



MODULE HANDBOOK COMMUNICATION SYSTEM BASICS AND LABORATORY



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

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

ENDORSEMENT PAGE






MODULE HANDBOOK

Communication Systems Basic and Laboratory

DEPARTMENT OF BIOMEDICAL ENGINEERING

INSTITUT TEKNOLOGI SEPULUH NOPEMBER
Number : 6819/IT2.IX.5.1.2/B/PP.03.00.00/2023

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>	Ir.Gatot Kusrahardjo, MT	Dosen <i>Lecturer</i>	TTD	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

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MODULE HANDBOOK

COMMUNICATION SYSTEM BASICS AND LABORATORY

Module name	Commnunication System Basics and Laboratory	
Module level	Undergraduate	
Code	EB234201	
Course (if applicable)	Communication System Basics and Laboratory	
Semester	second Semester (Genap)	
Person responsible for the module	Ir. Gatot Kusrahardjo, M.T.	
Lecturer	Ir. Gatot Kusrahardjo, M.T.	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory , 2 nd semester.	
Type of teaching, contact hours	Lectures, <60 students Monday, 11.00-12.50 (GMT+7)	
Workload	<ol style="list-style-type: none"> 1. Lectures : 3 x 50 = 150 minutes per week. 2. Exercises and Assignments : 3 x 60 = 180 minutes per week. 3. Private learning : 3 x 60 = 180 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	-	
Learning outcomes and their corresponding PLOs	<p>Course Learning Outcome (CLO) after completing this module,</p> <p>CLO 1: Students are able to understand and explain the history of telecommunication technology development, telecommunication principles, telecommunication protocol and world's telecommunication regulatory bodies</p> <p>CLO 2: Students are able to understand and explain the telecommunication media and theory of electromagnetic field</p> <p>CLO 3: Students are able to understand, explain, design and analyze the modulation and demodulation process in digital signal</p>	<p>PLO-01</p> <p>PLO-01</p> <p>PLO-05</p>

	<p>CLO 4: Students are able to understand, explain, design and analyze the modulation and demodulation process in analog signal</p> <p>CLO 5: Students are able to understand and explain the technique and terminologies regarding data communication, able to design and analyze the data communication process that happens both in physical and data link layer</p> <p>CLO 6: Students are able to understand and explain the telephony system, optic and satellite communication system also the recent telecommunication technology development and the application on biomedical field</p>	<p>PLO-05</p> <p>PLO-03</p> <p>PLO-03</p>
Content	<p><i>This course is a mandatory course which practically and theorytically studies the communication system in basic. This course aims the student to understand the cornerstone of the theory and communication principle such as the history and the evolution of technology telecommunication, components in communication system, network, and telecommunication service application, also the implementation in medical instrumentation. Moreover, this course aims the student to be able to do the experiment with appropriate tool and procedure. With the understanding and the capability students are hoped to be able to apply it in medical field</i></p>	
Study and examination requirements and forms of examination	<ul style="list-style-type: none"> • In-class exercises • Assignment 1, 2, 3, 4, 5 • Lab work 1, 2, 3 • Presentation • Mid-term examination • Final examination 	
Media employed	<p>LCD, whiteboard, websites (myITS Classroom), zoom.</p>	
Reading list	<p>Main :</p> <ol style="list-style-type: none"> 1. Roger L. Freeman, "Fundamentals of Telecommunications", John Wiley & Sons, Inc. New York, 1999 2. Roger L. Freeman, "Telecommunication System Engineering", John Wiley & Sons, Inc. New Jersey, 2004 <p>Supporting :</p> <ol style="list-style-type: none"> 1. Lillian Goleniewski, Kitty W Jarrett, "Telecommunications Essentials The Complete Global Source", Addison-Wesley, New Jersey, 2007 2. Annabel Z. Dodd, "The Essential Guide to Telecommunications", Prentica Hall, New Jersey, 2012 	

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 Sistem Komunikasi dan Laboratorium <i>Communication System Basics and Laboratory</i>	EB234201	Biomedical Instrumentation and Signal Processing	T=3	P=0	II	Oct 31, 2023	
OTORISASI / PENGESAHAN AUTHORIZATION / ENDORSEMENT	Dosen Pengembang RPS Developer Lecturer of Semester Learning Plan		Koordinator RMK Course Cluster Coordinator		Ka DEPARTEMEN Head of Department		
	(Ir. Gatot Kusrahardjo, 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-01 PLO-01	Mampu menerapkan Ilmu Pengetahuan Alam dan Matematika pada bidang Teknik Biomedika. <i>Able to apply Natural Sciences and Mathematics in the field of Biomedical Engineering.</i>					
	CPL-03 PLO-03	Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan. <i>Able to design and implement laboratory experiment and / or field experiments, analyze and interpret data, and use objective assessments to draw conclusions.</i>					

	CPL-05 PLO -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 <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 mengenai sejarah perkembangan teknologi telekomunikasi, prinsip-prinsip telekomunikasi, protokol telekomunikasi dan badan-badan regulasi telekomunikasi di dunia <i>Students are able to understand and explain the history of telecommunication technology development, telecommunication principles, telecommunication protocol and world's telecommunication regulatory bodies</i>
	CP MK 2 CLO 2	Mahasiswa mampu memahami dan menjelaskan mengenai media telekomunikasi dan teori medan elektromagnetika <i>Students are able to understand and explain the telecommunication media and theory of electromagnetic field</i>
	CP MK 3 CLO 3	Mahasiswa mampu memahami, menjelaskan, merancang dan menganalisa proses modulasi dan demodulasi pada sinyal analog <i>Students are able to understand, explain, design and analyze the modulation and demodulation process in analog signal</i>
	CP MK 4 CLO 4	Mahasiswa mampu memahami, menjelaskan, merancang dan menganalisa proses modulasi dan demodulasi pada sinyal digital <i>Students are able to understand, explain, design and analyze the modulation and demodulation process in digital signal</i>
	CP MK 5 CLO 5	Mahasiswa mampu memahami dan menjelaskan teknik dan terminologi yang berkaitan dengan komunikasi data, serta mampu merancang dan menganalisa proses komunikasi data yang terjadi pada lapisan fisik dan lapisan data link <i>Students are able to understand and explain the technique and terminologies regarding data communication, able to design and analyze the data communication process that happens both in physical and data link layer</i>
	CP MK 6 CLO 6	Mahasiswa mampu memahami dan menjelaskan sistem teleponi, sistem komunikasi optic dan satelit serta perkembangan terkini teknologi telekomunikasi dan aplikasinya pada bidang biomedika <i>Students are able to understand and explain the telephony system, optic and satellite communication system also the recent telecommunication technology development and the application on biomedical field</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>Mata kuliah Dasar Sistem Komunikasi dan Laboratorium merupakan mata kuliah wajib yang membahas mengenai ilmu dasar sistem komunikasi baik secara teori maupun praktek. Mata kuliah ini bertujuan agar mahasiswa memahami landasan teori dan prinsip komunikasi seperti sejarah dan evolusi teknologi telekomunikasi, komponen-komponen pada sistem komunikasi, jaringan, dan aplikasi layanan telekomunikasi, serta contoh-contoh implementasinya dalam instrumen medis. Selain itu, mata kuliah ini juga bertujuan agar mahasiswa mampu melakukan eksperimen dengan peralatan dan prosedur yang benar. Dengan pemahaman dan keterampilan tersebut mahasiswa diharapkan mampu menerapkannya dalam bidang medis.</p> <p><i>This course is a fundamental course which practically and theoretically studies the communication system in basic. This course aims the student to understand the cornerstone of the theory and communication principle such as the history and the evolution of technology telecommunication, components in communication system, network, and telecommunication service application, also the implementation in medical instrumentation. Moreover, this course aims the student to be able to do the experiment with appropriate tool and procedure. With the understanding and the capability students are hoped to be able to apply it in medical field</i></p>																																																																																											
<p>Bahan Kajian: Materi pembelajaran</p>	<ol style="list-style-type: none"> 1. Sejarah, prinsip-prinsip dan protokol telekomunikasi / <i>history, telecommunication protocol and principles</i> 2. Media telekomunikasi dan pengenalan medan elektromagnetika / <i>telecommunication medium and electromagnetic field introduction</i> 3. Teknik modulasi analog / <i>analog modulation technique</i> 4. Keterampilan proses modulasi analog / <i>analog modulation process skill</i> 																																																																																											

Course Materials:		5. Teknik modulasi digital / <i>digital modulation technique</i> 6. Keterampilan proses modulasi digital / <i>digital modulation process</i> 7. Perkembangan terkini teknologi telekomunikasi / <i>telecommunication technology recent development</i> 8. Keterampilan proses komunikasi data / <i>data communication process skill</i>					
Pustaka		Utama / Main:					
References		1. Roger L. Freeman, "Fundamentals of Telecommunications", John Wiley & Sons, Inc. New York, 1999 2. Roger L. Freeman, "Telecommunication System Engineering", John Wiley & Sons, Inc. New Jersey, 2004					
		Pendukung / Supporting:					
		1. Lillian Goleniewski, Kitty W Jarrett, "Telecommunications Essentials The Complete Global Source", Addison-Wesley, New Jersey, 2007 2. Annabel Z. Dodd, "The Essential Guide to Telecommunications", Prentice Hall, New Jersey, 2012					
Dosen Pengampu <i>Lecturers</i>							
Matakuliah syarat <i>Prerequisite</i>							
Mg ke/ Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) / <i>Final ability of each learning stage (LLO)</i>	Penilaian / <i>Assessment</i>		Bentuk 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>	Tatap Muka / <i>In-class (5)</i>	Daring / <i>Online (6)</i>		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-2	Mahasiswa mampu memahami dan menjelaskan mengenai sejarah perkembangan teknologi telekomunikasi, prinsip-	<ul style="list-style-type: none"> Mampu memahami dan menjelaskan sejarah telekomunikasi 	Non-tes : Tugas 1: Mengenai sejarah perkembangan teknologi	<ul style="list-style-type: none"> Kuliah dan brainstorming, tugas. [TM : 2x (3 x 50")] 	<ul style="list-style-type: none"> Chatting dan diskusi dalam forum platform ITS. 	<ul style="list-style-type: none"> Sejarah telekomunikasi Prinsip-prinsip telekomunikasi 	2

	<p>prinsip telekomunikasi, protokol telekomunikasi dan badan-badan regulasi telekomunikasi di dunia</p> <p><i>Students are able to understand and explain the history of telecommunication technology development, telecommunication principles, telecommunication protocol and world's telecommunication regulatory bodies</i></p>	<ul style="list-style-type: none"> • Mampu memahami dan menjelaskan mengenai prinsip-prinsip telekomunikasi • Mampu memahami dan menjelaskan protokol telekomunikasi • Mampu memahami cara kerja badan-badan regulasi telekomunikasi di dunia <ul style="list-style-type: none"> • <i>Able to understand and explain the telecommunication principles</i> • <i>Able to understand and explain the telecommunication protocols</i> • <i>Able to understand the work of world's telecommunication regulatory bodies</i> 	<p>telekomunikasi, prinsip-prinsip telekomunikasi, protokol telekomunikasi dan badan-badan regulasi telekomunikasi (Tugas Tertulis)</p> <p>Non-test : Task 1: <i>Regarding the history of telecommunication technology development, telecommunication principles, telecommunication protocols and world's telecommunication regulatory councils.</i></p>	<p>[BM : 2x (3 x 50")] [PT : 1x(3 x 50")]</p> <ul style="list-style-type: none"> • <i>lecture and brainstorming, assignment.</i> [FF : 2x (3 x 50")] [SA : 2x (3 x 50")] [SS : 1x(3 x 50")] 	<ul style="list-style-type: none"> • <i>Chat and discussion in ITS platform forum.</i> 	<ul style="list-style-type: none"> • Protokol telekomunikasi • Badan regulasi telekomunikasi di dunia <p>[Link materi di MyITSClassroom]</p> <ul style="list-style-type: none"> • <i>History of telecommunication</i> • <i>Telecommunication principles</i> • <i>Telecommunication protocols</i> • <i>World's telecommunication regulatory council</i> 	
3-4	<p>Mahasiswa mampu memahami dan menjelaskan mengenai media</p>	<ul style="list-style-type: none"> • Mampu memahami dan menjelaskan media telekomunikasi 	<p>Non-tes : Tugas 2 :</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, 	<ul style="list-style-type: none"> • Chatting dan diskusi dalam 	<ul style="list-style-type: none"> • Media telekomunikasi 	2

	<p>telekomunikasi dan teori medan elektromagnetika</p> <p><i>Students are able to understand and explain the telecommunication medium and theory of electromagnetic field</i></p>	<ul style="list-style-type: none"> • Mampu memahami dan menjelaskan dasar teori medan dan gelombang elektromagnetik : medium, mekanisme dan model-model perambatan gelombang elektromagnetik • <i>Able to understand and explain the telecommunication medium</i> • <i>Able to understand and explain the fundamental theory of field and electromagnetic wave: medium, mechanism and electromagnetic wave propagation models</i> 	<p>Mengenai media telekomunikasi dan teori medan elektromagnetika (Tugas Tertulis)</p> <p>Non-test : Task 2: Regarding telecommunication medium and electromagnetic field theory (written task)</p>	<p>latihan soal, tugas. [TM : 2x (2x 50")] [BM : 2x (3x 50")] [PT : 2 x (3x 50")]</p> <ul style="list-style-type: none"> • <i>lecture, discussion, ask and answer, assignment [FF : 2x (2x 50") [SA : 2x (3x 50") [SS : 2x (3x 50")]</i> 	<p>forum platform ITS.</p> <ul style="list-style-type: none"> • <i>Chat and discussion in ITS platform forum.</i> 	<ul style="list-style-type: none"> • Dasar teori medan dan gelombang elektromagnetik : medium, mekanisme dan model-model perambatan gelombang elektromagnetik • <i>Telecommunication medium</i> • <i>Basic theory of field and electromagnetic wave: medium, mechanism and electromagnetic wave propagation models</i> 	
5 - 7	<p>Mahasiswa mampu memahami, menjelaskan, merancang dan menganalisa proses modulasi dan demodulasi pada sinyal analog</p>	<ul style="list-style-type: none"> • Mampu memahami dan menjelaskan sinyal analog • Mampu merancang, menganalisa, dan menerapkan modulasi 	<p>Non-tes : • Tugas 3 : Perancangan dan analisa modulasi dan demodulasi</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, latihan soal, tugas [TM : 3x (3x 50")] 	<ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. 	<ul style="list-style-type: none"> • Pengenalan sinyal analog • Teknik perancangan dan analisa modulasi dan 	17

	<i>Students are able to understand, explain, design and analyze the modulation and demodulation process in analog signal</i>	<p>dan demodulasi analog</p> <ul style="list-style-type: none"> • <i>Able to understand the analog signal</i> • <i>Able to design, analyze, and implement both analog modulation and demodulation</i> 	<p>analog (Tugas Tertulis)</p> <ul style="list-style-type: none"> • Praktikum 1 : Proses modulasi analog (Praktikum Lab) <p>Non-test :</p> <ul style="list-style-type: none"> • Task 3: <i>Analog demodulation and modulation design and analysis (written task)</i> • Lab work 1: <i>Analog modulation process (lab work)</i> 	<p>[BM : 3x(3x 50")] [PT : 3x(3x 50")]</p> <ul style="list-style-type: none"> • <i>Lecture and discussion, ask and answer, assignment [FF : 3x (3 x 50")] [SA : 3x (3 x 50") [SS : 3x(3 x 50")]</i> 	<ul style="list-style-type: none"> • <i>Chat and discussion in ITS platform forum.</i> 	<p>demodulasi analog, serta penerapannya</p> <ul style="list-style-type: none"> • <i>Analog signal introduction</i> • <i>Design technique, and modulation and analog demodulation analysis, and its implementation</i> 	
8	EVALUASI TENGAH SEMESTER MID-SEMESTER EXAM						15
9 - 11	Mahasiswa mampu memahami, menjelaskan, merancang dan menganalisa proses modulasi dan demodulasi pada sinyal digital	<ul style="list-style-type: none"> • Mampu memahami dan menjelaskan sinyal digital. • Mampu merancang, menganalisa, dan menerapkan modulasi dan demodulasi analog 	<p>Non-tes :</p> <ul style="list-style-type: none"> • Tugas 4 : Perancangan dan analisa modulasi dan demodulasi digital (Tugas Tertulis) 	<ul style="list-style-type: none"> • Kuliah, Diskusi, tanya jawab, tugas. [TM : 3x (3x 50")] [BM : 3x(3x 50")] 	<ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. 	<ul style="list-style-type: none"> • Pengenalan sinyal digital • Teknik perancangan dan analisa modulasi dan demodulasi 	17

	<p><i>Students are able to understand, explain, design and analyze the modulation and demodulation process in digital signal</i></p>	<ul style="list-style-type: none"> • Able to understand and explain digital signal • Able to design, analyze, and implement both analog modulation and demodulation 	<ul style="list-style-type: none"> • Praktikum 2: Proses modulasi digital (Praktikum Lab) Non-test : • Task 4: Digital demodulation and modulation design and analysis (written task) • Labwork 2: Digital modulation process(lab work) 	<p><i>[PT : 3x(3x 50")]</i></p> <ul style="list-style-type: none"> • Lecture and discussion, ask and answer, assignment <i>[FF : 3x (3 x 50")]</i> <i>[SA : 3x (3 x 50")]</i> <i>[SS : 3x(3 x 50")]</i> 	<ul style="list-style-type: none"> • Chat and discussion in ITS platform forum. 	<p>digital, serta penerapannya</p> <ul style="list-style-type: none"> • Digital signal introduction • Design technique, and modulation and digital demodulation analysis, and its implementation 	
12-13	<p>Mahasiswa mampu memahami dan menjelaskan teknik dan terminologi yang berkaitan dengan komunikasi data, serta mampu merancang dan menganalisa proses komunikasi data yang terjadi pada lapisan fisik dan lapisan data link.</p>	<ul style="list-style-type: none"> • Mampu memahami sejarah perkembangan sistem komputer yang terdistribusi yang berpengaruh pada perkembangan data komunikasi, • Mampu menentukan dengan tepat metode transmisi, jenis transmisi, karakteristik 	<p>Non tes:</p> <ul style="list-style-type: none"> • Tugas 5 : Mengenai teknik dan terminologi yang berkaitan dengan komunikasi data (Tugas Tertulis) • Praktikum 3 : 	<ul style="list-style-type: none"> • Kuliah, Diskusi, tanya jawab, tugas. <i>[TM : 2x (3x 50")]</i> <i>[BM : 2x(3x 50")]</i> <i>[PT : 2x(3x 50")]</i> 	<ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. 	<ul style="list-style-type: none"> • Sejarah perkembangan sistem komputer yang terdistribusi yang berpengaruh pada perkembangan data komunikasi, • Metode transmisi, jenis transmisi, karakteristik media 	17


	<p><i>Students are able to understand and explain the technique and terminologies regarding data communication, able to design and analyze the data communication process that</i></p>	<p>media trasmisi dan dasar topologi jaringan,</p> <ul style="list-style-type: none"> • Mampu menentukan dengan tepat berbagai teknik deteksi kesalahan pengiriman data, berbagai teknik yang dipergunakan untuk mengurangi pengaruh kesalahan transmisi dan mengatur kecepatan alir data pada lapisan data link • Mampu memberikan kesimpulan yang sesuai dengan standar protokol data link untuk mengatur pertukaran data <ul style="list-style-type: none"> • <i>Able to understand the history of development in distributed computer system that influences the data communication development</i> 	<p>Proses komunikasi data (Praktikum Lab)</p> <p>Non-test:</p> <ul style="list-style-type: none"> • Task 3: Regarding the data communication techniques and terminologies 	<ul style="list-style-type: none"> • <i>lecture, discussion, ask and answer, assignment. [FF : 2x (3 x 50")] [SA : 2x (3 x 50")]</i> 	<ul style="list-style-type: none"> • <i>Chat and discussion in ITS platform forum.</i> 	<p>transmisi dan dasar topologi jaringan,</p> <ul style="list-style-type: none"> • Berbagai teknik deteksi kesalahan pengiriman data, berbagai teknik yang dipergunakan untuk mengurangi pengaruh kesalahan transmisi dan mengatur kecepatan alir data pada lapisan data link • Membahas standar protokol data link untuk mengatur pertukaran data <ul style="list-style-type: none"> • <i>The history of development in distributed computer system that influences the data communication development</i> 	
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	<i>happens both in physical and data link layer</i>	<ul style="list-style-type: none"> • <i>Able to properly determine the transmission method, type of transmission, transmission medium characteristic and network topology basic</i> • <i>Able to properly determine various technique of transmission data error detection, various used technique to reduce transmission error effect and set the data flow speed in data link layer</i> • <i>Able to correctly summarize the standard data link protocol for handling data exchange</i> 	<p><i>(written task)</i></p> <ul style="list-style-type: none"> • Lab work 3: <i>Data communication process(lab work)</i> 	<i>[SS : 2x(3 x 50")]</i>		<ul style="list-style-type: none"> • <i>the transmission method, type of transmission, transmission medium characteristic and network topology basic</i> • <i>discuss the standard data link protocol for handling data exchange</i> 	
14-15	Mahasiswa mampu memahami dan menjelaskan sistem teleponi, sistem komunikasi optic dan satelit serta perkembangan terkini teknologi telekomunikasi dan	<ul style="list-style-type: none"> • Mampu memahami dan menjelaskan sistem teleponi • mampu memahami dan menjelaskan pengenalan sistem komunikasi optik dan 	<p>Non tes:</p> <p>Presentasi : Materi presentasi tentang teknologi komunikasi yang terkini dan implementasinya</p>	<ul style="list-style-type: none"> • Kuliah dan diskusi, tugas <i>[TM : 2x (3x 50")]</i> <i>[BM : 2x(3x 50")]</i> 	<ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. 	<ul style="list-style-type: none"> • Pengenalan sistem teleponi • Pengenalan sistem komunikasi optic dan sistem komunikasi satelit 	5

<p>aplikasinya pada bidang biomedika</p> <p><i>Students are able to understand and explain the telephony system, optic and satellite communication system also the recent telecommunication technology development and the application on biomedical field</i></p>	<p>sistem komunikasi satelit</p> <ul style="list-style-type: none"> • mampu memahami dan menjelaskan perkembangan terkini teknologi telekomunikasi dan aplikasinya pada bidang biomedika • <i>Able to understand and explain telephony system</i> • <i>Able to understand and explain optical communication and satellite communication system</i> • <i>Able to understand and explain the recent development in telecommunication technology and the application in biomedical fields</i> 	<p>pada bidang biomedik, Presentasi dilakukan per kelompok (Tugas Presentasi)</p> <p><i>Non-Test Presentation: The presentation content regarding recent communication technology and the implementation in biomedical field, prentation is done per group (presentation task)</i></p>	<p><i>[PT : 2x(3x 50")]</i></p> <ul style="list-style-type: none"> • <i>Lecture and discussion, assignment [FF : 2x (3 x 50")]</i> • <i>[SA : 2x (3 x 50")]</i> • <i>[SS : 2x(3 x 50")]</i> 	<ul style="list-style-type: none"> • <i>Chat and discussion in ITS platform forum.</i> 	<ul style="list-style-type: none"> • Perkembangan terkini teknologi telekomunikasi dan aplikasinya pada bidang biomedika • <i>Telephony system introduction</i> • <i>Optical communication system and satellite communication system</i> • <i>Recent development in telecommunication technology and the application in biomedical field</i> 	
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 : Communication System Basic and Laboratory		RA&E
			Write Doc Code
Kode/code: EB234201	Bobot sks/credits (T/P): 2/0	Rumpun MK: Biomedical Instrumentation and Signal Processing Course Cluster: Biomedical Instrumentation and Signal Processing	Smt: II
OTORISASI AUTHORIZATION	Penyusun RA & E Compiler A&EP Ir. Gatot Kusrahardjo, M.T.	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 mampu memahami dan menjelaskan mengenai sejarah perkembangan teknologi telekomunikasi, prinsip-prinsip telekomunikasi, protokol telekomunikasi dan badan-badan regulasi telekomunikasi di dunia. LLO 1: <i>Students are able to understand and explain the history of telecommunication technology development,</i>	Non-tes : Tugas Tertulis 1: Mengenai sejarah perkembangan teknologi telekomunikasi, prinsip-prinsip telekomunikasi, protokol telekomunikasi dan badan-badan regulasi telekomunikasi. Tes: ETS Soal 1 (5% dari 15%) Non-test : Written Task 1: <i>Regarding the history of telecommunication technology development, telecommunication principles, telecommunication protocols and telecommunication regulatory councils.</i> Test: <i>Question 1 in Mid Exam (5% from 15%)</i>	7

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	<p><i>telecommunication principles, telecommunication protocol and world's telecommunication regulatory bodies</i></p>		
3-4	<p>Sub CP-MK 2: Mahasiswa mampu memahami dan menjelaskan mengenai media telekomunikasi dan teori medan elektromagnetika.</p> <p>LLO 2: <i>Students are able to understand and explain the telecommunication medium and theory of electromagnetic field.</i></p>	<p>Non-tes : Tugas Tertulis 2 : Mengenai media telekomunikasi dan teori medan</p> <p>Tes: ETS 1 Soal (5% dari 15%)</p> <p>Non-test : Written Task 2: <i>Regarding telecommunication medium and electromagnetic field theory (written task).</i></p> <p>Test: <i>Mid Exam 1 Question (5% from 15%)</i></p>	7
5-7	<p>Sub CP-MK 3: Mahasiswa mampu memahami, menjelaskan, merancang dan menganalisa proses modulasi dan demodulasi pada sinyal analog.</p> <p>LLO 3: <i>Students are able to understand, explain, design and analyze the modulation and demodulation process in analog signal.</i></p>	<p>Non-tes :</p> <ul style="list-style-type: none"> • Tugas Tertulis 3: <i>Perancangan dan analisa modulasi dan demodulasi analog (Tugas Tertulis)</i> • Praktikum 1 : <i>Proses modulasi analog (Praktikum Lab)</i> <p>Tes: ETS 1 Soal (5% dari 15%)</p> <p>Non-test :</p> <ul style="list-style-type: none"> • Task 3: <i>Analog demodulation and modulation design and analysis</i> • Lab Work 1: <i>Analog modulation process (lab work)</i> <p>Test: <i>1 Questions in Mid Exam (5% from 15%)</i></p>	22
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

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
9-11	<p>Sub CP-MK 4: Mahasiswa mampu memahami, menjelaskan, merancang dan menganalisa proses modulasi dan demodulasi pada sinyal digital.</p> <p>LLO 4: <i>Students are able to understand, explain, design and analyze the modulation and demodulation process in digital signal.</i></p>	<p>Non-tes :</p> <ul style="list-style-type: none"> • Tugas Tertulis 4: Perancangan dan analisa modulasi dan demodulasi digital (Tugas Tertulis) • Lab Work 2: Proses modulasi digital (Praktikum Lab) <p>Tes: 1 soal pada EAS (6% dari 20%)</p> <p>Non-test :</p> <ul style="list-style-type: none"> • Written Task 4: <i>Digital demodulation and modulation design and analysis</i> • Lab Work 2: <i>Digital modulation process(lab work)</i> <p>Test: 1 Question Final Exam (6% from 20%)</p>	23
12-13	<p>Sub CP-MK 5: Mahasiswa mampu memahami dan menjelaskan teknik dan terminologi yang berkaitan dengan komunikasi data, serta mampu merancang dan menganalisa proses komunikasi data yang terjadi pada lapisan fisik dan lapisan data link.</p> <p>LLO 5: <i>Students are able to understand and explain the technique and terminologies regarding data communication, able to design and analyze the data communication process that happens both in</i></p>	<p>Non-tes :</p> <ul style="list-style-type: none"> • Tugas Tertulis 5: Mengenai teknik dan terminologi yang berkaitan dengan komunikasi data • Praktikum 3: Proses komunikasi data <p>Tes: EAS 2 Soal (7% dari 20%)</p> <p>Non-test:</p> <ul style="list-style-type: none"> • Written Task 5: <i>Regarding the data communication technique and terminologies</i> • Praktikum 3: <i>Data communication process</i> <p>Test: 2 Question in Final Exam (7% from 20%)</p>	24

Mg ke/ Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	<i>physical and data link layer.</i>		
14-15	<p>Sub CP-MK 6: Mahasiswa mampu memahami dan menjelaskan sistem teleponi, sistem komunikasi optic dan satelit serta perkembangan terkini teknologi telekomunikasi dan aplikasinya pada bidang biomedika.</p> <p>LLO 6: <i>Students are able to understand and explain the telephony system, optic and satellite communication system also the recent telecommunication technology development and the application on biomedical field.</i></p>	<p>Non-tes : Presentasi : Materi presentasi tentang teknologi komunikasi yang terkini dan implementasinya pada bidang biomedik, Presentasi dilakukan per kelompok (Tugas Presentasi)</p> <p>Tes: EAS 1 Soal (12% dari 20%)</p> <p>Non-test: Presentation: <i>The presentation content regarding recent communication technology and the implementation in biomedical field, prentation is done per group (presentation task)</i></p> <p>Test: <i>1 Question in Final Exam (12% from 20%)</i></p>	17
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>	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-01 / <i>PLO-01</i>	CPMK 1 / <i>CLO 1</i>	Week 1-2	Task 1	2
			Mid Exam 1 Question	5
CPL-03 / <i>PLO-03</i>	CPMK 2 / <i>CLO 2</i>	Week 3-4	Task 2	2
			Mid Exam 1 Question	5
	CPMK 6 / <i>CLO 6</i>	Week 14-15	Presentation	5
			Final Exam 1 Question	12
CPL-05/ <i>PLO-05</i>	CPMK 3 / <i>CLO 3</i>	Week- 5-7	Task 3	2
			Lab Work 1	15
			Mid Exam 1 Question	5
	CPMK 4 / <i>CLO 4</i>	Week- 9-11	Task 4	2
			Lab Work 2	15
			Final Exam 1 Question	6
	CPMK 5 / <i>CLO 5</i>	Week- 12-13	Task 5	2
			Lab Work 3	15
	Final Exam 2 Question		7	
		Week- 8	Mid Exam Question	15
				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	0.02												0.02
2	Task 2	0.02												0.02

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
3	Task 3					0.05								0.05
4	Lab Work 1					0.15								0.15
5	Mid Exam	0.05		0.05		0.05								0.15
6	Task 4					0.02								0.02
7	Lab Work 2					0.15								0.15
8	Task 5			0.02										0.02
9	Lab Work 3			0.15										0.15
10	Presentation			0.05										0.05
11	Final Exam			0.19		0.06								0.25
	Total	0.09		0.46		0.48								1.03

