis and design of the power supply circuit and find examples of its application.</i> Lab Work 5: <i>Power supply design and analysis.</i>	jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"] [PT : 4 x 50"] ● <i>Presentation, discussion, ask and answer, exercise, assignment.</i> [FF : 4 x 50"] [SA : 4 x 50"] [SS : 4 x 50"]		daya dan tipe-tipe catu daya. ● Metode analisa dan perancangan rangkaian catu daya. ● <i>Introduction of power amplifier circuits and types of power supply.</i> ● <i>Methods of analysis and design of power supply circuits.</i> ●	
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14	Mahasiswa memahami dan mampu menjelaskan aplikasi komponen PNP. <i>Students understand and are able to explain the PNP component application.</i>	• Mampu merepresentasikan komponen PNP, operasi dan rangkaiannya. • Mampu menjelaskan tentang aplikasi komponen PNP. • <i>Able to represent PNP components, operations and its circuit.</i> • <i>Able to explain PNP component applications.</i>	Non tes: Tugas 9: Mencari aplikasi komponen PNP. Non-test: Task 9: <i>Search PNP component applications.</i>	• Kuliah, diskusi, tanya jawab, latihan soal, tugas. [TM : 4 x 50"] [BM : 4 x 50"] [PT : 4 x 50"] • <i>Presentation, discussion, ask and answer, exercise, assignment.</i> [FF : 4 x 50"] [SA : 4 x 50"] [SS : 4 x 50"]		• Pengenalan komponen PNP, operasi dan rangkaiannya : <i>Silicon-controlled rectifiers (SCRs), Silicon-controlled switches (SCSs), Gate turn-off switches (GTO), Light-activated SCRs (LSCR), Shockley diodes and diacs, Triacs, Phototransistors and opto-isolators, Unijunction and programmable unijunction transistors.</i> • Aplikasi komponen PNP. • <i>Introduction to PNP components, operations and its circuit:</i> <i>Silicon-controlled rectifiers (SCRs), Silicon-controlled</i>	2.5
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						<i>switches (SCSs), Gate turn-off switches (GTO), Light-activated SCRs (LSCR), Shockley diodes and diacs, Triacs, Phototransistors and opto-isolators, Unijunction and programmable unijunction transistors.</i> • <i>PNPN component applications.</i>	
15-16	EVALUASI AKHIR SEMESTER FINAL-SEMESTER EXAM						20

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 : Basic Electronics and Laboratory		RA&E
			Write Doc Code
Kode/code: EB234302	Bobot sks/credits (T/P): 4/0	Rumpun MK: Ilmu Dasar Teknik Course Cluster: Basic Engineering	Smt: III
OTORISASI AUTHORIZATION	Penyusun RA & E Compiler A&EP Fauzan Arrofiqi, S.T., M.T., Ph.D.	Koordinator RMK Course Cluster Coordinator Dr. Rachmad Setiawan 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 memahami dan mampu menjelaskan teori dasar tentang bahan semikonduktor dan komponen dioda, serta mampu mengidentifikasi karakteristik dioda. LLO 1: <i>Students are able to understand and explain basic theories about semiconductor materials and diode components, and are able to identify diode characteristics.</i>	Non-tes : Tugas 1: Mencari aplikasi <i>PN Junction</i> seperti <i>Photovoltaic (PV) Cell</i> , operasi dan aplikasinya. Tugas 2: Mencari datasheet dioda Ge dan Si, menjelaskan parameter-parameter dioda berdasarkan datasheet, Macam-macam dioda dan aplikasinya. Praktikum 1: Identifikasi karakteristik dioda. Tes: ETS Soal 1 (4.375% dari ETS 17.5%) Non-test : Task 1: <i>Search PN Junction applications such as Photovoltaic (PV) Cell, operations and the applications.</i> Task 2: <i>Search Ge and Si diode datasheet, explain diode parameters based on the datasheet, diode types and the applications.</i> Lab Work 1: <i>Characteristics of the diode identification.</i> Test: <i>Question 1 in Mid Exam (4.375% of Mid Exam 17.5%)</i>	13

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
3-4	Sub CP-MK 2: Mahasiswa memahami rangkaian aplikasi dioda dan mampu merancang, menganalisa serta merealisasikan rangkaian aplikasi dioda dengan metodologi yang benar. LLO 2: <i>Students are able to understand a series of diode applications and are able to design, analyze, and realize a series of diode applications with the correct methodology.</i>	Non-tes : Tugas 3: Mengerjakan soal perhitungan mengenai analisa rangkaian dasar diode, rangkaian penyearah, <i>clipper</i>, <i>clamper</i>, pengali tegangan dan rangkaian dioda zener. Praktikum 2: Perancangan rangkaian aplikasi dioda. Tes: ETS Soal 2 (4.375% dari ETS 17.5%) Non-test : Task 3: <i>Solving calculation problems regarding diode basic circuit analysis, rectifier circuits, clipper, clampers, voltage multipliers and zener diode circuits.</i> Lab Work 2: <i>Diode application circuit design.</i> Test: <i>Question 2 in Mid Exam (4.375% of Mid Exam 17.5%)</i>	10.5
5	Sub CP-MK 3: Mahasiswa memahami teori dasar transistor BJT dan mampu menjelaskan operasi dasar dari transistor BJT. LLO 3: <i>Students are able to understand the basic theory of the BJT transistor and are able to explain the basic operations of the BJT transistor.</i>	Non-tes : Tugas 4: Mencari datasheet transistor BJT, menjelaskan parameter-parameter transistor BJT berdasarkan datasheet, mengerjakan soal perhitungan mengenai analisa karakteristik BJT (penentuan titik kerja BJT untuk konfigurasi bias dasar). Tes: ETS Soal 3 (4.375% dari ETS 17.5%) Non-test : Task 4: <i>Searching for the BJT transistor datasheet, explain the parameters of the BJT transistor based on the datasheet, solve calculation problems regarding the characteristic</i>	2.5

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
		<i>analysis of the BJT (determining the working point of the BJT for basic bias configurations).</i> Test: <i>Question 3 in Mid Exam (4.375% of Mid Exam 17.5%)</i>	
6-7	Sub CP-MK 4: Mahasiswa memahami rangkaian <i>bias dc</i> dan <i>switching</i> dan mampu merancang, menganalisa serta merealisasikan rangkaian <i>bias dc</i> dan <i>switching</i> dengan metodologi yang benar. LLO 4: <i>Students are able to understand dc bias circuits and switching and are able to design, analyze, and realize dc bias circuits and switching with the correct methodology.</i>	Non-tes : Tugas 5: Mengerjakan soal perhitungan mengenai analisa dan perancangan rangkaian <i>bias dc</i> dan <i>switching</i> serta mencari contoh aplikasinya. Praktikum 3: Proses <i>bias dc</i> dan <i>switching</i>. Tes: ETS Soal 4 (4.375% dari ETS 17.5%) Non-test : Task 5: <i>Solve calculation problems regarding the analysis and design of dc bias circuits and switching then search for some examples of the application.</i> Lab Work 3: <i>DC bias and switching process.</i> Test: <i>Question 4 in Mid Exam (4.375% of Mid Exam 17.5%)</i>	10.5
8	Evaluasi Tengah Semester Mid Exam	Tes: Ujian Tulis/Ujian Daring Test: <i>Writing Exams / Online Exams</i>	17.5
9-10	Sub CP-MK 5: Mahasiswa memahami tahapan perancangan rangkaian penguat (<i>amplifier</i>) menggunakan transistor BJT dan mampu merancang, menganalisa serta	Non-tes : Tugas 6: Mengerjakan soal perhitungan mengenai analisa dan perancangan rangkaian <i>amplifier single stage</i> dan <i>multistage</i> serta mencari contoh aplikasinya. Praktikum 4: Perancangan dan analisis <i>amplifier single stage</i> dan <i>multistage</i>. Tes:	10.5

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	merealisasikan rangkaian <i>amplifier single stage</i> dan <i>multistage</i> dengan metodologi yang benar. LLO 5: <i>Students are able to understand the stages of amplifier circuit design using BJT transistors and are able to design, analyze, and realize single stage and multistage amplifier circuits with the correct methodology.</i>	EAS Soal 1 (5% dari ETS 20%) Non-test : Task 6: <i>Solving calculation problems regarding the analysis and design of single stage and multistage amplifier circuits and find examples of the application.</i> Lab Work 4: <i>Design and analysis of single stage and multistage amplifiers.</i> Test: <i>Question 1 in Final Exam (5% of Mid Exam 20%)</i>	
11-12	Sub CP-MK 6: Mahasiswa memahami teori dasar transistor FET dan mampu menjelaskan tahapan perancangan penguat menggunakan transistor FET. LLO 6: <i>Students are able to understand the basic theory of the FET transistor and explain the stages of amplifier design using a FET transistor.</i>	Non-tes : Tugas 7: Mengerjakan soal perhitungan mengenai analisa dan perancangan rangkaian penguat FET serta mencari contoh aplikasinya. Tes: EAS Soal 2 (5% dari EAS 20%) Non-test: Task 7: <i>Solve calculation problems regarding the analysis and design of the FET amplifier circuit and search examples of its application.</i> Test: <i>Question 2 in Final Exam (5% of Final Exam 20%)</i>	2.5
13-14	Sub CP-MK 7:	Non-tes : Tugas 8:	10.5

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	Mahasiswa memahami rangkaian penguat daya dan mampu merancang, menganalisa serta merealisasikan rangkaian penguat daya dengan metodologi yang benar. LLO 7: <i>Students are able to understand power amplifier circuits and are able to design, analyze and realize power amplifier circuits using the correct methodology.</i>	Mengerjakan soal perhitungan mengenai analisa dan perancangan rangkaian penguat daya serta mencari contoh aplikasinya. Praktikum 5: Perancangan dan analisis penguat daya. Tes: EAS Soal 3 (5% dari ETS 20%) Non-test : Task 8: <i>Solve calculation problems regarding the analysis and design of the power amplifier circuit and find examples of its application.</i> Lab Work 5: <i>Power amplifier design and analysis.</i> Test: <i>Question 3 in Final Exam (5% of Mid Exam 20%).</i>	
15	Sub CP-MK 8: Mahasiswa memahami dan mampu menjelaskan aplikasi komponen PNP. LLO 8: <i>Students understand and are able to explain the PNP component application.</i>	Non-tes : Tugas 9: Mencari aplikasi komponen PNP. Tes: EAS Soal 4 (5% dari EAS 20%) Non-test: Task 9: <i>Search PNP component applications.</i> Test: <i>Question 4 in Final Exam (5% of Final Exam 20%)</i>	2.5
16	Evaluasi Akhir Final Exam	Tes: Ujian Tulis/Ujian Daring Test: <i>Writing Exams / Online Exams</i>	20
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-04 / <i>PLO-04</i>	CPMK 1 / <i>CLO 1</i>	<i>Week- 1-2</i>	<i>Task 2</i>	2.5
		<i>Week- 8</i>	<i>Mid Exam Question 1</i>	4.375
	CPMK 2 / <i>CLO 2</i>	<i>Week- 3-4</i>	<i>Task 3</i>	2.5
		<i>Week- 8</i>	<i>Mid Exam Question 2</i>	4.375
	CPMK 3 / <i>CLO 3</i>	<i>Week- 5</i>	<i>Task 4</i>	2.5
		<i>Week- 8</i>	<i>Mid Exam Question 3</i>	4.375
	CPMK 8 / <i>CLO 8</i>	<i>Week- 15</i>	<i>Task 9</i>	2.5
		<i>Week- 16</i>	<i>Final Exam Question 4</i>	5
CPL-06 / <i>PLO-06</i>	CPMK 1 / <i>CLO 1</i>	<i>Week- 1-2</i>	<i>Lab Work 1</i>	8
	CPMK 2 / <i>CLO 2</i>	<i>Week- 3-4</i>	<i>Lab Work 2</i>	8
	CPMK 4 / <i>CLO 4</i>	<i>Week- 6-7</i>	<i>Lab Work 3</i>	8
	CPMK 5 / <i>CLO 5</i>	<i>Week- 9-10</i>	<i>Lab Work 4</i>	8
	CPMK 7 / <i>CLO 7</i>	<i>Week- 13-14</i>	<i>Lab Work 5</i>	8
CPL-08 / <i>PLO-08</i>	CPMK 1 / <i>CLO 1</i>	<i>Week- 1-2</i>	<i>Task 1</i>	2.5
	CPMK 4 / <i>CLO 4</i>	<i>Week- 6-7</i>	<i>Task 5</i>	2.5
		<i>Week- 8</i>	<i>Mid Exam Question 4</i>	4.375
	CPMK 5 / <i>CLO 5</i>	<i>Week- 9-10</i>	<i>Task 6</i>	2.5
		<i>Week- 16</i>	<i>Final Exam Question 1</i>	5
	CPMK 6 / <i>CLO 6</i>	<i>Week- 11-12</i>	<i>Task 7</i>	2.5
		<i>Week- 16</i>	<i>Final Exam Question 2</i>	5
	CPMK 7 / <i>CLO 7</i>	<i>Week- 13-14</i>	<i>Task 8</i>	2.5
		<i>Week- 16</i>	<i>Final Exam Question 3</i>	5

				$\Sigma = 100\%$
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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	Tugas 1 (Tugas 1-5) Assignment 1 (Task 1-5)				0.1		0.05							0.15
2	Evaluasi Tengah Semester Midterm Exam				0.1		0.05		0.05					0.2
3	Tugas 2 (Tugas 6-9) Assignment 2 (Task 6-9)						0.075		0.075					0.15
4	Evaluasi Akhir Semester Final Exam						0.075		0.125					0.2
5	Praktikum dan						0.15		0.15					0.3

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
	Laboratorium Practicum and Laboratory													
	Total				0.2		0.4		0.4					1