

Module Handbook

Advanced Electric Circuits and Laboratory



Bachelor Degree Program Department of Biomedical Engineering

Faculty of Intelligent Electrical Technology and Informatics
Institut Teknologi Sepuluh Nopember



MODULE HANDBOOK

Advanced Electric Circuits and Laboratory

DEPARTMENT OF BIOMEDICAL ENGINEERING

INSTITUT TEKNOLOGI SEPULUH NOPEMBER
Number : 6816/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. Ir. Hendra Kusuma, M.Eng. Sc	Dosen <i>Lecturer</i>	TTD	November 18, 2022
Pemeriksa dan Pengendalian <i>Review and Control</i>	Dr. Rachmad Setiawan, 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

ADVANCED ELECTRIC CIRCUITS AND LABORATORY

Module name	Advance Electrical Circuit and Laboratory	
Module level	Undergraduate	
Code	EB234305	
Course (if applicable)	Advanced Electric Circuits and Laboratory	
Semester	First Semester (Gasal)	
Person responsible for the module	Dr. Ir. Hendra Kusuma, M.Eng. Sc	
Lecturer		
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory , 3 rd semester.	
Type of teaching, contact hours	Lectures, <60 students Tuesdays, 11.00-12.50 (GMT+7)	
Workload	1. Lectures : 3 x 50 = 100 minutes per week. 2. Exercises and Assignments : 2 x 60 = 120 minutes (2 hours) per week. 3. Private learning : 2 x 60 = 120 minutes (2 hours) 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	-	
	Course Learning Outcome (CLO) after completing this module, CLO 1: Students are able to understand and explain the theory of sinusoid and phasor. CLO 2: Students are able understand, explain, and analyze AC <i>steady state</i> circuit CLO 3: Students are able to understand and explain the theory of power analysis CLO 4: Students are able to understand, explain, and analyze magnetic coupled circuit CLO 5: Students are able to understand and explain the theory of frequency response	PLO-04 PLO-08 PLO-06 PLO-06 PLO-06

Content	Advance Electrical Circuit and laboratory is a mandatory course which both theoretically and practically studies the electrical circuit in advance. this course aims for the student to understand the AC circuit theory, power analysis, transformer, etc. Moreover, the course also aims for the student to be able to do the experiment regarding both the theory of basic electrical circuit and advance electrical circuit, so that the student could be trained and capable for using the tools of electrical scalar measurement or its derivation, do the experiment with the proper tools and procedure for collecting the data followed by analyzing the characteristics of the circuit. With both the knowledge and laboratory capability, in hope that the students are able to apply it in the biomedical discipline	
Study and examination requirements and forms of examination	• In-class exercises • Assignment 1, 2, 3, 4, 5, 6 • Lab work 1, 2, 3, 4, 5 • Mid-term examination • Final examination	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.	
Reading list	Main : 1. Pujiono, "Rangkaian Listrik", Graha Ilmu, Yogyakarta, 2013. 2. Alexander Charles K., Sadiku Matthew O. N., "Fundamentals of Electric Circuit Fourth edition", McGraw-Hill, New York, 2009. Supporting : 1. Hyatt, William H., Kemmerly Jack E, "Engineering circuit analysis", McGraw-Hill, New York, 1983. 2. Edminister Josep A., "Electric Circuit, Schaum series", McGraw-Hill, New York, 1983	

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
Rangkaian Listrik Lanjut dan laboratorium Advanced Electric Circuits and Laboratory	EB234305	Biomedical Instrumentation and Signal Processing	T=3	P=0	III	Nov 9, 2022
OTORISASI / PENGESAHAN AUTHORIZATION / ENDORSEMENT	Dosen Pengembang RPS Developer Lecturer of Semester Learning Plan		Koordinator RMK Course Cluster Coordinator		Ka DEPARTEMEN Head of Department	
	(Dr. Rachmad Setiawan S.T., M.T.)		(Dr. Rachmad Setiawan, S.T., M.T.)		(Dr. Achmad Arifin, S.T., M.Eng.)	
Capaian Pembelajaran Learning Outcomes	CPL-PRODI yang dibebankan pada MK PLO Program Charged to The Course					
	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	<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>
	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 mampu memahami dan menjelaskan teori tentang <i>sinusoidal</i> dan <i>phasor</i> <i>Students are able to understand and explain the theory of sinusoid and phasor.</i>
	CP MK 2 CLO 2	Mahasiswa mampu memahami, menjelaskan dan menganalisa rangkaian AC <i>steady state</i> <i>Students are able understand, explain, and analyze AC steady state circuit</i>
	CP MK 3 CLO 3	Mahasiswa mampu memahami dan menjelaskan teori tentang analisa daya (<i>power analysis</i>) <i>Students are able to understand and explain the theory of power analysis</i>
	CP MK 4 CLO 4	Mahasiswa mampu memahami, menjelaskan dan menganalisa rangkaian <i>magnetic coupled</i> <i>Students are able to understand, explain, and analyze magnetic coupled circuit</i>
	CP MK 5 CLO 5	Mahasiswa mampu memahami dan menjelaskan teori tentang respon frekuensi <i>Students are able to understand and explain the theory of frequency response</i>

Peta CPL – CP MK Map of PLO - CLO		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>						✓						
Diskripsi Singkat MK Short Description of Course	Mata kuliah Rangkaian Listrik Lanjut dan Laboratorium merupakan mata kuliah wajib yang membahas materi lanjutan dari rangkaian listrik dasar baik secara teori maupun praktek. Mata kuliah ini bertujuan agar mahasiswa memahami tentang teori rangkaian AC, analisa daya, tranformator dan lain-lain. Selain itu, mata kuliah ini juga bertujuan agar mahasiswa mampu melakukan eksperimen mengenai teori yang sudah dipelajari dan dipahami baik untuk materi rangkaian listrik dasar maupun rangkaian listrik lanjut, sehingga mahasiswa bisa terlatih dan terampil dalam menggunakan peralatan atau tools untuk melakukan pengukuran besaran listrik atau turunannya, melakukan eksperimen dengan peralatan dan prosedur yang benar untuk mengumpulkan data serta kemudian menganalisanya untuk mendapatkan karakteristik (sifat) rangkaian (sistem). Dengan pemahaman teori dan keterampilan dalam laboratorium tersebut, mahasiswa diharapkan mampu menerapkannya terutama pada disiplin ilmu biomedik.												
	<i>Advance Electrical Circuit and laboratory is a fundamental course which both theoretically and practically studies the electrical circuit in advance. this course aims for the student to understand the AC circuit theory, power analysis, transformator, etc. Moreover, the course also aims for the student to be able to do the experiment regarding both the theory of basic electrical cicuit and advance electrical circuit, so that the student could be trained and capable for using the tools of electrical scalar measurement or it derivation, do the experiment with the proper tools and procedure for collecting the data followed by analyzing the characteristics of the circuit. With both the knowledge and laboratory capability, in hope that the students are able to apply it in the biomedical discipline</i>												

Bahan Kajian: Materi pembelajaran Course Materials:		1. Rangkaian AC <i>steady state</i> / <i>AC steady state circuit</i> 2. <i>Power analysis</i> / <i>power analysis</i> 3. <i>Mutual inductance, energy</i> dan transformator linier / <i>Mutual inductance, energy, and linear Transformator</i> 4. Keterampilan mengenai hukum dasar dan teori rangkaian / <i>capability of fundamental law and circuit theory</i> 5. Keterampilan mengenai penyederhanaan rangkaian dan transfer daya / <i>capability of circuit simplification and power transfer</i> 6. Keterampilan mengenai sifat rangkaian / <i>capability of circuit characteriztic</i> 7. Keterampilan mengenai rangkaian transien DC / <i>capability of DC transient circuit</i> 8. Keterampilan mengenai resonansi / <i>capability of resonant</i>				
Pustaka References		Utama / Main: 1. Pujiono, “Rangkaian Listrik”, Graha Ilmu, Yogyakarta, 2013. 2. Alexander Charles K., Sadiku Matthew O. N., “Fundamentals of Electric Circuit Fourth edition”, McGraw-Hill, New York, 2009. Pendukung / Supporting: 1. Hyatt, William H., Kemmerly Jack E, “Engineering circuit analysis”, McGraw-Hill, New York, 1983. 2. Edminister Josep A., “Electric Circuit, Schaum series”, McGraw-Hill, New York, 1983				
Dosen Pengampu Lecturers						
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)
1-3	Mahasiswa mampu memahami dan menjelaskan teori tentang <i>sinusoidal</i> dan <i>phasor</i> .	• Mampu menghitung <i>sinusoidal</i> dan <i>phasor</i> • Mampu mengidentifikasi hubungan <i>phasor</i> dengan elemen rangkaian • Mampu menghitung impedansi dan admitansi • Mampu menghitung kombinasi impedansi • Mampu memberikan kesimpulan yang sesuai hukum dasar dan teori rangkaian untuk praktikum	Non-tes : • Tugas 1: Mengerjakan soal perhitungan mengenai <i>sinusoidal</i> dan <i>phasor</i> (Tugas Tertulis) • Praktikum 1 : Hukum dasar dan teori rangkaian (Praktikum Lab)	• Kuliah dan brainstorming, tanya jawab, tugas. [TM : 3x (3 x 50")] [BM : 3x (2 x 60")] [PT : 3x (2 x 60")]	• Daring dan luring melalui Share ITS • <i>Chat and discussion in ITS platform forum.</i>	• Pengenalan sinusoidal • Pengenalan <i>phasor</i> • Hubungan <i>phasor</i> dengan elemen rangkaian • Impedansi dan admitansi • Kombinasi impedansi • Review hukum dasar dan teori rangkaian untuk praktikum [Link materi di MyITSClassroom]	Tugas 1: 5 Praktikum 1: 8
	<i>Students are able to understand and explain the</i>	• <i>Able to calculate sinusoids and phasor</i>	Non-test : • Task 1:	• <i>Presentation and brainstorming, ask</i>		• <i>Data Characteristics</i>	

	<i>theory of sinusoid and phasor.</i>	• Able to identify the relationship between phasor and circuit element • Able to calculate impedance and admittance • Able to calculate the combination of impedance • Able to correctly summarize the fundamental law and circuit theory for lab work	<i>Finding the calculation problem regarding sinusoids and phasor</i> • Lab work I: <i>Fundamental law and circuit theory (lab work)</i>	<i>and answer, assignment.</i> [FF : 3x (3 x 50'')] [SA : 3x (2 x 60'')] [SS : 3x (2 x 60'')]		• Levels of Measurement • Data Representation with Graph • Data Representation with Table	
4-6	Mahasiswa mampu memahami, menjelaskan dan menganalisa rangkaian AC <i>steady state</i> .	• Mampu menentukan teknik analisa rangkaian AC: analisa node dan mesh • Mampu menghitung teorema rangkaian: superposisi dan transformasi • Mampu menghitung rangkaian pengganti thevenin dan norton • Mampu memberikan kesimpulan yang sesuai teori penyederhanaan rangkaian dan transfer	Non-tes : • Tugas 2: Mengerjakan soal perhitungan mengenai analisa rangkaian AC analisa node dan mesh, teorema rangkaian superposisi dan transformasi sumber (Tugas Tertulis) • Tugas 3: Mengerjakan soal perhitungan	• Kuliah dan brainstorming, tanya jawab, tugas. [TM : 3x (3 x 50'')] [BM : 3x (2 x 60'')] [PT : 3x (2 x 60'')]	• Daring dan luring melalui Share ITS	• Teknik analisa rangkaian AC : analisa node dan mesh • Teorema rangkaian : superposisi dan transformasi sumber • Rangkaian pengganti thevenin dan norton • Review teori penyederhanaan rangkaian dan	4

	<i>Students are able understand, explain, and analyze AC steady state circuit</i>	daya rangkaian DC untuk praktikum • Able to determine the AC circuit analysis technique: node and mesh analysis • Able to calculate circuit theorem: superposition and source transformation • Able to calculate the alternate circuit of Thevenin and norton • Able to correctly summarize the simplification theory and DC circuit power transfer for lab work	mengenai analisa rangkaian pengganti thevenin dan norton (Tugas Tertulis) Non-test : • Task 2: Finding the calculation problem regarding AC circuit analysis and mesh • Task 3: Finding the calculation problem regarding thevenin and norton alternate circuit analysis	• Presentation and brainstorming, ask and answer, assignment. [FF : 3x (3 x 50")] [SA : 3x (2 x 60")] [SS : 3x (2 x 60")]	• Chat and discussion in ITS platform forum.	transfer daya rangkaian DC untuk praktikum • AC circuit analyzing technique : node analysis and mes • Circuit theorem: superposition and source transformation • Alternate circuit of thevenin and norton • Simplification circuit theory and DC circuit power transfer review for lab work	
7-9	Mahasiswa mampu memahami dan menjelaskan teori tentang	• Mampu menganalisa daya (power analysis): instantaneous and average power,	Non-tes : • Tugas 4: Mengerjakan soal perhitungan	• Kuliah dan brainstorming, tanya jawab,tugas. [TM : 2x (3 x 50")]	• Daring dan luring melalui Share ITS	• Analisa daya (power analysis) : instantaneous and	12

	analisa daya (<i>power analysis</i>) <i>Students are able to understand and explain the theory of power analysis</i>	<i>maximum average power transfer, effective or RMS value, apparent power and power factor, complex power, conservation of AC power, power factor correction</i> ● Mampu memberikan kesimpulan yang sesuai sifat rangkaian untuk praktikum	mengenai analisa daya pada rangkaian AC ● Praktikum 3: Sifat rangkaian (Praktikum Lab) Non-test : ● Task 4: Finding the calculation problem regarding power analysis in AC circuit ● Lab work 3: Circuit characteristic (lab work)	[BM : 2x (3 x 50")] [PT : 2x (3 x 50")] ● Presentation and brainstorming, ask and answer, assignment. [FF : 2x (3 x 50")] [SA : 2x (3 x 50")] [SS : 2x (3 x 50")]	● Chat and discussion in ITS platform forum.	<i>average power, maximum average power transfer, effective or RMS value, apparent power and power factor, complex power, conservation of AC power, power factor correction</i> ● Review teori mengenai sifat rangkaian untuk praktikum ● Power analysis: instantaneous and average power, maximum average power transfer, effective or RMS value, apparent power and power factor, complex power, conservation of AC power, power factor correction	
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						• <i>Theory of circuit characteristic review for lab work</i>	
8	EVALUASI TENGAH SEMESTER MID-SEMESTER EXAM						30
10-12	Mahasiswa mampu memahami, menjelaskan dan menganalisa rangkaian <i>magnetic coupled</i> <i>Students are able to understand, explain, and</i>	• Mampu menghitung <i>Mutual Inductance, energy</i> dan transformator linier: pengenalan transformer, pengenalan <i>mutual inductance</i>, energi pada coupled circuit, transformer linier dan ideal, aplikasi • Mampu memberikan kesimpulan yang sesuai review rangkaian transien DC untuk praktikum • <i>Able to calculate mutual inductance, energy and linear</i>	Non-tes : • Tugas 5: Mengerjakan soal perhitungan mengenai analisa rangkaian <i>magnetic coupled</i> (Tugas Tertulis) • Praktikum 4: Rangkaian transien DC (Praktikum Lab) Non-test : • Task 5:	• Kuliah dan brainstorming, tanya jawab, tugas. [TM : 3x (3 x 50'')] [BM : 3x (3 x 50'')] [PT : 3x (3 x 50'')] • <i>Presentation and brainstorming, ask</i>	• Daring dan luring melalui Share ITS • <i>Chat and discussion in</i>	• <i>Mutual inductance, energy</i> dan transformator linier : pengenalan transformer, pengenalan <i>mutual inductance</i>, energi pada coupled circuit, transformer linier dan ideal, aplikasi • Review rangkaian transien DC untuk praktikum • <i>Mutual inductance, energy and linier transformator :</i>	5

	<i>analyze magnetic coupled circuit</i>	<i>transformator: pengenalan transformer, pengenalan mutual inductance, energi pada cupled circuit, linear and ideal transformator, application</i> ● <i>Able to correctly summarize the DC transient review for lab work</i>	<i>Solving the calculation regarding magnetic coupled circuit</i> ● Lab work 4: DC transient circuit (lab work)	<i>and answer, assignment.</i> [FF : 3x (3 x 50")] [SA : 3x (3 x 50")] [SS : 3x (3 x 50")]	<i>ITS platform forum.</i>	<i>tranformator introduction, mutual inductance introduction, energy in coupled circuit, linear and ideal transformator, application</i> ● <i>DC transient circuit review for lab work</i>	
13-15	Mahasiswa mampu memahami dan menjelaskan teori tentang respon frekuensi. <i>Students are able to understand and explain the</i>	● Mampu menghitung respon frekuensi: fungsi alih, decibel, bode plot, rangkaian resonansi seri dan parallel, rangkaian filter pasif ● <i>Able calculate the frequency response: transfer function, decibel, bode plot,</i>	Non tes: ● Tugas 6: Mengerjakan soal perhitungan mengenai respon frekuensi (Tugas Tertulis) ● Praktikum 5 : Rangkaian resonansi (Praktikum Lab) Non-test: ● Task 6:	● Kuliah dan brainstorming, tanya jawab, tugas. [TM : 3x (3 x 50")] [BM : 3x (3 x 50")] [PT : 3x (3 x 50")] ● <i>Presentation and brainstorming, ask</i>	● Daring dan luring melalui Share ITS ● <i>Chat and discussion in</i>	● Respon frekuensi : fungsi alih, decibel, bode plot, rangkaian resonansi seri dan parallel, rangkaian filter pasif ● <i>Frequency response: Transfer function, decibel, bode plot,</i>	5

	<i>theory of frequency response</i>	<i>series and parallel resonant circuit, passive filter circuit</i>	<i>Solving the calculation regarding frequency response</i> ● Lab work 5: <i>Resonant circuit</i>	<i>and answer, assignment.</i> [FF : 3x (3 x 50")] [SA : 3x (3 x 50")] [SS : 3x (3 x 50")]	<i>ITS platform forum.</i>	<i>series resonant and parallel circuit, passive filter circuit</i>	
16	EVALUASI AKHIR SEMESTER FINAL-SEMESTER EXAM						40

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 : Advance Electrical Engineering			RA&E
				Write Doc Code
Kode/code: EB234305	Bobot sks/credits (T/P): 2/0	Rumpun MK: Biomedical Instrumentation and Signal Processing Course Cluster: Biomedical Instrumentation and Signal Processing	Smt: III	
OTORISASI AUTHORIZATION	Penyusun RA & E Compiler A&EP Dr. Ir. Hendra Kusuma, M.Eng. Sc	Koordinator RMK Course Cluster Coordinator Dr. Rachmad Setiawan, S.T., M.T.	Ka DEP Head of DEP Dr. Norma Hermawan, S.T., M.Sc.	

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
1-3	Sub CP-MK 1: Mahasiswa mampu memahami dan menjelaskan teori tentang <i>sinusoidal</i> dan <i>phasor</i> LLO 1: <i>Students are able to understand and explain the theory of sinusoid and phasor</i>	Non-tes : Tugas 1: Mengerjakan soal perhitungan mengenai <i>sinusoidal</i> dan <i>phasor</i> (Tugas Tertulis) Praktikum 1 : Hukum dasar dan teori rangkaian (Praktikum Lab) Tes: 1 Soal ETS (5% dari 15%) Non-test : Task 1: <i>Solving the calculation regarding sinusoids and phasor()</i> Lab work I: <i>Fundamental law and circuit theory (lab work)</i> Test: 1 Question in Mid Exam (5% from 15%)	18
4-6	Sub CP-MK 2: Mahasiswa mampu memahami, menjelaskan dan menganalisa rangkaian AC <i>steady state</i>	Non-tes : Tugas 2: Mengerjakan soal perhitungan mengenai analisa rangkaian AC analisa node dan mesh, teorema rangkaian superposisi dan transformasi sumber (Tugas Tertulis) Tugas 3:	18

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	LLO 2: <i>Students are able to understand, explain, and analyze AC steady state circuit</i>	Mengerjakan soal perhitungan mengenai analisa rangkaian pengganti thevenin dan norton(Tugas Tertulis) Tes: 1 soal ETS () Non-test : Task 2: <i>Solving the calculation regarding node and mesh analysis in AC circuit, superposition circuit theorem and source transformator(Written Task)</i> Task 3: <i>Solving the calculation regarding thevenin and norton alternate circuit analysis (Written Task)</i> Test: 1 Question in Mid Exam()	
7-9	Sub CP-MK 3: Mahasiswa mampu memahami dan menjelaskan teori tentang analisa daya (<i>power analysis</i>) LLO 3: <i>Students are able to understand and explain the theory of power analysis</i>	Non-tes : Tugas 4: Mengerjakan soal perhitungan mengenai analisa daya pada rangkaian AC Praktikum 3: Sifat rangkaian (Praktikum Lab) Tes: 1 soal ETS (3% dari 15%) Non-test : Task 4: <i>Solving calculation regarding power analysis in AC circuit</i> Lab work 3: <i>Circuit characteristic (lab work)</i> Test: 1 Question in Mid Exam (3% from 15%)	16
8	Evaluasi Tengah Semester Mid Exam Question	Tes: Ujian Tulis/Ujian Daring Test: Writing Exams / Online Exams	15
10-12	Sub CP-MK 4: Mahasiswa mampu memahami, menjelaskan dan menganalisa rangkaian <i>magnetic</i>	Non-tes : ● Tugas 5: Mengerjakan soal perhitungan mengenai analisa rangkaian <i>magnetic coupled</i> (Tugas Tertulis) ● Praktikum 4: Rangkaian transien DC (Praktikum Lab)	24

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	<i>coupled</i> LLO 4: <i>Students are able to understand, explain, and analyze magnetic coupled circuit</i> <i>Students are able to understand and explain the theory of frequency response</i>	Tes: 2 soal EAS(11% dari 15%) Non-test : • Task 5: <i>Solving the calculation regarding magnetic coupled circuit</i> • Lab work 4: <i>DC transient circuit (lab work)</i> Test: 2 Question in Final Exam(11% dari 15%)	
13-15	Sub CP-MK 5: Mahasiswa mampu memahami dan menjelaskan teori tentang respon frekuensi. LLO 5: <i>Students are able to understand and explain the theory of frequency response</i>	Non tes: • Tugas 6: Mengerjakan soal perhitungan mengenai respon frekuensi (Tugas Tertulis) • Praktikum 5 : Rangkaian resonansi (Praktikum Lab) Tes: 2 soal pada EAS(11% dari 15%) Non-test: • Task 6: <i>Solving the calculation regarding frequency response</i> • Lab work 5: <i>Resonant circuit</i> Test: 2 Question in Final Exam(11% from 15%)	24
16	Evaluasi Akhir Final Exam Question	Tes: Ujian Tulis/Ujian Daring Test: Writing Exams / Online Exams	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-01 / PLO-01	CPMK 1 / CLO 1	Week- 1-3	Written Task 1	5
			Lab Work 1	8
CPL-03 / PLO-03	CPMK 3 / CLO 3	Week- 7-9	Written Task 4	5
			Lab Work 3	8
		Week- 8	Mid Exam Question	15
	CPMK 4 / CLO 4	Week 10-12	Written Task 5	5
			Lab Work 4	8
	CPMK 5 / CLO 5	Week- 13-15	Written Task 6	5
			Lab Work 5	8
CPL-05 / PLO-05	CPMK 2 / CLO 2	Week- 4-6	Written Task 2	5
			Written task 3	5
			Lab Work 2	8
		Week- 16	Final Exam Question	15
				$\Sigma = 100\%$

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	Tugas 1 (Tugas Tulis 1 - 4) Assignment 1 (Written				0.07		0.04		0.04					0.15

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
	Assignment 1 - 4)													
2	Evaluasi Tengah Semester Mid Exam				0.07		0.07		0.07					0.2
3	Tugas 2 (Tugas Tulis 5 - 6) Assignment 2(Written Assignment 5 - 6)				0.02		0.09		0.04					0.15
4	Evaluasi Akhir Semester Final Exam				0		0.12		0.08					0.2
5	Praktikum (Praktikum 1 - 4) Practicum (Practicum 1 - 4)				0		0.17		0.13					0.3
	Total				0.15		0.50		0.35					1