



MODULE HANDBOOK BIOCYBERNETICS



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

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

ENDORSEMENT PAGE







MODULE HANDBOOK

Biocybernetics

DEPARTMENT OF BIOMEDICAL ENGINEERING

INSTITUT TEKNOLOGI SEPULUH NOPEMBER
Number : B/21369/IT2.IX.5.1.2/PP.03.00.00/2020

| 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> | M. Hilman Fatoni, S.T., M.T. | Dosen <i>Lecturer</i> |  | November 23, 2019 |
| Pemeriksa dan Pengendalian <i>Review and Control</i> | Ir. Josaphat Pramudijanto, M.Eng. | Tim kurikulum <i>Curriculum team</i> |  | February 13, 2020 |
| Persetujuan <i>Approval</i> | Ir. Josaphat Pramudijanto, M.Eng. | Koordinator RMK <i>Course Cluster Coordinator</i> |  | March 05, 2020 |
| Penetapan <i>Determination</i> | Dr. Achmad Arifin, S.T., M.Eng. | Kepala Departemen <i>Head of Department</i> |  | March 12, 2020 |

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MODULE HANDBOOK

BIOCYBERNETICS

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| Module name | Biocybernetics | |
| Module level | Undergraduate | |
| Code | EB184701 | |
| Course (if applicable) | Biocybernetics | |
| Semester | First Semester (Gasal) | |
| Person responsible for the module | M. Hilman Fatoni, S.T., M.T. | |
| Lecturer | ??? | |
| Language | Bahasa Indonesia and English | |
| Relation to curriculum | Undergraduate degree program, mandatory , 7 th semester. | |
| Type of teaching, contact hours | ??? | |
| 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 (3 hours) per week. 3. Private learning : 3 x 60 = 180 minutes (3 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 | - | |
| Learning outcomes and their corresponding PLOs | <p>Course Learning Outcome (CLO) after completing this module,</p> <p>CLO 1: Students understand the concept and history of biocybernetics.</p> <p>CLO 2: Students understand modeling concepts that can be used for the physiological systems of the human body.</p> <p>CLO 3: Students understand the homeostasis system in the body.</p> <p>CLO 4: Students understand the five-sense system that plays a role in regulating body movements.</p> <p>CLO 5: Students are able to simulate body movements.</p> | <p>PLO-02</p> <p>PLO-02</p> <p>PLO-02</p> <p>PLO-02</p> <p>PLO-05</p> |

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| | <p>CLO 6: Students understand Human Machine Interface techniques that can be used in biocybernetics.</p> <p>CLO 7: Students understand the application of intelligent systems in the regulation of body movements.</p> | <p>PLO-02</p> <p>PLO-06</p> |
| Content | <p>This course studies biocybernetics concept and history, the concept of modeling human physiology systems, homeostasis System in the Body, sensor system to regulate body movements, voluntary movement modeling and simulation, Human Machine Interface for simulating gestures, and Intelligent system application on the regulation of gestures</p> | |
| Study and examination requirements and forms of examination | <ul style="list-style-type: none"> ● In-class exercises ● Written Task 1 ● Presentation Task 1, 2, 3, 4, 5 ● Programming Task 1 ● Mid-term examination ● Final examination | |
| Media employed | <p>LCD, whiteboard, websites (myITS Classroom), zoom.</p> | |
| Reading list | <p>Main :</p> <p>1. -</p> <p>Supporting :</p> <p>1. -</p> | |

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 |
| Biocybernetics <i>Biocybernetics</i> | EB184701 | Biocybernetics | T=3 | P=0 | VII | Feb 27, 2020 |
| OTORISASI / PENGESAHAN AUTHORIZATION / ENDORSEMENT | Dosen Pengembang RPS <i>Developer Lecturer of Semester Learning Plan</i> | | Koordinator RMK <i>Course Cluster Coordinator</i> | | Ka DEPARTEMEN <i>Head of Department</i> | |
| | <p style="text-align: center;">(M. Hilman Fatoni, S.T., M.T.)</p> | | <p style="text-align: center;">(Ir. Josaphat Pramudijanto, M.Eng.)</p> | | <p style="text-align: center;">(Dr. Achmad Arifin, S.T., M.Eng.)</p> | |
| Capaian Pembelajaran Learning Outcomes | CPL-PRODI yang dibebankan pada MK PLO Program Charged to The Course | | | | | |
| | CPL-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. | | | | |
| | PLO-02 | 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 | 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-05 | 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. | | | | |

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| | CPL-06 | Mampu menerapkan ilmu pengetahuan, keterampilan, dan metode terkini dalam menyelesaikan permasalahan di bidang Teknik Biomedika. | | | | | | | | | | | |
| | PLO-06 | <i>Able to apply the latest knowledge, skills and methods in solving problems in the field of Biomedical Engineering.</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 memahami konsep dan sejarah biocybernetics. <i>Students understand the concept and history of biocybernetics.</i> | | | | | | | | | | | |
| | CP MK 2 CLO 2 | Mahasiswa memahami konsep pemodelan yang dapat digunakan untuk sistem fisiologi tubuh manusia. <i>Students understand modeling concepts that can be used for the physiological systems of the human body.</i> | | | | | | | | | | | |
| | CP MK 3 CLO 3 | Mahasiswa memahami sistem homeostasis pada tubuh. <i>Students understand the homeostasis system in the body.</i> | | | | | | | | | | | |
| | CP MK 4 CLO 4 | Mahasiswa memahami sistem panca indera yang berperan untuk mengatur gerak tubuh. <i>Students understand the five-sense system that plays a role in regulating body movements.</i> | | | | | | | | | | | |
| | CP MK 5 CLO 5 | Mahasiswa mampu membuat simulasi gerak tubuh. <i>Students are able to simulate body movements.</i> | | | | | | | | | | | |
| | CP MK 6 CLO 6 | Mahasiswa memahami teknik Human Machine Interface yang dapat digunakan pada <i>biocybernetics</i> . <i>Students understand Human Machine Interface techniques that can be used in biocybernetics.</i> | | | | | | | | | | | |
| | CP MK 7 CLO 7 | Mahasiswa memahami aplikasi sistem cerdas pada regulasi gerak tubuh. <i>Students understand the application of intelligent systems in the regulation of body movements.</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 CLO 1 / LLO 1 | | √ | | | | | | | | | | |
| | CPMK 2 / SUB CPMK 2 CLO 2 / LLO 2 | | √ | | | | | | | | | | |
| | CPMK 3 / SUB CPMK 3 | | √ | | | | | | | | | | |

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| | CLO 3 / LLO 3 | | | | | | | | | | | | | |
| | CPMK 4 / SUB CPMK 4 CLO 4 / LLO 4 | | √ | | | | | | | | | | | |
| | CPMK 5 / SUB CPMK 5 CLO 5 / LLO 5 | | | | | √ | | | | | | | | |
| | CPMK 6 / SUB CPMK 6 CLO 6 / LLO 6 | | √ | | | | | | | | | | | |
| | CPMK 7 / SUB CPMK 7 CLO 7 / LLO 7 | | | | | | √ | | | | | | | |
| Diskripsi Singkat MK <i>Short Description of Course</i> | Mata kuliah ini mempelajari tentang mensimulasikan sistem gerak manusia dengan mengintegrasikan komponen sensor sebagai pengganti panca indera. <i>This course studies about simulating human motion systems by integrating sensor components as a substitute for the five senses.</i> | | | | | | | | | | | | | |
| Bahan Kajian: Materi pembelajaran <i>Course Materials:</i> | <ol style="list-style-type: none"> 1. Konsep dan sejarah biocybernetics / <i>Biocybernetics concept and history.</i> 2. Konsep pemodelan sistem fisiologi manusia / <i>The concept of modeling human physiology systems.</i> 3. Sistem Homeostasis pada Tubuh / <i>Homeostasis System in the Body.</i> 4. Sistem sensor untuk meregulasi gerak tubuh / <i>Sensor system to regulate body movements.</i> 5. Pemodelan dan simulasi voluntary movement / <i>Voluntary movement modeling and simulation.</i> 6. Human Machine Interface untuk simulasi gerak tubuh / <i>Human Machine Interface for simulating gestures.</i> 7. Aplikasi sistem cerdas pada regulasi gerak tubuh / <i>Intelligent system application on the regulation of gestures.</i> | | | | | | | | | | | | | |
| Pustaka <i>References</i> | Utama / Main: <ol style="list-style-type: none"> 1. - Pendukung / Supporting: <ol style="list-style-type: none"> 1. - | | | | | | | | | | | | | |

| 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> | | | | |
| (1) | (2) | (3) | (4) | Tatap Muka / <i>In-class (5)</i> | Daring / <i>Online (6)</i> | (7) | (8) |
| 1 | Mahasiswa memahami konsep dan sejarah biocybernetics. <i>Students understand the concept and history of biocybernetics.</i> | <ul style="list-style-type: none"> Mampu menjelaskan kebutuhan bidang kedokteran akan teknik biocybernetics. <i>Able to explain the medical field's needs for biocybernetics techniques.</i> | <p>Non-tes : Tugas Tertulis 1: Menjelaskan konsep biocybernetics dan aplikasi yang mungkin dilakukan pada bidang kedokteran.</p> <p>Non-test : Written Task 1: <i>Describe the concept of biocybernetics and its possible applications in medicine.</i></p> | <ul style="list-style-type: none"> Kuliah dan brainstorming, tanya jawab. <i>[TM : 3 x 50"]</i> <i>[BM : 3 x 60"]</i> <i>[PT : 3 x 60"]</i> <i>Presentation and brainstorming, ask and answer.</i> <i>[FF : 3 x 50"]</i> <i>[SA : 3 x 60"]</i> <i>[SS : 3 x 60"]</i> | <ul style="list-style-type: none"> Chatting dan diskusi dalam forum platform ITS. <i>Chat and discussion in ITS platform forum.</i> | <ul style="list-style-type: none"> Konsep biocybernetics. Sejarah biocybernetics. <i>[Link materi di MyITSClassroom]</i> <i>The concept of biocybernetics</i> <i>History of biocybernetics.</i> <i>[Material link on MyITSClassroom]</i> | 5 |
| 2 | Mahasiswa memahami konsep pemodelan yang dapat digunakan untuk sistem fisiologi tubuh manusia. | <ul style="list-style-type: none"> Mampu menjelaskan kegunaan pemodelan sistem fisiologi untuk | <p>Non-tes : Tugas Presentasi 1: Menjelaskan pemodelan sistem fisiologi berdasarkan</p> | <ul style="list-style-type: none"> Kuliah dan brainstorming, tanya jawab. <i>[TM : 3 x 50"]</i> <i>[BM : 3 x 60"]</i> | <ul style="list-style-type: none"> Chatting dan diskusi dalam forum platform ITS. | <ul style="list-style-type: none"> Konsep Pemodelan. Metode-metode pemodelan | 5 |

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| | <p><i>Students understand modeling concepts that can be used for the physiological systems of the human body.</i></p> | <p>bidang Teknik Biomedik.</p> <ul style="list-style-type: none"> • Able to explain the usefulness of physiological systems modeling for the field of Biomedical Engineering. | <p>makalah jurnal atau konferen terkini yang tersedia.</p> <p>Non-test : Presentation Task 1: Describe physiological systems modeling based on the latest available journal or conference papers.</p> | <p>[PT : 3 x 60"]</p> <ul style="list-style-type: none"> • Presentation and brainstorming, ask and answer. [FF : 3 x 50"] [SA : 3 x 60"] [SS : 3 x 60"] | <ul style="list-style-type: none"> • Chat and discussion in ITS platform forum. | <p>sistem fisiologi tubuh manusia. [Link materi di MyITSClassroom]</p> <ul style="list-style-type: none"> • Modeling Concepts. • Methods of modeling the human body physiological system. <p>[Material link on MyITSClassroom]</p> | |
| 3 - 4 | <p>Mahasiswa memahami sistem homeostasis pada tubuh.</p> <p><i>Students understand the homeostasis system in the body.</i></p> | <ul style="list-style-type: none"> • Mampu memodelkan salah satu sistem homeostasis pada tubuh. • Able to model one of the homeostatic systems in the body. | <p>Non-tes : Tugas Presentasi 2: Menjelaskan pemodelan homeostasis.</p> <p>Non-test : Presentation Task 2: Describe homeostasis modeling.</p> | <ul style="list-style-type: none"> • Kuliah dan brainstorming, tanya jawab. [TM : 2 x 3 x 50"] [BM : 2 x 3 x 60"] [PT : 2 x 3 x 60"] • Presentation and brainstorming, ask and answer. [FF : 2 x 3 x 50"] [SA : 2 x 3 x 60"] [SS : 2 x 3 x 60"] | <ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. • Chat and discussion in ITS platform forum. | <ul style="list-style-type: none"> • Sistem Homeostasis. • Pemodelan Sistem Homeostasis. <p>[Link materi di MyITSClassroom]</p> <ul style="list-style-type: none"> • Homeostasis System. • Homeostasis System Modeling. <p>[Material link on MyITSClassroom]</p> | 5 |
| 5 - 7 | <p>Mahasiswa memahami sistem panca indera yang berperan untuk mengatur gerak tubuh.</p> | <ul style="list-style-type: none"> • Mampu memodelkan dan mensimulasikan sistem panca | <p>Non-tes : Tugas Presentasi 3: Menjelaskan pemodelan sistem</p> | <ul style="list-style-type: none"> • Kuliah dan brainstorming, tanya jawab. [TM : 3 x 3 x 50"] | <ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. | <ul style="list-style-type: none"> • Sistem neurofisiologi untuk gerak tubuh. | 10 |


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| | <i>Students understand the five-sense system that plays a role in regulating body movements.</i> | <p>indera yang berperan dalam regulasi gerak tubuh.</p> <ul style="list-style-type: none"> • <i>Able to model and simulate the five sensory systems that play a role in the regulation of body movements.</i> | <p>panca indera untuk gerak tubuh beserta dengan simulasinya.</p> <p>Non-test : Presentation Task 3: <i>Describe the modeling of the sensory system for body movements and their simulation.</i></p> | <p>[BM : 3 x 3 x 60"] [PT : 3 x 3 x 60"]</p> <ul style="list-style-type: none"> • <i>Presentation and brainstorming, ask and answer.</i> [FF : 3 x 3 x 50"] [SA : 3 x 3 x 60"] [SS : 3 x 3 x 60"] | <i>Chat and discussion in ITS platform forum.</i> | <ul style="list-style-type: none"> • Sistem panca indera untuk gerak tubuh. • Pemodelan sistem panca indera untuk gerak tubuh. [Link materi di MyITSClassroom] • <i>Neurophysiological system for body movement.</i> • <i>The five senses system for body movement.</i> • <i>Modeling of the sensory system for body movements.</i> [Material link on MyITSClassroom] | |
| 8 | EVALUASI TENGAH SEMESTER MID-SEMESTER EXAM | | | | | | 15 |
| 9 | <p>Mahasiswa mampu membuat simulasi gerak tubuh</p> <p><i>Students are able to simulate body movements.</i></p> | <ul style="list-style-type: none"> • Mampu mensimulasikan sistem gerak tubuh berdasarkan data yang diperoleh. • <i>Able to simulate the body</i> | <p>Non-tes : Tugas Pemrograman 1: Mensimulasikan sistem gerak tubuh berdasarkan data eksperimen menggunakan EMG dan Force Plate.</p> | <ul style="list-style-type: none"> • Kuliah dan brainstorming, tanya jawab. [TM : 3 x 50"] [BM : 3 x 60"] [PT : 3 x 60"] | <ul style="list-style-type: none"> • Chatting dan diskusi dalam forum platform ITS. • <i>Chat and discussion in</i> | <ul style="list-style-type: none"> • Sistem gerak tubuh. • Pemodelan sistem gerak tubuh. • Simulasi sistem gerak tubuh. | 20 |

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| | | <p><i>movement system based on the data obtained.</i></p> | <p>Non-test : Programming Task 1: <i>Simulate the body motion system based on experimental data using EMG and Force Plate.</i></p> | <ul style="list-style-type: none"> ● <i>Presentation and brainstorming, ask and answer.</i> [FF : 3 x 50"] [SA : 3 x 60"] [SS : 3 x 60"] | <p><i>ITS platform forum.</i></p> | <p>[Link materi di MyITSClassroom]</p> <ul style="list-style-type: none"> ● <i>Movement system.</i> ● <i>Body motion system modeling.</i> ● <i>Simulation of the body movement system.</i> <p>[Material link on MyITSClassroom]</p> | |
| <p>10 - 11</p> | <p>Mahasiswa memahami teknik Human Machine Interface yang dapat digunakan pada <i>biocybernetics</i>.</p> <p><i>Students understand Human Machine Interface techniques that can be used in biocybernetics.</i></p> | <ul style="list-style-type: none"> ● Mampu memberikan feedback yang sesuai kepada user saat melakukan percobaan. ● <i>Able to provide appropriate feedback to the user when conducting experiments.</i> | <p>Non-test : Tugas Presentasi 4: Mengintegrasikan program HMI untuk memberikan feedback saat simulasi pergerakan tubuh.</p> <p>Non-test : Presentation Task 4: <i>Integrate the HMI program to provide feedback during simulated body movements.</i></p> | <ul style="list-style-type: none"> ● Kuliah dan brainstorming, tanya jawab. [TM : 2 x 3 x 50"] [BM : 2 x 3 x 60"] [PT : 2 x 3 x 60"] ● <i>Presentation and brainstorming, ask and answer.</i> [FF : 2 x 3 x 50"] [SA : 2 x 3 x 60"] [SS : 2 x 3 x 60"] | <ul style="list-style-type: none"> ● Chatting dan diskusi dalam forum platform ITS. ● <i>Chat and discussion in ITS platform forum.</i> | <ul style="list-style-type: none"> ● Konsep HMI. ● Aplikasi HMI pada bidang Teknik Biomedik secara umum. ● Aplikasi HMI untuk sistem gerak. <p>[Link materi di MyITSClassroom]</p> <ul style="list-style-type: none"> ● <i>HMI concept.</i> ● <i>HMI applications in the field of Biomedical Engineering in general.</i> | <p>10</p> |

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| | | | | | | <ul style="list-style-type: none"> ● <i>HMI application for motion systems.</i> [Material link on MyITSClassroom] | |
| 12 - 14 | <p>Mahasiswa memahami aplikasi sistem cerdas pada regulasi gerak tubuh.</p> <p><i>Students understand the application of intelligent systems in the regulation of body movements.</i></p> | <ul style="list-style-type: none"> ● Mampu mengintegrasikan teknik sistem cerdas yang sesuai dalam meregulasi pergerakan tubuh. ● <i>Able to integrate the appropriate intelligent system techniques in regulating body movement.</i> | <p>Non-tes : Tugas Presentasi 5: Mengintegrasikan sistem cerdas pada program simulasi pergerakan tubuh.</p> <p>Non-test : Presentation Task 5: <i>Integrate smart systems into body movement simulation programs.</i></p> | <ul style="list-style-type: none"> ● Kuliah dan brainstorming, tanya jawab. [TM : 3 x 3 x 50"] [BM : 3 x 3 x 60"] [PT : 3 x 3 x 60"] ● <i>Presentation and brainstorming, ask and answer.</i> [FF : 3 x 3 x 50"] [SA : 3 x 3 x 60"] [SS : 3 x 3 x 60"] | <ul style="list-style-type: none"> ● Chatting dan diskusi dalam forum platform ITS. ● <i>Chat and discussion in ITS platform forum.</i> | <ul style="list-style-type: none"> ● Teknik sistem cerdas. ● Aplikasi sistem cerdas pada sistem gerak tubuh. [Link materi di MyITSClassroom] ● <i>Intelligent systems engineering.</i> ● <i>Smart system application on the gesture system.</i> [Material link on MyITSClassroom] | 10 |
| 15-16 | EVALUASI AKHIR SEMESTER FINAL-SEMESTER EXAM | | | | | | 20 |

TM=Tatap Muka, **PT**=Penugasan Terstruktur, **BM**=Belajar Mandiri.
FF = Face to Face, **SA** = Structured Assignment, **SS** = Self Study.

II. Rencana Asesmen & Evaluasi (RAE) / *Assessment & Evaluation Plan*

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|  | ASSESSMENT & EVALUATION PLAN BACHELOR DEGREE PROGRAM OF BIOMEDICAL ENGINEERING - FTEIC ITS Course : Biocybernetics | | RA& E |
| | | | Write Doc Code |
| Kode/code: EB184701 | Bobot sks/credits (T/P): 3/0 | Rumpun MK: Biocybernetics Course Cluster: Biocybernetics | Smt: VII |
| OTORISASI AUTHORIZATION | Penyusun RA & E <i>Compiler A&E</i> M. Hilman Fatoni, S.T., M.T. | Koordinator RMK <i>Course Cluster Coordinator</i> Ir. Josaphat Pramudijanto, M.Eng. | Ka DEP <i>Head of DEP</i> Dr. Achmad Arifin, S.T., M.Eng. |

| Mg ke/ Week (1) | Sub CP-MK / <i>Lesson Learning Outcomes (LLO)</i> (2) | Bentuk Asesmen (Penilaian) <i>Form of Assessment</i> (3) | Bobot / Load (%) (4) |
|-----------------------|--|---|----------------------------|
| 1 | Sub CP-MK 1: Mahasiswa memahami konsep dan sejarah biocybernetics. LLO 1: <i>Students understand the concept and history of biocybernetics.</i> | Non-tes : Tugas Tertulis 1: Menjelaskan konsep biocybernetics dan aplikasi yang mungkin dilakukan pada bidang kedokteran. Tes : ETS Soal 1 (?% dari ETS 15%) EAS Soal 1 (?% dari EAS 20%) Non-test : Written Task 1: <i>Describe the concept of biocybernetics and its possible applications in medicine.</i> Test : Question 1 in Mid Exam (?% of Mid Exam 15%) Question 1 in Final Exam (?% of Final Exam 20%) | 16.7 |
| 2 | Sub CP-MK 2: Mahasiswa memahami konsep pemodelan yang dapat digunakan untuk sistem | Non-tes : Tugas Presentasi 1: Menjelaskan pemodelan sistem fisiologi berdasarkan makalah jurnal atau konferen terkini yang tersedia. Tes : ETS Soal 2 (?% dari ETS 15%) | 16.7 |

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| | <p>fisiologi tubuh manusia.</p> <p>LLO 2: Students understand modeling concepts that can be used for the physiological systems of the human body.</p> | <p>Non-test : Presentation Task 1: <i>Describe physiological systems modeling based on the latest available journal or conference papers.</i></p> <p>Test : Question 2 in Mid Exam (?% of Mid Exam 15%)</p> | |
| 3-4 | <p>Sub CP-MK 3: Mahasiswa memahami sistem homeostasis pada tubuh.</p> <p>LLO 3: Students understand the homeostasis system in the body.</p> | <p>Non-tes : Tugas Presentasi 2: Menjelaskan pemodelan homeostasis.</p> <p>Tes : ETS Soal 3 (?% dari ETS 15%)</p> <p>Non-test : Presentation Task 2: <i>Describe homeostasis modeling.</i></p> <p>Test : Question 3 in Mid Exam (?% of Mid Exam 15%)</p> | 11.1 |
| 5-7 | <p>Sub CP-MK 4: Mahasiswa memahami sistem panca indera yang berperan untuk meregulasi gerak tubuh.</p> <p>LLO 4: Students understand the five-sense system that plays a role in regulating body movements.</p> | <p>Non-tes : Tugas Presentasi 3: Menjelaskan pemodelan sistem panca indera untuk gerak tubuh beserta dengan simulasinya.</p> <p>Tes : ETS Soal 4 (?% dari ETS 15%) EAS Soal 2 (?% dari EAS 20%)</p> <p>Non-test : Presentation Task 3: <i>Describe the modeling of the sensory system for body movements and their simulation.</i></p> <p>Test : Question 4 in Mid Exam (?% of Mid Exam 15%) Question 2 in Final Exam (?% of Final Exam 20%)</p> | 16.7 |
| 9 | <p>Sub CP-MK 5: Mahasiswa mampu membuat simulasi gerak tubuh.</p> | <p>Non-tes : Tugas Pemrograman 1: Mensimulasikan sistem gerak tubuh berdasarkan data eksperimen menggunakan EMG dan Force Plate.</p> <p>Tes :</p> | 16.7 |

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| | <p>LLO 5: <i>Students are able to simulate body movements.</i></p> | <p>EAS Soal 3 (?% dari EAS 20%)</p> <p>Non-test : Programming Task 1: <i>Simulate the body motion system based on experimental data using EMG and Force Plate.</i></p> <p>Test : <i>Question 3 in Final Exam (?% of Final Exam 20%)</i></p> | |
| 10-11 | <p>Sub CP-MK 6: Mahasiswa memahami teknik Human Machine Interface yang dapat digunakan pada <i>biocybernetics</i>.</p> <p>LLO 6: <i>Students understand Human Machine Interface techniques that can be used in biocybernetics.</i></p> | <p>Non-tes : Tugas Presentasi 4: Mengintegrasikan program HMI untuk memberikan feedback saat simulasi pergerakan tubuh.</p> <p>Tes : EAS Soal 4 (?% dari EAS 20%)</p> <p>Non-test : Presentation Task 4: <i>Integrate the HMI program to provide feedback during simulated body movements.</i></p> <p>Test : <i>Question 4 in Final Exam (?% of Final Exam 20%)</i></p> | 11.1 |
| 12-14 | <p>Sub CP-MK 7: Mahasiswa memahami aplikasi sistem cerdas pada regulasi gerak tubuh.</p> <p>LLO 7: <i>Students understand the application of intelligent systems in the regulation of body movements.</i></p> | <p>Non-tes : Tugas Presentasi 5: Mengintegrasikan sistem cerdas pada program simulasi pergerakan tubuh.</p> <p>Non-test : Presentation Task 5: Integrate smart systems into body movement simulation programs.</p> | 11.1 |
| 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-02 / <i>PLO-02</i> | CPMK 1 / <i>CLO 1</i> | Week- 1 | <i>Written Task 1</i> | 5 |
| | | Week- 8 | <i>Mid Exam Question 1</i> | ? |
| | | Week- 15-16 | <i>Final Exam Question 1</i> | ? |
| | CPMK 2 / <i>CLO 2</i> | Week- 2 | <i>Presentation Task 1</i> | 5 |
| | | Week- 8 | <i>Mid Exam Question 2</i> | ? |
| | CPMK 3 / <i>CLO 3</i> | Week- 3-4 | <i>Presentation Task 2</i> | 5 |
| | | Week- 8 | <i>Mid Exam Question 3</i> | ? |
| | | Week- 5-7 | <i>Presentation Task 3</i> | 10 |
| | CPMK 4 / <i>CLO 4</i> | Week- 8 | <i>Mid Exam Question 4</i> | ? |
| | | Week- 15-16 | <i>Final Exam Question 2</i> | ? |
| | | Week- 10-11 | <i>Presentation Task 4</i> | 10 |
| CPL-05 / <i>PLO-05</i> | CPMK 5 / <i>CLO 5</i> | Week- 9 | <i>Programming Task 1</i> | 20 |
| | | Week- 15-16 | <i>Final Exam Question 3</i> | ? |
| CPL-06 / <i>PLO-06</i> | CPMK 6 / <i>CLO 6</i> | Week- 12-14 | <i>Presentation Task 5</i> | 10 |
| | | | | $\Sigma = 100\%$ |

| No | <i>Form of Assessment</i> | <i>PLO-01</i> | <i>PLO-02</i> | <i>PLO-03</i> | <i>PLO-04</i> | <i>PLO-05</i> | <i>PLO-06</i> | <i>PLO-07</i> | <i>PLO-08</i> | <i>PLO-09</i> | <i>PLO-10</i> | <i>PLO-11</i> | <i>PLO-12</i> | <i>Total</i> |
|----|----------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|
| 1 | <i>Written Task 1</i> | | 0.05 | | | | | | | | | | | 0.05 |
| 2 | <i>Presentation Task 1</i> | | 0.05 | | | | | | | | | | | 0.05 |
| 3 | <i>Presentation Task 2</i> | | 0.05 | | | | | | | | | | | 0.05 |
| 4 | <i>Presentation Task 3</i> | | 0.1 | | | | | | | | | | | 0.1 |
| 5 | <i>Presentation Task 4</i> | | 0.1 | | | | | | | | | | | 0.1 |

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|---|----------------------------|--|---|--|--|-----|-----|--|--|--|--|--|--|------------|
| 6 | <i>Presentation Task 5</i> | | | | | | 0.1 | | | | | | | 0.1 |
| 7 | <i>Programming Task 1</i> | | | | | 0.2 | | | | | | | | 0.2 |
| 8 | <i>Mid Exam</i> | | ? | | | ? | ? | | | | | | | ? |
| 9 | <i>Final Exam</i> | | ? | | | ? | ? | | | | | | | ? |
| | <i>Total</i> | | ? | | | ? | ? | | | | | | | 1 |