MODULE HANDBOOK
CLINICAL ENGINEERING

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

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

MODULE HANDBOOK
NON-STATIONARY SIGNAL ANALYSIS

Module name	**Clinical Engineering**	
Module level	Undergradute	
Code	EB184804	
Course (if applicable)	Clinical Engineering	
Semester	Second Semester (Genap)	
Person responsible for the module	Jerry Dwi Trijoyo Purnomo, S.Si. M.Si	
Lecturer	Dr. Tri Arief Sardjono, S.T., M.T.	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergradute degree program, **mandatory**, 8th semester.	
Type of teaching, contact hours	Lectures, <60 students Tuesdays, 11.00-12.50 (GMT+7)	
Workload	1. Lectures : 2 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	2 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	Biomedical Instrumentations and Laboratory	
Learning outcomes and their corresponding PLOs	Course Learning Outcome (CLO) after completing this module, CLO1: Students are able to explain the scope of clinical engineering. CLO2: Students are able to provide quality assessments and equipment development CLO3: Students are able to explain the Regulatory Framework which includes risk analysis, responsibility, technical safety and handling of accidents due to equipment CLO4: Students are able to prepare planning procedures and procurement of medical equipment	PLO-02 PLO-08 PLO-06 PLO-03

	CLO5: Students are able to devise methods of maintaining, storing and disposing medical equipment	PLO-03
Content	The Clinical Engineering course provides knowledge about the scope of clinical engineering in hospitals and health facilities including assessment administration, acquisition, and utilization of health technology.	
Study and examination requirements and forms of examination	● Written Assignment 1, 2, 3 ● Presentation 1,2 ● Mid-term examination ● Final examination	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.	
Reading list	Main : 1. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph D. Bronzino ed. Clinical Engineering, Principles and Applications in Engineering Series. CRC Press, Boca Raton, 2003. 2. Joseph F. Dyro ed. Clinical Engineering Handbook. Elsevier Academic Press, USA, 2004. 3. Azzam F G Taktak, Paul Ganney, David Long, Paul White ed. Clinical Engineering: A Handbook for Clinical and Biomedical Engineers. Elsevier Academic Press, UK, 2014. Supporting : 1. Roberto Miniati, Ernesto Iadanza, Fabrizio Dori. Clinical Engineering: From Devices to Systems. Elsevier Academic Press, USA, 2016.	

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***
Teknik Klinika ***Clinical Engineeering***	EB184804	Biomedical Instrumentation and Signal Processing	T=2	P=0	VIII	Feb 27, 2020
OTORISASI / PENGESAHAN ***AUTHORIZATION / ENDORSEMENT***	**Dosen Pengembang RPS** ***Developer Lecturer of Semester Learning Plan***		**Koordinator RMK** ***Course Cluster Coordinator***		**Ka DEPARTEMEN** ***Head of Department***	
	(Jerry Dwi Trijoyo Purnomo, S.Si. M.Si)		**(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-02 *PLO-02*	Mampu **menemukan**, **memahami**, **menjelaskan**, **merumuskan**, dan **menyelesaikan** permasalahan umum pada bidang Teknik dan permasalahan khusus pada bidang Teknik Biomedika yang meliputi instrumentasi biomedika cerdas, teknik rehabilitasi medika, pencitraan dan pengolahan citra medika, serta informatika medika. Able to **find, understand, explain, formulate**, and **solve** general problems in the field of Engineering and special problems in the field of Biomedical Engineering which includes intelligent biomedical instrumentation, medical rehabilitation techniques, imaging and processing of medical images, and medical informatics.					
	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.				

		*Able to **design** and **implement** laboratory experiment and / or field experiments, **analyze** and **interpret** data, and use objective assessments to draw conclusions.*
	CPL-06 *PLO-06*	Mampu **menerapkan** ilmu pengetahuan, keterampilan, dan metode terkini dalam menyelesaikan permasalahan di bidang Teknik Biomedika. Able to **apply** the latest knowledge, skills and methods in solving problems in the field of Biomedical Engineering.
	CPL-08 *PLO-08*	Mampu **bekerja dalam tim** lintas disiplin dan budaya serta **bertanggung jawab** kepada masyarakat dan **mematuhi hukum dan etika profesi** dalam menyelesaikan masalah Teknik Biomedika. Able to **work in** interdisciplinary and intercultural **teams** and be **responsible** to the community and **comply with legal and professional ethics** in solving Biomedical Engineering problems.
	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 menjelaskan ruang lingkup teknik klinika. *Students are able to explain the scope of clinical engineering.*
	CP MK 2 ***CLO 2***	Mahasiswa mampu memberikan penilaian kualitas dan pengembangan peralatan . *Students are able to provide quality assessments and equipment development.*
	CP MK 3 ***CLO 3***	Mahasiswa mampu menjelaskan Framework Regulasi yang meliputi Analisis resiko, tanggung jawab, keselamatan teknis dan penanganan kecelakaan akibat peralatan. *Students are able to explain the Regulatory Framework which includes risk analysis, responsibility, technical safety and handling of accidents due to equipment.*
	CP MK 4 ***CLO 4***	Mahasiswa mampu menyiapkan prosedur perencanaan dan pengadaan peralatan medis. *Students are able to prepare planning procedures and procurement of medical equipment.*
	CP MK 5 ***CLO 5***	Mahasiswa mampu menyusun metode pemeliharaan, penyimpanan dan pemusnahan peralatan medis. *Students are able to devise methods of maintaining, storing and disposing medical equipment.*

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 *CLO 1 / LLO 1*		√										

	CPMK 2 / SUB CPMK 2 *CLO 2 / LLO 2*								√				
	CPMK 3 / SUB CPMK 3 *CLO 3 / LLO 3*						√						
	CPMK 4 / SUB CPMK 4 *CLO 4 / LLO 4*			√									
	CPMK 5 / SUB CPMK 5 *CLO 5 / LLO 5*			√									

Diskripsi Singkat MK ***Short Description of Course***	Mata kuliah Teknik Klinika memberikan pengetahuan tentang ruang lingkup teknik klinika di rumah sakit dan fasilitas kesehatan yang meliputi administrasi asesmen, akuisisi, dan utilisasi teknologi kesehatan. *The Clinical Engineering course provides knowledge about the scope of clinical engineering in hospitals and health facilities including assessment administration, acquisition, and utilization of health technology.*
Bahan Kajian: Materi pembelajaran ***Course Materials:***	1. Ruang lingkup teknik klinika / *The scope of clinical engineering* 2. Penilaian kualitas dan pengembangan peralatan / *Quality assessment and equipment development* 3. Framework Regulasi: Analisis risiko, tanggung jawab, keselamatan teknis dan penanganan kerusakan peralatan / *Regulatory Framework: Analysis of risks, responsibilities, technical safety and handling of equipment damage* 4. Prosedur perencanaan dan pengadaan peralatan medis / *Medical equipment planning and procurement planning procedures* 5. Metode pemeliharaan, penyimpanan dan pemusnahan peralatan medis / *Methods of maintenance, storage and disposal of medical equipment*
Pustaka	**Utama / *Main*:**

References	1. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph D. Bronzino ed. Clinical Engineering, Principles and Applications in Engineering Series. CRC Press, Boca Raton, 2003. 2. Joseph F. Dyro ed. Clinical Engineering Handbook. Elsevier Academic Press, USA, 2004. 3. Azzam F G Taktak, Paul Ganney, David Long, Paul White ed. Clinical Engineering: A Handbook for Clinical and Biomedical Engineers. Elsevier Academic Press, UK, 2014. **Pendukung / *Supporting*:** *1.* Roberto Miniati, Ernesto Iadanza, Fabrizio Dori. Clinical Engineering: From Devices to Systems. Elsevier Academic Press, USA, 2016.
Dosen Pengampu ***Lecturers***	Dr. Tri Arief Sardjono, S.T., M.T.
Matakuliah syarat ***Prerequisite***	Instrumentasi Biomedika dan Laboratorium *Biomedical Instrumentations and Laboratory*

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 /*Assess-ment Load* (%)**
		Indikator / ***Indicator***	**Kriteria & Teknik /** ***Criteria & Techniques***				
(1)	**(2)**	**(3)**	**(4)**	**Tatap Muka /** ***In-class* (5)**	**Daring /** ***Online* (6)**	**(7)**	**(8)**
1 - 2	Mahasiswa mampu menjelaskan ruang lingkup teknik klinika *Students are able to explain the scope of clinical engineering.*	• Kelengkapan dan kerapian hasil laporan presentasi • Ketepatan menjelaskan pemahaman materi • *Completeness and neatness of the results*	**Non-tes : Presentasi 1** ***Non-test : Presentation 1***	• Kuliah, diskusi dan presentasi [TM : 2 x 50”] [BM : 2 x 50”] [PT : 2 x 50”] • *Lecture, discussion, and presentation*	• Chatting dan diskusi dalam forum platform ITS. • *Chat and discussion in ITS platform forum.*	• Ruang lingkup teknik klinika • *The scope of clinical engineering*	**10**

		of the presentation report ● *Accuracy in explaining understanding of the materia*l		*[FF : 2 x 50”]* *[SA : 2 x 50”]* *[SS : 2 x 50”]*			
3-4	Mahasiswa mampu memberikan penilaian kualitas dan pengembangan peralatan. *Students are able to provide quality assessments and equipment development.*	● Ketepatan waktu pengumpulan tugas. ● Kebenaran melaksanakan tugas. ● Keberhasilan menjelaskan tugas. ● Kebenaran jawaban dan analisis. ● *On time submission of assignments* ● *Correct assignment work.* ● *Success of explaining assignments.* ● *Correct answers and analysis.*	**Non-tes :** **Tugas 1** ***Non-test :*** ***Task 1***	● Kuliah, diskusi dan tugas [TM : 2 x 50”] [BM : 2 x 50”] [PT : 2 x 50”] ● *Lecture, discussion, and assignment* *[FF : 2 x 50”]* *[SA : 2 x 50”]* *[SS : 2 x 50”]*		● Penilaian kualitas dan pengembangan peralatan ● *Quality assessment and equipment development*	**5**
5 - 7	Mahasiswa mampu menjelaskan Framework Regulasi yang meliputi Analisis resiko, tanggung	● Kelengkapan dan kerapian hasil laporan presentasi	**Non-tes :** **Presentasi 2**	● Kuliah, diskusi dan presentasi [TM : 2 x 50”] [BM : 2 x 50”]		● Framework Regulasi: Analisis risiko, tanggung jawab, keselamatan	**10**

	jawab, keselamatan teknis dan penanganan kecelakaan akibat peralatan Students are able to explain the Regulatory. *Framework which includes risk analysis, responsibility, technical safety and handling of accidents due to equipment.*	• Ketepatan menjelaskan pemahaman materi • *Completeness and neatness of the results of the presentation report* • *Accuracy in explaining understanding of the materia*l	***Non-test :*** ***Presentation 2***	[PT : 2 x 50"] • *Lecture, discussion, and presentation* *[FF : 2 x 50"]* *[SA : 2 x 50"]* *[SS : 2 x 50"]*		teknis dan penanganan kerusakan peralatan. • *Regulatory Framework: Analysis of risks, responsibilities, technical safety and handling of equipment damage.*	
8	**EVALUASI TENGAH SEMESTER** ***MID-SEMESTER EXAM***						**25**
9 - 11	Mahasiswa mampu menyiapkan prosedur perencanaan dan pengadaan peralatan medis. *Students are able to prepare planning procedures and procurement of medical equipment.*	• Ketepatan waktu pengumpulan tugas. • Kebenaran melaksanakan tugas. • Keberhasilan menjelaskan tugas. • Kebenaran jawaban dan analisis. . • *On time submission of assignments* • *Correct assignment work.* • *Success of explaining assignments.* • *Correct answers and analysis.*	**Non-tes :** **Tugas 2** ***Non-test :*** ***Task 2***	• Kuliah, diskusi dan tugas [TM : 2 x 50"] [BM : 2 x 50"] [PT : 2 x 50"] • *Lecture, discussion, and assignment* *[FF : 2 x 50"]* *[SA : 2 x 50"]* *[SS : 2 x 50"]*		• Prosedur perencanaan dan pengadaan peralatan medis. • *Medical equipment planning and procurement planning procedures.*	**10**

12 -14	Mahasiswa mampu menyusun metode pemeliharaan, penyimpanan dan pemusnahan peralatan medis. *Students are able to devise methods of maintaining, storing and disposing medical equipment.*	● Ketepatan waktu pengumpulan tugas. ● Kebenaran melaksanakan tugas. ● Keberhasilan menjelaskan program. ● Kebenaran jawaban dan analisis. . ● *On time submission of assignments* ● *Correct assignment work.* ● *Success of explaining programs.* *Correct answers and analysis.*	**Non tes:** **Tugas 3** ***Non-test:*** ***Task 3***	● Kuliah, diskusi dan tugas [TM : 2 x 50”] [BM : 2 x 50”] [PT : 2 x 50”] ● *Lecture, discussion, and assignment* *[FF : 2 x 50”]* *[SA : 2 x 50”]* *[SS : 2 x 50”]*		● Metode pemeliharaan, penyimpanan dan pemusnahan peralatan medis ● Methods of maintenance, storage and disposal of medical equipment	**10**
15-16	**EVALUASI AKHIR SEMESTER** ***FINAL-SEMESTER EXAM***						**30**

TM=Tatap Muka, **PT**=Penugasan Terstuktur, **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 : Non-Stationary Signal Analysis**		**RA&E** Write Doc Code
Kode/*code*: **EB184802**	**Bobot sks/*credits* (T/P): 3/0**	**Rumpun MK: Biomedical Instrumentation and Signal Processing** ***Course Cluster: Biomedical Instrumentation and Signal Processing***	Smt: VIII
OTORISASI ***AUTHORIZATION***	**Penyusun RA & E** ***Compiler A&EP*** **Jerry Dwi Trijoyo Purnomo, S.Si. M.Si**	**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 menjelaskan ruang lingkup teknik klinika ***LLO 1:*** *Students are able to explain the scope of clinical engineering.*	**Non-tes :** **Presentasi 1** **Tes:** 1 Soal Pada ETS (10% dari ETS 25%) ***Non-test :*** ***Presentation 1*** ***Test:*** *1 question on Mid Exam (10% of Mid Exam 25%)*	10
3-4	**Sub CP-MK 2:** Mahasiswa mampu memberikan penilaian kualitas dan	**Non-tes :** **Tugas 1** **Tes:** 1 Soal Pada ETS (12.5% dari ETS 25%) ***Non-test :*** ***Task 1***	5

	pengembangan peralatan ***LLO 2:*** *Students are able to provide quality assessments and equipment development.*	***Test:*** *1 Question in Mid Exam (15% of Mid Exam 15%)*	
5-7	**Sub CP-MK 3:** Mahasiswa mampu menjelaskan Framework Regulasi yang meliputi Analisis resiko, tanggung jawab, keselamatan teknis dan penanganan kecelakaan akibat peralatan ***LLO 3:*** *Students are able to explain the Regulatory Framework which includes risk analysis, responsibility, technical safety and handling of accidents due to equipment*	**Non-tes :** **Presentasi 2** **Tes:** 3 Soal Pada ETS (27.5% dari ETS 25%) ***Non-test :*** ***Presentation 2*** ***Test:*** *3 Question in Mid Exam (27.5% of Mid Exam 25%)*	10
8	**Evaluasi Tengah Semester** ***Mid Exam***	**Tes:** Ujian Tulis/Ujian Daring ***Test:*** *Writing Exams / Online Exams*	25
9-11	**Sub CP-MK 4:** Mahasiswa mampu menyiapkan prosedur perencanaan dan	**Non-tes :** **Tugas 2** **Tes:** 3 Soal Pada EAS (25% dari EAS 30%)	10

	pengadaan peralatan medis ***LLO 4:*** *Students are able to prepare planning procedures and procurement of medical equipment*	***Non-test :*** ***Task 2*** ***Test:*** *3 Question in Final Exam (25% of Final Exam 30%)*	
12-14	**Sub CP-MK 5:** Mahasiswa mampu menyusun metode pemeliharaan, penyimpanan dan pemusnahan peralatan medis ***LLO 5:*** *Students are able to devise methods of maintaining, storing and disposing medical equipment*	**Non-tes :** **Tugas 3** **Tes:** 3 Soal Pada EAS (25% dari EAS 30%) ***Non-test:*** ***Task 3*** ***Test:*** *3 Question in Final Exam (25% of Final Exam 30%)*	10
15-16	**Evaluasi Akhir** ***Final Exam***	**Tes:** Ujian Tulis/Ujian Daring ***Test:*** *Writing Exams / Online Exams*	30
		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 / *PLO charged to the course*	**CPMK / *Course Learning Outcome (CLO)***	**Minggu ke / *Week***	**Bentuk Asesmen / *Form of Assessment***	**Bobot / *Load* (%)**
CPL-02 / *PLO-02*	CPMK 1 / *CLO 1*	*Week- 1-2*	*Presentation 1*	10
		Week- 8	*Mid Exam 1 Question*	5
CPL-03 / *PLO-03*	CPMK 4 / *CLO 4*	*Week 9-11*	*Task 2*	10
		Week 15-16	*Final Exam 3 Question*	15
	CPMK 5 / *CLO 5*	*Week 12-14*	*Task 3*	10
		Week 15-16	*Final Exam 3 Question*	15
CPL-06 / *PLO-06*	CPMK 3 / CLO 3	*Week 5-7*	*Presentation 2*	10
		Week 8	*Mid Exam 3 Question*	13.75
CPL-08 / *PLO-08*	CPMK 2 / CLO 2	*Week 3-4*	*Task 1*	5
		Week 8	*Mid Exam 1 Question*	6.25
				∑ = 100%

No	***Form of Assessment***	***PLO-01***	***PLO-02***	***PLO-03***	***PLO-04***	***PLO-05***	***PLO-06***	***PLO-07***	***PLO-08***	***PLO-09***	***PLO-10***	***PLO-11***	***PLO-12***	***Total***
1	*Task 1*								0.05					**0.05**
2	*Task 2*			0.1										**0.1**
3	*Task 3*			0.1										**0.1**
4	*Presentation 1*		0.1											**0.1**
5	*Presentation 2*						0.1							**0.05**
6	*Mid Exam*		0.05				0.1375		0.0625					**0.25**
7	*Final Exam*			0.3										**0.3**
	Total		0.15	0.5			0.2375		0.1125					**1**