



MODULE HANDBOOK BIOMATERIALS



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

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

ENDORSEMENT PAGE






MODULE HANDBOOK

Biomaterials

DEPARTMENT OF BIOMEDICAL ENGINEERING


INSTITUT TEKNOLOGI SEPULUH NOPEMBER
Number : B/21360/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>	Yuli Setiyorini	Dosen <i>Lecturer</i>	TTD	November 23, 2019
Pemeriksa dan Pengendalian <i>Review and Control</i>	M. Hilman Fatoni, S.T., M.T.	Tim kurikulum <i>Curriculum team</i>		February 12, 2020
Persetujuan <i>Approval</i>	Ir. Josaphat Pramudijanto, M.Eng.	Koordinator RMK <i>Course Cluster Coordinator</i>		March 04, 2020
Penetapan <i>Determination</i>	Dr. Achmad Arifin, S.T., M.Eng.	Kepala Departemen <i>Head of Department</i>		March 11, 2020

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	<p>biology and medical fields and certain characteristics of those materials.</p> <p>CLO 3: Students are able to explain how biomaterials interact with the body.</p> <p>CLO 4: Students are able to explain and implement the biomaterial testing process.</p> <p>CLO 5: Students are able to explain the application of biomaterials available in the world of medic.</p>	<p>PLO-06</p> <p>PLO-03</p> <p>PLO-08</p>
Content	<p>The Biomaterials course is a compulsory course that discusses the basic sciences of materials and their classifications. This course aims for students to understand material classifications applicable in the medical field and understand the body's natural response to biomaterial implantation.</p>	
Study and examination requirements and forms of examination	<ul style="list-style-type: none"> • In-class exercises • Assignment 1, 2, 3, 4 • Presentation • Mid-term examination • Final project • Final examination 	
Media employed	<p>LCD, whiteboard, websites (myITS Classroom), zoom.</p>	
Reading list	<ol style="list-style-type: none"> 1. Ratner, Buddy D. "Biomaterials Science : An Introduction to Materials in Medicine, 3rd Ed", Academic Press 2. Temenoff, Johnna S. "Biomaterials : The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall 3. Park, Joon, "Biomaterials : An Introduction, 3rd Ed", Springer 	

I. Rencana Pembelajaran Semester / *Semester Learning Plan*

		INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS) FAKULTAS TEKNOLOGI ELEKTRO DAN INFORMATIKA CERDAS DEPARTEMEN TEKNIK BIOMEDIK				Kode Dokumen
RENCANA PEMBELAJARAN SEMESTER						
MATA KULIAH (MK) <i>COURSE</i>	KODE <i>CODE</i>	Rumpun MK <i>Course Cluster</i>	BOBOT (sks) <i>CREDITS</i>		SEMESTER	Tgl Penyusunan <i>Compilation Date</i>
Biomaterials	EB184505	Biocybernetics	T=3	P=0	V	June 27, 2020
OTORISASI / PENGESAHAN <i>AUTHORIZATION / ENDORSEMENT</i>	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>	
	(Yuli Setiyorini)		(Ir. Josaphat Pramudijanto, M.Eng.)		(Dr. Achmad Arifin, S.T., M.Eng.)	
Capaian Pembelajaran	CPL-PRODI yang dibebankan pada MK <i>PLO Program Charged to The Course</i>					
Learning Outcomes	CPL-03 <i>PLO-03</i>	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 <i>PLO-06</i>	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 <i>PLO-08</i>	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				

	<p>Capaian Pembelajaran Mata Kuliah (CPMK) – Bila CP MK sebagai kemampuan pada tiap tahap pembelajaran CP MK = Sub CP MK Course Learning Outcome (CLO) - If CLO as description capability of each Learning Stage in the course, then CLO = LLO</p>																																																																												
	<p>CP MK 1 CLO 1</p>	<p>Mahasiswa memahami apa yang dimaksud dengan biomaterial dan perbedaannya dengan material secara general. <i>Students understand what biomaterials is and its difference with other materials in general.</i></p>																																																																											
	<p>CP MK 2 CLO 2</p>	<p>Mahasiswa memahami material yang digunakan di bidang biologi dan kedokteran serta karakteristik khusus dari material tersebut. <i>Students understand the materials used in the biology and medical fields and certain characteristics of those materials.</i></p>																																																																											
	<p>CP MK 3 CLO 3</p>	<p>Mahasiswa mampu menjelaskan bagaimana biomaterial berinteraksi dengan tubuh. <i>Students are able to explain how biomaterials interact with the body.</i></p>																																																																											
	<p>CP MK 4 CLO 4</p>	<p>Mahasiswa mampu menjelaskan dan menerapkan proses pengujian biomaterial. <i>Students are able to explain and implement the biomaterial testing process.</i></p>																																																																											
	<p>CP MK 5 CLO 5</p>	<p>Mahasiswa mampu menjelaskan aplikasi biomaterial yang telah tersedia di dunia kedokteran. <i>Students are able to explain the application of biomaterials available in the world of medic.</i></p>																																																																											
<p>Peta CPL – CP MK <i>Map of PLO - CLO</i></p>	<table border="1"> <thead> <tr> <th data-bbox="353 802 656 866"></th> <th data-bbox="656 802 775 866">CPL-01</th> <th data-bbox="775 802 893 866">CPL-02</th> <th data-bbox="893 802 1012 866">CPL-03</th> <th data-bbox="1012 802 1131 866">CPL-04</th> <th data-bbox="1131 802 1249 866">CPL-05</th> <th data-bbox="1249 802 1368 866">CPL-06</th> <th data-bbox="1368 802 1487 866">CPL-07</th> <th data-bbox="1487 802 1606 866">CPL-08</th> <th data-bbox="1606 802 1724 866">CPL-09</th> <th data-bbox="1724 802 1843 866">CPL-10</th> <th data-bbox="1843 802 1962 866">CPL-11</th> <th data-bbox="1962 802 2089 866">CPL-12</th> </tr> </thead> <tbody> <tr> <td data-bbox="353 866 656 986"> CPMK 1 / SUB CPMK 1 <i>CLO 1 / LLO 1</i> </td> <td data-bbox="656 866 775 986"></td> <td data-bbox="775 866 893 986"></td> <td data-bbox="893 866 1012 986"></td> <td data-bbox="1012 866 1131 986"></td> <td data-bbox="1131 866 1249 986"></td> <td data-bbox="1249 866 1368 986">√</td> <td data-bbox="1368 866 1487 986"></td> <td data-bbox="1487 866 1606 986"></td> <td data-bbox="1606 866 1724 986"></td> <td data-bbox="1724 866 1843 986"></td> <td data-bbox="1843 866 1962 986"></td> <td data-bbox="1962 866 2089 986"></td> </tr> <tr> <td data-bbox="353 986 656 1106"> CPMK 2 / SUB CPMK 2 <i>CLO 2 / LLO 2</i> </td> <td data-bbox="656 986 775 1106"></td> <td data-bbox="775 986 893 1106"></td> <td data-bbox="893 986 1012 1106"></td> <td data-bbox="1012 986 1131 1106"></td> <td data-bbox="1131 986 1249 1106"></td> <td data-bbox="1249 986 1368 1106">√</td> <td data-bbox="1368 986 1487 1106"></td> <td data-bbox="1487 986 1606 1106"></td> <td data-bbox="1606 986 1724 1106"></td> <td data-bbox="1724 986 1843 1106"></td> <td data-bbox="1843 986 1962 1106"></td> <td data-bbox="1962 986 2089 1106"></td> </tr> <tr> <td data-bbox="353 1106 656 1225"> CPMK 3 / SUB CPMK 3 <i>CLO 3 / LLO 3</i> </td> <td data-bbox="656 1106 775 1225"></td> <td data-bbox="775 1106 893 1225"></td> <td data-bbox="893 1106 1012 1225"></td> <td data-bbox="1012 1106 1131 1225"></td> <td data-bbox="1131 1106 1249 1225"></td> <td data-bbox="1249 1106 1368 1225">√</td> <td data-bbox="1368 1106 1487 1225"></td> <td data-bbox="1487 1106 1606 1225"></td> <td data-bbox="1606 1106 1724 1225"></td> <td data-bbox="1724 1106 1843 1225"></td> <td data-bbox="1843 1106 1962 1225"></td> <td data-bbox="1962 1106 2089 1225"></td> </tr> <tr> <td data-bbox="353 1225 656 1347"> CPMK 4 / SUB CPMK 4 <i>CLO 4 / LLO 4</i> </td> <td data-bbox="656 1225 775 1347"></td> <td data-bbox="775 1225 893 1347"></td> <td data-bbox="893 1225 1012 1347">√</td> <td data-bbox="1012 1225 1131 1347"></td> <td data-bbox="1131 1225 1249 1347"></td> <td data-bbox="1249 1225 1368 1347"></td> <td data-bbox="1368 1225 1487 1347"></td> <td data-bbox="1487 1225 1606 1347"></td> <td data-bbox="1606 1225 1724 1347"></td> <td data-bbox="1724 1225 1843 1347"></td> <td data-bbox="1843 1225 1962 1347"></td> <td data-bbox="1962 1225 2089 1347"></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>			√									
	CPL-01	CPL-02	CPL-03	CPL-04	CPL-05	CPL-06	CPL-07	CPL-08	CPL-09	CPL-10	CPL-11	CPL-12																																																																	
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	CPMK 5 / SUB CPMK 5 CLO 5 / LLO 5								√				
Deskripsi Singkat MK	Mata kuliah Biomaterial merupakan mata kuliah wajib yang membahas mengenai ilmu-ilmu dasar material dan klasifikasinya. Mata kuliah ini bertujuan agar mahasiswa memahami klasifikasi material yang dapat diaplikasikan dalam bidang kedokteran dan memahami respon natural tubuh terhadap implantasi biomaterial.												
Short Description of Course	<i>The Biomaterials course is a compulsory course that discusses the basic sciences of materials and their classifications. This course aims for students to understand material classifications applicable in the medical field and understand the body's natural response to biomaterial implantation.</i>												
Bahan Kajian: Materi pembelajaran Course Materials:	<ol style="list-style-type: none"> 1. Karakteristik material / <i>Material characteristics</i> 2. Klasifikasi dan karakteristik biomaterial / <i>Classification and characteristics of biomaterials</i> 3. Interaksi biomaterial dengan sel dan jaringan / <i>The interaction between biomaterials with cells and tissues</i> 4. Pengujian biomaterial / <i>Testing of biomaterials</i> 5. Aplikasi material di bidang kedokteran / <i>Application of materials in the medical field</i> 												
Pustaka References	Utama / Main : <ol style="list-style-type: none"> 4. Ratner, Buddy D. "Biomaterials Science : An Introduction to Materials in Medicine, 3rd Ed", Academic Press 5. Temenoff, Johnna S. "Biomaterials : The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall 6. Park, Joon, "Biomaterials : An Introduction, 3rd Ed", Springer 												
Dosen Pengampu Lecturers													
Mata kuliah syarat Prerequisite													

Mg Ke/ Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) / <i>Final ability of each learning stage (LLO)</i>	Penilaian / Assessment		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 (%) / Assessment Load (%)
		Indikator / Indicator	Kriteria & Teknik / Criteria & Techniques	Tatap Muka (5) / <i>In-class (5)</i>	Daring (6) / <i>Online (6)</i>		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	<p>Mahasiswa memahami apa yang dimaksud dengan biomaterial dan perbedaannya dengan material secara general.</p> <p><i>Students understand what biomaterials is and its difference with other materials in general.</i></p>	<ul style="list-style-type: none"> Mampu mendefinisikan pengertian dasar material dan biomaterial Mampu menjelaskan perbedaan antara material dan biomaterial Mampu menjelaskan tentang berbagai klasifikasi material <i>Able to define the basic understanding of materials and biomaterials</i> <i>Able to explain the difference between materials and biomaterials</i> <i>Able to explain various</i> 	<p>Non-tes: Tugas 1: Melakukan klasifikasi material (Tugas Tertulis)</p> <p>Tes: Soal ETS (masuk dalam penilaian ETS)</p> <p>Non-test: Task 1: <i>Perform material classification (Written Task)</i></p> <p>Test: <i>Mid-term examination questions (included in the mid-term</i></p>	<ul style="list-style-type: none"> Kuliah, diskusi, tanya jawab, tugas [TM : 1 x 50"] [BM : 1 x 60"] [PT : 1 x 60"] <i>Lecture, discussion, question and answer, exercise and assignment</i> <i>[FF : 1 x 50"] [SA : 1 x 60"] [SS : 1 x 60"]</i> 	<ul style="list-style-type: none"> Kuliah, diskusi, tanya jawab, tugas dalam platform myITS Classroom <i>Lecture, discussion, question and answer, exercise and assignment in myITS Classroom platform</i> 	<ul style="list-style-type: none"> Kontrak kuliah: - Motivasi belajar - Rencana pembelajaran - Aturan-aturan perkuliahan - Tujuan perkuliahan - Sistem penilaian, buku ajar/sumber pustaka Pengertian dasar material dan biomaterial Perbedaan material dan biomaterial Klasifikasi material <i>Course contract:</i> 	<p>Tugas 1: 2.5</p> <p>Task 1: 2.5</p>

		<i>material classifications</i>	<i>assessment)</i>			<ul style="list-style-type: none"> - <i>Motivation to learn</i> - <i>Lesson plan</i> - <i>Lecture rules</i> - <i>Course objective</i> - <i>Assessment system, textbooks / library resources</i> • <i>Basic understanding of materials and biomaterials</i> • <i>Differences in materials and biomaterials</i> • <i>Classification of materials</i> 	
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<p>2-4</p>	<p>Mahasiswa memahami material yang digunakan di bidang biologi dan kedokteran serta karakteristik khusus dari material tersebut.</p> <p><i>Students understand the materials used in the biology and medical fields and certain characteristics of those materials.</i></p>	<ul style="list-style-type: none"> • Mampu membedakan jenis material yang banyak digunakan dibidang biologi dan kedokteran • Mampu memahami karakteristik material secara umum dan biomaterial • Mampu melakukan klasifikasi biomaterial <ul style="list-style-type: none"> • <i>Able to distinguish types of materials that are widely used in the fields of biology and medicine</i> • <i>Able to understand material characteristics in general and biomaterials</i> • <i>Able to perform biomaterial classification</i> 	<p>Non-tes: Tugas 2: Klasifikasi dan karakteristik dari biomaterial (Tugas Tertulis)</p> <p>Tes: Soal ETS (masuk dalam penilaian ETS)</p> <p>Non-test: Task 2: Classification and characteristics of biomaterials (Written Task)</p> <p>Test: Mid-term examination questions (included in the mid-term assessment)</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas <p>[TM : 3 x 50"] [BM : 3 x 60"] [PT : 3 x 60"]</p> <ul style="list-style-type: none"> • <i>Lecture, discussion, question and answer, exercise and assignment</i> <p>[TM : 3 x 50"] [BM : 3 x 60"] [PT : 3 x 60"]</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas dalam platform myITS Classroom • <i>Lecture, discussion, question and answer, exercise and assignment in myITS Classroom platform</i> 	<ul style="list-style-type: none"> • Jenis material yang banyak digunakan dibidang biologi dan kedokteran • Karakteristik material secara umum • Karakteristik biomaterial • Klasifikasi biomaterial <ul style="list-style-type: none"> • <i>Types of materials that are widely used in the fields of biology and medicine</i> • <i>General material characteristics</i> • <i>Characteristics of biomaterials</i> • <i>Classification of biomaterials</i> 	<p>Tugas 2: 5</p> <p>Task 2: 5</p>
<p>5-7</p>	<p>Mahasiswa mampu menjelaskan bagaimana biomaterial berinteraksi dengan tubuh.</p>	<ul style="list-style-type: none"> • Mampu menjelaskan Interaksi biomaterial dengan sel dan jaringan tubuh 	<p>Non-tes: Tugas 3: Interaksi biomaterial dengan</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas 	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas dalam platform myITS 	<ul style="list-style-type: none"> • Interaksi biomaterial dengan sel dan jaringan tubuh 	<p>Tugas 3: 2.5</p> <p>Task 3:</p>

	<i>Students are able to explain how biomaterials interact with the body.</i>	<ul style="list-style-type: none"> • <i>Able to explain the to explain the interaction of biomaterials with cells and body tissues</i> 	<p>sel dan jaringan tubuh (Tugas Tertulis)</p> <p>Test: Soal ETS (masuk dalam penilaian ETS)</p> <p>Non-test: Task 3: <i>Biomaterial interactions with cells and body tissues (Written Task)</i></p> <p>Test: <i>Mid-term examination questions (included in the mid-term assessment)</i></p>	<p>[TM : 3 x 50"] [BM : 3 x 60"] [PT : 3 x 60"]</p> <ul style="list-style-type: none"> • <i>Lecture, discussion, question and answer, exercise and assignment</i> <p>[TM : 3 x 50"] [BM : 3 x 60"] [PT : 3 x 60"]</p>	<p>Classroom</p> <ul style="list-style-type: none"> • <i>Lecture, discussion, question and answer, exercise and assignment in myITS Classroom platform</i> 	<ul style="list-style-type: none"> • <i>Biomaterials interactions with cells and body tissues</i> 	2.5
8	EVALUASI TENGAH SEMESTER MID-SEMESTER EXAM						22.5
9-12	Mahasiswa mampu menjelaskan dan menerapkan proses pengujian biomaterial.	<ul style="list-style-type: none"> • Mampu memahami dan menjelaskan tahapan pengujian biomaterial 	<p>Non-tes: Tugas 4: Teknik-teknik pengujian</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas 	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas dalam platform myITS 	<ul style="list-style-type: none"> • Tahapan pengujian biomaterial • Teknik-teknik 	<p>Tugas 4: 10</p> <p>Task 4: 10</p>


	<p><i>Students are able to explain and implement the biomaterial testing process.</i></p>	<ul style="list-style-type: none"> • Mampu menerapkan teknik-teknik yang digunakan dalam pengujian biomaterial • <i>Able to understand and explain the stages of biomaterial testing.</i> • <i>Able to apply the techniques used in biomaterial testing</i> 	<p>biomaterial (Tugas Tertulis)</p> <p>Tes: Soal EAS (masuk dalam penilaian EAS)</p> <p>Non-test: Task 4: <i>Biomaterial testing techniques (Written Task)</i></p> <p>Test: <i>Final examination questions (included in the final assessment)</i></p>	<p>[TM : 4 x 50"] [BM : 4 x 60"] [PT : 4 x 60"]</p> <ul style="list-style-type: none"> • <i>Lecture, discussion, question and answer, exercise and assignment</i> <p>[TM : 4 x 50"] [BM : 4 x 60"] [PT : 4 x 60"]</p>	<p>Classroom</p> <ul style="list-style-type: none"> • <i>Lecture, discussion, question and answer, exercise and assignment in myITS Classroom platform</i> 	<p>yang digunakan dalam pengujian biomaterial</p> <ul style="list-style-type: none"> • <i>Stages of biomaterial testing</i> • <i>Techniques used in biomaterial testing</i> 	
13-15	<p>Mahasiswa mampu menjelaskan aplikasi biomaterial yang telah tersedia di dunia kedokteran.</p> <p><i>Students are able to explain the application of biomaterials available in the world of medic.</i></p>	<ul style="list-style-type: none"> • Mampu menjelaskan aplikasi biomaterial di dunia kedokteran • Mampu menjelaskan teknologi terkini terkait penggunaan biomaterial • <i>Able to explain the application of</i> 	<p>Presentasi: Topik presentasi secara umum mengenai aplikasi biomaterial di dunia kedokteran. Mahasiswa akan dibagi menjadi beberapa grup dan diminta untuk</p>	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas <p>[TM : 3 x 50"] [BM : 3 x 60"] [PT : 3 x 60"]</p> <ul style="list-style-type: none"> • <i>Lecture, discussion,</i> 	<ul style="list-style-type: none"> • Kuliah, diskusi, tanya jawab, tugas dalam platform myITS Classroom • <i>Lecture, discussion, question and answer, exercise</i> 	<ul style="list-style-type: none"> • Aplikasi biomaterial di dunia kedokteran • Teknologi terkini terkait penggunaan biomaterial • <i>Application of biomaterials in</i> 	<p>Presentasi: 15%</p> <p>Final Project: 17.5%</p> <p>Presentatio n: 15%</p>

		<p><i>biomaterials in the medical world.</i></p> <ul style="list-style-type: none"> • <i>Able to explain the latest technology related to the use of biomaterials</i> 	<p>memilih topik khusus presentasi mereka (Tugas Presentasi)</p> <p>Final Project: Penentuan tema final project diberikan pada minggu ke – 8. Proses evaluasi final project dilakukan pada minggu ke – 15 dan 16 (Diskusi)</p> <p>Presentation: <i>General presentation topics regarding the application of biomaterials in medical world. Students will be divided into several groups and asked to choose a specific topic for their presentation (Presentation Task)</i></p> <p>Final Project:</p>	<p><i>question and answer, exercise and assignment</i></p> <p><i>[TM : 3 x 50"]</i> <i>[BM : 3 x 60"]</i> <i>[PT : 3 x 60"]</i></p>	<p><i>and assignment in myITS Classroom platform</i></p>	<p><i>medical world</i></p> <ul style="list-style-type: none"> • <i>The latest technology related to the use of biomaterials</i> 	<p>Final Project: 17.5%</p>
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			<i>Determination of the theme of the final project is given in week 8. The final project evaluation process is carried out on weeks 15 and 16 (Discussion)</i>				
16	EVALUASI AKHIR SEMESTER FINAL-SEMESTER EXAM						25

TM=Tatap Muka, **PT**=Penugasan Terstruktur, **BM**=Belajar Mandiri.

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

	ASSESSMENT & EVALUATION PLAN BACHELOR DEGREE PROGRAM OF BIOMEDICAL ENGINEERING - FTEIC ITS Course : Biomaterials		RA&E Write Doc Code
	Kode / Code: EB184505	Bobot sks / Credits (T/P): 3/0	Rumpun MK: Biocybernetics <i>Course Cluster: Biocybernetics</i>
OTORISASI <i>AUTHORIZATION</i>	Penyusun RA & E <i>Compiler A&EP</i> Yuli Setiyorini	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 / <i>Load (%)</i> (4)
1	Sub CP-MK 1: Mahasiswa memahami apa yang dimaksud dengan biomaterial dan perbedaannya dengan material secara general. LLO 1: <i>Students understand what biomaterials is and its difference with other materials in general.</i>	Non-tes: Tugas 1: Melakukan klasifikasi material (Tugas Tertulis) Tes: ETS Soal 1 (masuk dalam penilaian ETS) Non-test: Task 1: <i>Perform material classification (Written Task)</i> Test: <i>Mid-term examination question 1 (included in the mid-term assessment)</i>	16.67
2-4	Sub CP-MK 2:	Non-tes:	22.22

Mg ke / Week (1)	Sub CP-MK / <i>Lesson Learning Outcomes (LLO)</i> (2)	Bentuk Asesmen (Penilaian) <i>Form of Assessment</i> (3)	Bobot / <i>Load (%)</i> (4)
	<p>Mahasiswa memahami material yang digunakan di bidang biologi dan kedokteran serta karakteristik khusus dari material tersebut.</p> <p>LLO 2: <i>Students understand the materials used in the biology and medical fields and certain characteristics of those materials.</i></p>	<p>Tugas 2: Klasifikasi dan karakteristik dari biomaterial (Tugas Tertulis)</p> <p>Tes: ETS Soal 2 dan 3 (masuk dalam penilaian ETS)</p> <p>Non-test: Task 2: <i>Classification and characteristics of biomaterials (Written Task)</i></p> <p>Test: <i>Mid-term examination questions 2 and 3 (included in the mid-term assessment)</i></p>	
5-7	<p>Sub CP-MK 3:</p> <p>Mahasiswa mampu menjelaskan bagaimana biomaterial berinteraksi dengan tubuh.</p> <p>LLO 3: <i>Students are able to explain how biomaterials interact with the body.</i></p>	<p>Non-tes: Tugas 3: Interaksi biomaterial dengan sel dan jaringan tubuh (Tugas Tertulis)</p> <p>Tes: ETS Soal 4 dan 5 (masuk dalam penilaian ETS)</p> <p>Non-test: Task 3: <i>Biomaterial interactions with cells and body tissues (Written Task)</i></p> <p>Test: <i>Mid-term examination questions 4 and 5 (included in the mid-term assessment)</i></p>	16.67
8	<p>Evaluasi Tengah Semester</p> <p> Mid-Semester Exam</p>	<p>Tes: Ujian Tulis/Ujian Daring</p> <p>Test: <i>Written Exams/Online Examinations</i></p>	
9-12	Sub CP-MK 4:	<p>Non-tes: Tugas 4:</p>	19.44

Mg ke / Week (1)	Sub CP-MK / Lesson Learning Outcomes (LLO) (2)	Bentuk Asesmen (Penilaian) Form of Assessment (3)	Bobot / Load (%) (4)
	<p>Mahasiswa mampu menjelaskan dan menerapkan proses pengujian biomaterial.</p> <p>LLO 4: <i>Students are able to explain and implement the biomaterial testing process.</i></p>	<p>Teknik-teknik pengujian biomaterial (Tugas Tertulis)</p> <p>Tes: EAS Soal 1 dan 2 (masuk dalam penilaian EAS)</p> <p>Non-test: Task 4: <i>Biomaterial testing techniques (Written Task)</i></p> <p>Test: <i>Final examination questions 1 and 2 (included in the final assessment)</i></p>	
13-15	<p>Sub CP-MK 5:</p> <p>Mahasiswa mampu menjelaskan aplikasi biomaterial yang telah tersedia di dunia kedokteran.</p> <p>LLO 5: <i>Students are able to explain the application of biomaterials available in the world of medic.</i></p>	<p>Presentasi: Topik presentasi secara umum mengenai aplikasi biomaterial di dunia kedokteran. Mahasiswa akan dibagi menjadi beberapa grup dan diminta untuk memilih topik khusus presentasi mereka (Tugas Presentasi)</p> <p>Final Project: Penentuan tema final project diberikan pada minggu ke – 8. Proses evaluasi final project dilakukan pada minggu ke – 15 dan 16 (Diskusi)</p> <p>Tes: EAS Soal 3, 4, dan 5 (masuk dalam penilaian EAS)</p> <p>Presentation: <i>General presentation topics regarding the application of biomaterials in medical world. Students will be divided into several groups and asked to choose a specific topic for their presentation (Presentation Task)</i></p> <p>Final Project: <i>Determination of the theme of the final project is given in week 8. The final project evaluation process is carried out on weeks 15 and 16 (Discussion)</i></p> <p>Test: <i>Final examination questions 3, 4, and 5 (included in the final assessment)</i></p>	25
16	Evaluasi Akhir Semester	<p>Tes: Ujian Tulis/Ujian Daring</p>	

Mg ke / Week (1)	Sub CP-MK / <i>Lesson Learning Outcomes (LLO)</i> (2)	Bentuk Asesmen (Penilaian) <i>Form of Assessment</i> (3)	Bobot / <i>Load (%)</i> (4)
	<i>Final Exam</i>	Test: <i>Written Exams/Online Examinations</i>	
Total bobot penilaian <i>Total assessment load</i>			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-03 / PLO-03	CPMK 4 / CLO 4	Week- 9	Task 4	10
		Week- 16	Final Exam Question 1-2	10
CPL-06 / PLO-06	CPMK 1 / CLO 1	Week- 1	Task 1	2.5
		Week- 8	Mid Exam Question 1	4.5
	CPMK 2 / CLO 2	Week- 2	Task 2	5
		Week- 8	Mid Exam Question 2-3	9
	CPMK 3 / CLO 3	Week- 5	Task 3	2.5
		Week- 8	Mid Exam Question 4-5	9
CPL-08 / PLO-08	CPMK 5 / CLO 5	Week- 13	Presentation	15
		Week- 15	Final Project	17.5
		Week- 16	Final Exam Question 3-5	15
				Σ = 100%

No	Form of Assess-ment	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						0.025							0.025
2	Task 2						0.050							0.050
3	Task 3						0.025							0.025
4	Mid Exam						0.250							0.250
5	Task 4				0.100									0.100
6	Presentation				0.150									0.150
7	Final Project				0.175									0.175
8	Final Exam						0.250			0.200				0.225
	Total				0.425		0.375			0.200				1