MODULE HANDBOOK
INTELLIGENT BIOMEDICAL INSTRUMENTATION SYSTEM

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

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

ENDORSEMENT PAGE

MODULE HANDBOOK
Intelligent Biomedical Instrumentation Systems Design
DEPARTMENT OF BIOMEDICAL ENGINEERING
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
Number : 6858/IT2.IX.5.1.2/B/PP.03.00.00/2023

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

+

MODULE HANDBOOK

INTELLIGENT BIOMEDICAL INSTRUMENTATION SYSTEM DESIGN

Module name	**Intelligent Biomedical Instrumentation System Design**	
Module level	Undergradute	
Code	EB234901	
Course (if applicable)	Intelligent Biomedical Instrumentation System Design	
Semester	Specialization	
Person responsible for the module		
Lecturer	Dr. Achmad Arifin, S.T., M.Eng.	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergradute degree program, **specialization**.	
Type of teaching, contact hours	Lectures, <60 students	
Workload	1. Lectures : 3 x 50 = 150 minutes per week. 2. Exercises and Assignments : 3 x 50 = 120 minutes per week. 3. Private learning : 3 x 50 = 120 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	Course Learning Outcome (CLO) after completing this module, CLO 1: Students understand and are able to explain the computer based biomedical signal instrumentation & analysis framework. CLO 2: Students understand and are able to explain intelligent system methods for biomedical applications. CLO 3: Skilled students design intelligent biomedical instrumentation systems.	PLO-02 PLO-05 PLO-06 PLO-07
Content	This course provides knowledge about framework computer based biomedical signal intrumentation and analysis along with integration with intelligent systems , as well as skills in designing intelligent biomedical instrumentation systems.	

Study and examination requirements and forms of examination	● In-class exercises ● Assignment 1, 2, 3 ● Demo Task and Report ● Mid-term examination ● Final examination
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.
Reading list	Main : 1. Subhas Chandra Mukhopadhyay and Aimé Lay-Ekuakille (Eds.), Advances in Biomedical Sensing, Measurements, Instrumentation, Springer-Verlag Berlin Heidelberg, 2010. 2. Donna L. Hudson and Maurice E. Cohen Neural Network and Artificial Intelligence for Biomedical Engineering, IEEE Press Series in Biomedical Engineering, 2000.

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***
Rancangan Sistem Instumentasi Biomedika Cerdas ***Intelligent Biomedical Instrumentation System Design***	EB234901	Teknik Biomedik *Biomedical Engineering*	T=3	P=0	Peminatan *Specialization*	Oct 27 2023
OTORISASI / PENGESAHAN ***AUTHORIZATION / ENDORSEMENT***	**Dosen Pengembang RPS** ***Developer Lecturer of Semester Learning Plan***		**Koordinator RMK** ***Course Cluster Coordinator***		**Ka DEPARTEMEN** ***Head of Department***	
					(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-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

		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
	CPL-07 ***PLO-07***	Mampu **merencanakan**, **menyelesaikan**, dan **mengevaluasi** tugas di dalam batasan-batasan yang ada. *Able to plan, complete, and evaluate tasks within existing boundaries*
	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 kerangka computer based biomedical signal instrumentation & analysis *Students understand and are able to explain the computer based biomedical signal instrumentation & analysis framework*
	CP MK 2 ***CLO 2***	Mahasiswa memahami dan mampu menjelaskan metoda sistem cerdas untuk aplikasi biomedika *Students understand and are able to explain intelligent system methods for biomedical applications*
	CP MK 3 ***CLO 3***	Mahasiswa terampil merancang sistem instrumentasi biomedika cerdas *Skilled students design intelligent biomedical instrumentation systems*

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*							√					

Diskripsi Singkat MK	Mata kuliah ini memberikan pengetahuan mengenai *framework computer based biomedical signal instrumentation & analysis* beserta integrasinya dengan sistem cerdas, serta ketrampilan menyusun rancangan sistem instrumentasi biomedika cerdas.

Short Description of Course	*This course provides knowledge about framework computer based biomedical signal intrumentation and analysis along with integration with intelligent systems , as well as skills in designing intelligent biomedical instrumentation systems.*
Bahan Kajian: Materi pembelajaran ***Course Materials:***	1. Analisis dan instrumentasi berbasis komputer / *Computer based instrumentation and analysis* 2. Artificial Neural System untuk diagnosis dan terapi / *Artificial Neural System for diagnosis and therapy* 3. Fuzzy System untuk aplikasi biomedis/ *Fuzzy System for biomedical applications* 4. Analisis dan instrumentasi biomedika tertanam / *Embedded biomedical instrument and analysis* 5. Teknologi hibrid untuk instrumentasi cerdas / *Hybrid technology for smart instrumentation*
Pustaka ***References***	**Utama / *Main*:** 1. Subhas Chandra Mukhopadhyay and Aimé Lay-Ekuakille (Eds.), Advances in Biomedical Sensing, Measurements, Instrumentation, Springer-Verlag Berlin Heidelberg, 2010. 2. Donna L. Hudson and Maurice E. Cohen Neural Network and Artificial Intelligence for Biomedical Engineering, IEEE Press Series in Biomedical Engineering, 2000.
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 /*Assess-ment Load* (%)**
		Indikator / ***Indicator***	**Kriteria & Teknik /** ***Criteria & Techniques***				
(1)	**(2)**	**(3)**	**(4)**	**Tatap Muka /** ***In-class* (5)**	**Daring /** ***Online* (6)**	**(7)**	**(8)**

1,2,3	Mahasiswa memahami dan mampu menjelaskan kerangka computer based biomedical signal instrumentation & analysis *Students understand and are able to explain the computer based biomedical signal instrumentation & analysis framework*	• Ketepatan waktu pengumpulan tugas • Kebenaran melaksanakan tugas • Keberhasilan menjelaskan tugas • Kebenaran jawaban dan analisis • Kelengkapan dan kerapian hasil laporan presentasi • Ketepatan menjelaskan pemahaman materi • *On time submission of assignments* • *Correctness of tasks done* • *Success of explaining assignments* • *Truth answers and analysis* • *Completeness and neatness of the results of the presentation report* • *Accuracy in explaining understanding of the material*	**Non-tes :** Diskusi Tugas Presentasi ***Non-test :*** *Discussion* *Assignment* *Presentation*	• Kuliah dan diskusi • Penugasan Terstruktur [TM : 3x (3 x 50")] [BM : 3x (3 x 50")] [PT : 3x (3 x 50")] • *Lectures and discussions* • *Structured Assignments* *[FF : 3x (3 x 50")]* *[SA : 3x (3 x 50")]* *[SS : 3x (3 x 50")]*	• Belajar Mandiri – Daring atau Luring melalui Share ITS • *Independent Learning - Online or Offline via ITS Share*	• *Computer based instrumentation and analysis* • Pengenalan konsep sistem informasi manajemen **[Link materi di MyITSClassroom]** • *Computer based instrumentation and analysis* • *Introduction to the concept of management information systems*	**5** **10**

4,5,6,7	Mahasiswa memahami dan mampu menjelaskan metoda sistem cerdas untuk aplikasi biomedika *Students understand and are able to explain intelligent system methods for biomedical applications*	• Ketepatan waktu pengumpulan tugas • Kebenaran melaksanakan tugas • Keberhasilan menjelaskan tugas • Kebenaran jawaban dan analisis • Kelengkapan dan kerapian hasil laporan presentasi • Ketepatan menjelaskan pemahaman materi • *On time submission of assignments* • *Correctness of tasks done* • *Success of explaining assignments* • *Truth answers and analysis* • *Completeness and neatness of the results of the presentation report* • *Accuracy in explaining understanding of the material*	**Non-tes :** Diskusi Tugas Presentasi ***Non-test :*** *Discussion* *Assignment* *Presentation*	• Kuliah dan diskusi • Penugasan Terstruktur [TM : 3x (3 x 50")] [BM : 3x (3 x 50")] [PT : 3x (3 x 50")] • *Lectures and discussions* • *Structured Assignments* *[FF : 3x (3 x 50")]* *[SA : 3x (3 x 50")]* *[SS : 3x (3 x 50")]*	• Belajar Mandiri – Daring atau Luring melalui Share ITS • *Independent Learning - Online or Offline via ITS Share*	• Artificial Neural System untuk diagnosis dan terapi • Fuzzy System untuk aplikasi biomedis • *Artificial Neural System for diagnosis and therapy* • *Fuzzy System for bimedical aplications*	**5** **10**

8	**EVALUASI TENGAH SEMESTER** ***MID-SEMESTER EXAM***						**20**
9,10,11,12,13,14	Mahasiswa terampil merancang sistem instrumentasi biomedika cerdas *Skilled students design intelligent biomedical instrumentation systems*	• Ketepatan waktu pengumpulan tugas • Kebenaran melaksanakan tugas • Keberhasilan menjelaskan tugas • Kebenaran jawaban dan analisis • Kelengkapan dan kerapian hasil laporan proyek akhir • Ketepatan waktu pengumpulan laporan proyek akhir • Kebenaran menjelaskan proyek akhir • *On time submission of assignments* • *Correctness of tasks done* • *Success of explaining assignments* • *Truth answers and analysis* • *Completeness and neatness of the results*	**Non-tes :** Diskusi Tugas Praktikum ***Non-test :*** *Discussion* *Assignment* *Practicum*	• Kuliah dan diskusi • Penugasan Terstruktur [TM : 6x (3 x 50")] [BM : 6x (3 x 50")] [PT : 6x (3 x 50")] • *Lectures and discussions* • *Structured Assignments* *[FF : 6x (3 x 50")]* *[SA : 6x (3 x 50")]* *[SS : 6x (3 x 50")]*	• Belajar Mandiri – Daring atau Luring melalui Share ITS • *Independent Learning - Online or Offline via ITS Share*	• *Embedded biomedical instrument and analysis* • Teknologi hibrid untuk instrumentasi cerdas • *Embedded biomedical instrument and analysis* • *Hybrid technology for smart instrumentation*	**5** **25**

		of the final project report • *Timeliness of final project report submission* • *Truth explains the final project*					
15-16	**EVALUASI AKHIR SEMESTER** ***FINAL-SEMESTER EXAM***						**20**

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 : Intelligent Biomedical Instrumentation System Design**		**RA&E** Write Doc Code
Kode/*code*: **EB234901**	**Bobot sks/*credits* (T/P): 3/0**	**Rumpun MK: Teknik Biomedik** ***Course Cluster: Biomedical Engineering***	Smt: Peminatan *Specialization*
OTORISASI ***AUTHORIZATION***	**Penyusun RA & E** ***Compiler A&EP***	**Koordinator RMK** ***Course Cluster Coordinator***	**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:** Mampu menjelaskan kerangka *computer based biomedical signal instrumentation and analysis.* ***LLO 1:*** *Able to explain computer based biomedical signal instrumentation and analysis framework*	**Non-tes :** **Tugas 1** **Presentasi 1** **Tes:** ETS Soal 1 (5% dari ETS 20%) ***Non-test :*** ***Task 1*** ***Presentation 1*** ***Test:*** *Question 1 in Mid Exam (5% of Mid Exam 20%)*	5 10
3-7	**Sub CP-MK 2:** mampu menjelaskan metoda sistem cerdas untuk aplikasi biomedika (*Artificial Neural System, Fuzzy System*) ***LLO 2:***	**Non-tes :** **Tugas 2** **Presentasi 2** **Tes:** ETS Soal 3 (15% dari ETS 20%) ***Non-test :***	5 10

	able to explain intelligent system methods for biomedical applications (Artificial Neural System, Fuzzy System)	***Task 2*** ***Presentation 2*** ***Test:*** *Question 3 in Mid Exam (15% of Mid Exam 20%)*	
8	**Evaluasi Tengah Semester** ***Mid Exam***	**Tes:** Ujian Tulis/Ujian Daring ***Test:*** *Writing Exams / Online Exams*	20
9-11	**Sub CP-MK 3:** Perancangan dan analisis *Embedded biomedical instrumentation* ***LLO 3:*** *Embedded biomedical instrumentation design and analysis*	**Non-tes :** **Tugas 3** **Tugas Demo dan Laporan** **Tes:** EAS Soal 1 (10% dari EAS 20%) ***Non-test :*** ***Task 3*** ***Demo Tasks and Reports*** ***Test :*** *Question 2 in Final Exam (10% of Final Exam 20%)*	5
12-14	**Sub CP-MK 4:** Teknologi hibrid untuk instrumentasi cerdas ***LLO 4:*** *Hybrid technology for smart instrumentation*	**Non-tes :** **Tugas Demo dan Laporan** **Tes:** EAS Soal 1 (10% dari EAS 20%) ***Non-test :*** ***Demo Tasks and Reports*** ***Test :*** *Question 1 in Final Exam (10% of Final Exam 20%)*	25
15-16	**Evaluasi Akhir** ***Final Exam***	**Tes:** Ujian Tulis/Ujian Daring ***Test:*** *Writing Exams / Online Exams*	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 / *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*	*Task 1*	5
		Week- 1-2	*Presentation 1*	10
		Week- 8	*Mid Exam Question 1*	5
CPL-05 / *PLO-05*	CPMK 2 / *CLO 2*	*Week- 3-7*	*Task 2*	5
		Week- 3-7	*Presentation 2*	10
		Week- 8	*Mid Exam Question 2,3,4*	15
CPL-07 / *PLO-07*	CPMK 3 / *CLO 3*	*Week- 9-11*	*Task 3*	5
		Week- 9-11	*Demo Task and Report*	25
		Week- 16	*Final Exam Question 1*	20
				∑ = 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	*Presentation 1*		0.1											**0.1**
3	*Task 2*					0.05								**0.05**
4	*Presentation 2*					0.1								**0.1**
5	*Task 3*							0.05						**0.05**
6	*Demo Task and Report*							0.25						**0.25**
7	*Mid Exam*		0.05			0.15								**0.2**
8	*Final Exam*							0.2						**0.2**
	Total		0.2			0.3		0.5						**1**