MODULE HANDBOOK

CHEMISTRY 1

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

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

MODULE HANDBOOK
CHEMISTRY 1

Module name	**CHEMISTRY 1**	
Module level	Undergradute	
Code	SK184101	
Course (if applicable)	Chemistry 1	
Semester	First/Second Semester	
Person responsible for the module	Zjahra Vianita Nugraheni, S.Si., M.Si.	
Lecturer	ITS Chemistry Lecturer Team	
Language	Bahasa Indonesia	
Relation to curriculum	Undergradute degree program, **mandatory**, 1st/2nd semester.	
Type of teaching, contact hours	Lectures, <60 students	
Workload	1. Lectures : 3 x 50 = 150 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	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 are able to use the basic principles of chemistry as a basis for studying science related to chemistry. CLO 2 Students can perform basic chemical calculations	PLO 5,8 PLO 1,5,8
Content	This course studies the basic principles of chemistry which are used as the basis for studying the next subject related to chemistry. The materials presented including atomic theory, chemical bonds, stoichiometry, state of matter and phase changes, acid-base theorem, ionic equilibrium in solution, chemical thermodynamics, chemical kinetics and electrochemistry.	
Study and examination	● In-class exercises ● Assignment 1, 2, 3 ● Mid-term examination	

requirements and forms of examination	● Final examination
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.
Reading list	Main : 1. Tim Dosen Departemen Kimia, (2019). “Kimia 1”, edisi kedua, Media Bersaudara, Surabaya. Supporting : 1. Oxtoby, D.W., Gillis, H.P. and Campion, A., (2012). ”Principles of Modern Chemistry”, 7th Edition, Brooks/Cole. 2. Chang, R. and Goldsby, K., (2012). “Chemistry”, 11th Edition, McGraw-Hill, USA. 3. Goldberg, D. E., (2007). “Fundamental of Chemistry”, 4th Edition, McGraw-Hill Companies

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***
Kimia 1 ***Chemistry 1***	SK184101	UMUM *GENERAL*	T=3	P=0	I/II	07 Januari 2020 January 7th, 2020

OTORISASI / PENGESAHAN ***AUTHORIZATION / ENDORSEMENT***	**Dosen Pengembang RPS** ***Developer Lecturer of Semester Learning Plan***	**Koordinator RMK** ***Course Cluster Coordinator***	**Ka DEPARTEMEN** ***Head of Department***
	Zjahra Vianita Nugraheni, S.Si., M.Si.	Herdayanto S. Putro S.Si., M.Si.	Prof. Dr.rer.nat. Fredy Kurniawan, M.Si.

Capaian Pembelajaran ***Learning Outcomes***	**CPL-PRODI yang dibebankan pada MK** ***PLO Program Charged to The Course***	
	A.1 CPL-01 *A.1 PLO-01*	Memiliki moral, etika, tanggung jawab dan kepribadian yang baik di dalam menyelesaikan tugasnya *Have good morals, ethics, responsibility and personality in completing their duties*
	B.3 CPL-05 *B.3 PLO-05*	Bertanggungjawab pada pekerjaan sendiri dan dapat diberi tanggung jawab atas pencapaian hasil kerja organisasi *Responsible for his own task and can be given responsibility for the achievement of the organization*
	D.1 CPL-08 *D.1 PLO-08*	Mampu mengaplikasikan pola pikir kimia dan memanfaatkan IPTEK pada bidangnya dalam menyelesaikan masalah yang dihadapi *Able to apply chemical mindset and take advantage of science and technology in their fields for solving 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 menggunakan prinsip-prinsip dasar ilmu kimia sebagai dasar dalam mempelajari ilmu yang berkaitan dengan kimia. *Students are able to use the basic principles of chemistry as a basis for studying subject related to chemistry.*

<table>
<tr><td></td><td>CP MK 2
CLO 2</td><td>Mahasiswa dapat melakukan perhitungan-perhitungan dasar kimia
Students can perform basic chemical calculations</td></tr>
<tr><td>Peta CPL – CP MK

Map of PLO - CLO</td><td colspan="2">
<table>
<tr><td></td><td>CPL 1
PLO 1</td><td>CPL 2
PLO 2</td><td>CPL 3
PLO 3</td><td>CPL 4
PLO 4</td><td>CPL 5
PLO 5</td><td>CPL 6
PLO 6</td><td>CPL 7
PLO 7</td><td>CPL 8
PLO 8</td><td>CPL 9
PLO 9</td></tr>
<tr><td>CPMK 1
CLO 1</td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>CPMK 2
CLO 2</td><td>✓</td><td></td><td></td><td></td><td>✓</td><td></td><td></td><td>✓</td><td></td></tr>
</table>
</td></tr>
<tr><td>Diskripsi Singkat MK

Short Description of Course</td><td colspan="2">Mata kuliah ini mempelajari prinsip prinsip dasar ilmu kimia yang digunakan sebagai dasar untuk mempelajari ilmu-ilmu selanjutnya yang berkaitan dengan kimia. Materi yang disampaikan meliputi teori atom, ikatan kimia, stoikhiometri, wujud zat dan perubahan fasa, teori asam basa, kesetimbangan ionik dalam larutan, termodinamika kimia, kinetika kimia dan elektrokimia.

This course studies the basic principles of chemistry which are used as the basis for studying the next subjects related to chemistry. The material presented includes atomic theorem, chemical bonds, stoichiometry, state of matter and phase changes, acid-base theorem, ionic equilibrium in solution, chemical thermodynamics, chemical kinetics and electrochemical.</td></tr>
<tr><td>Bahan Kajian:
Materi pembelajaran

Course Materials:</td><td colspan="2">1. Konsep dasar kimia
2. Model dan struktur atom, Konfigurasi Elektron
3. Ikatan Kimia
4. Stoikhiometri dan Reaksi Kimia
5. Wujud Zat dan Perubahan Fase
6. Larutan, Konsentrasi, Sifat Koligatif
7. Kesetimbangan Kimia, Teori Asam Basa, Kesetimbangan Ionik dalam Larutan (Asam Basa, Kelarutan, Kompleks dan Pengendapan)
8. Termodinamika Kimia
9. Kinetika Kimia
10. Elektrokimia

1. Basic concept of chemistry
2. Atom’s model and structure, electron configuration
3. Chemical bond</td></tr>
</table>

	4. *Stoichiometry and chemical reaction* 5. *State of matter and phase changes* 6. *Solution, concentration, and colligative characteristic* 7. *Chemical equilibrium, acid-base theorem, ionic equilibrium in solution(acid-base, solubility, complex and deposition)* 8. *Chemical thermodynamics* 9. *Chemical kinetics* 10. *Electrochemical*
Pustaka ***References***	**Utama / *Main*:** 1. Halliday & Resnic; 'Fundamental of Physics'. John Wiley and Sons, New York, 1987 2. Tim Dosen, "Diktat Fisika II", ”Soal-soal Fisika II", Fisika FMIPA-ITS 3. Giancoli, DC., (terj, Yuhilza H), 'Fisika, jilid 2', Ertangga, Jakarta, 2001 **Pendukung / *Supporting*:** 1. Alonso & Finn,"Fundamental University Physics", Addison Wesley Pub Comp Inc,13`.ed, Calf, 1990 2. Tipler, PA,(ted. L Prasetio dan R.W.Adi), "Fisika : untuk Sains dan Teknik, Jilid 2", Erlangga, Jakarta, 1998
Dosen Pengampu ***Lecturers***	Zjahra Vianita Nugraheni, S.Si., M.Si.
Matakuliah syarat ***Prerequisite***	-

Mg ke/ ***Week***	**Kemampuan akhir tiap tahapan belajar (Sub-CPMK) /** ***Final ability of each learning stage (LLO)***	**Penilaian /** ***Assessment***		**Bentuk 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	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Konsep Dasar Kimia *Students are able to explain the basic principles of chemistry, including the basic concepts of chemistry*	• Ketepatan dalam menjelaskan konsep dasar kimia • Ketepatan dalam perhitungan (rumus dan satuan) • Ketepatan dalam memberikan contoh konsep dasar kimia dalam kehidupan sehari-hari yang relevan • *Accuracy in explaining basic chemical concepts* • *Accuracy in calculations (formulas and units)* • *Accuracy in providing examples of chemical basic concepts in daily life*	Pemberian contoh soal perhitungan sederhana *Giving examples of simple calculation problems*	● Small Grup discussion [TM:1×(2×50'] [TM:1x(1x50')] ● *Small Grup discussion [FF:1×(2×50'] [FF:1x(1x50')]*		● Kontrak Kuliah ● Proses analisis materi (unsur,senyawa, sifat fisika, sifat kimia) ● Hukum-hukum dasar penggabungan unsur (Proust, Lavoisier, Dalton) ● *Study Contracts* ● *Analysis of matter (elements, compounds, physical properties, chemical properties)* ● *Basic laws of compounding elements (Proust, Lavoisier, Dalton)*	*2*
2	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Model dan Struktur Atom	● Ketepatan dalam menjelaskan konsep struktur atom ● Ketepatan dalam perhitungan model atom sederhana	Pemberian latihan soal *Giving exercises*	● Small Grup discussion [TM:1×(2×50)] [TM:1x(1x50)] [PT:1x(1x60')]		● Perkembangan model dan struktur atom ● Percobaan-percobaan yang mendasarinya	

	Students are able to explain the basic principles of chemistry, including Atomic Model and Structure	• *Accuracy in explaining the concept of atom's structure* • *Accuracy in calculating simple atomic model*		• *Small Group Discussion* [FF:1×(2×50)] [FF:1x(1x50)] [SS : 1x(1x60')]		(Dalton, Thompson, Rutherford, Bohr dan Spektrum Atom Hidrogen) • *Revolution of atomic structure and models* • *The experiments that underlie it (Dalton, Thompson, Rutherford, Bohr and the Atomic Spectrum of Hydrogen)*	
3	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Konfigurasi Elektron dan sifat sistem periodik unsur *Students are able to explain the basic principles of chemistry, including electron configuration and properties of periodic system of elements*	• Ketepatan dalam menjelaskan dan menuliskan konfigurasi elektron dari atom/unsur dan ion • Ketepatan dalam menjelaskan 4 sifat dasar dalam sistem periodik unsur • *Accuracy in explaining and writing down the electron configuration of atoms / elements and ions*	Tugas *Assignment*	• Role-Play & Simulation [TM: 1×(2×50')] • Small Grup Discussion [TM: 1×(1×50')] [PT: 1x(1x60')] • *Role-Play & Simulation* *[FF: 1×(2×50')]* • *Small Grup Discussion* *[FF: 1×(1×50')]* *[SS: 1x(1x60')]*		• Konfigurasi elektron suatu atom/unsur dan ion • Sistem Periodik Unsur • Sifat periodisitas unsur • *Electron configuration of an atom/element and ion* • *Periodic System of Elements*	

		• *Accuracy in explaining 4 basic properties in the periodic system of elements*				• *Periodicity of the elements*	
4	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Ikatan Kimia *Students are able to explain the basic principles of chemistry, including Chemical Bonds*	• Ketepatan dalam menjelaskan konsep pembentukan ikatan kimia • Ketepatan dalam menjelaskan dan membedakan jenis ikatan kimia • *Accuracy in explaining the formation of chemical bond* • *Accuracy in describing and differentiating types of chemical bonds*	Tugas Kelompok *Group task*	• Role-Play & Simulation [TM: 1×(2×50')] • Small Grup Discussion [TM: 1×(1×50')] [PT: 1x(1x60')] • *Role-Play & Simulation [FF: 1×(2×50')]* • *Small Grup Discussion [FF: 1×(1×50')] [SS: 1x(1x60')]*		• Ikatan ionik, kovalen dan kovalen polar • Momen dipol, ikatan logam, ikatan hidrogen, dan ikatan Van der Walls • Struktur dan bentuk geometri molekul (struktur Lewis dan hibridisasi) • *Ionic, covalent and polar covalent bonds* • *Dipole moments, metal bonds, hydrogen bonds, and Van der Walls bonds* • *Structures and geometries of molecule(Lewis structures and hybridization)*	**2**
5	Mahasiswa mampu menjelaskan prinsip-prinsip	Ketepatan melakukan perhitungan yang	Kuis Responsi	Small Grup discussion		• Perhitungan konsep mol	Responsi :2

	dasar kimia, meliputi Konsep Mol, Stoikhiometri dan Sifat Koligatif Larutan *Students are able to explain the basic principles of chemistry, including the Mole Concept, Stoichiometry and Colligative Properties of Solutions*	berkaitan dengan konsentrasi larutan, stoikhiometri dan sifat koligatif larutan. *The accuracy of performing calculations related to solution concentration, stoichiometry and colligative properties of solutions.*	*Quiz* *Review session*	[TM: 1×(2×50')] [TM: 1x(1x50')] [PT: 1x(1x60')] *Small Grup discussion* *[FF: 1×(2×50')]* *[FF: 1x(1x50')]* *[SS: 1x(1x60')]*		● Rumus empiris dan rumus molekul ● Satuan Konsentrasi(M, m, N, F, %, ppm, ppb) ● Stoikhiometri dalam Larutan ● Sifat Koligatif Larutan ● *Concept in calculation of the mole* ● *Empirical formula and molecular formula* ● *Unit of Concentration (M, m, N, F,%, ppm, ppb)* ● *Stoichiometry in Solutions* ● *Colligative Properties of Solutions*	Kuis: 15 *Review session: 2* *Quiz: 15*
6-7	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia meliputi Wujud Zat dan Perubahan Fasa. *Students are able to explain the basic principles of*	● Ketepatan dalam menjelaskan konsep perbedaan 3 macam wujud zat beserta sifat-sifatnya ● Ketepatan dalam perhitungan yang	Kuis Tugas *Quiz* *Assignment*	● Small Grup discussion [TM: 1×(2×50')] [TM: 1x(1x50')] ● *Small Grup discussion*	Self directed learning [BM: 1×(1×50')] Grup discussion [TM: 1x(2x50')] [PT: 1x(1x60')]	● Wujud Gas (Hukum-hukum gas dan sifat fisiknya). ● Wujud Cair (sifat fisik cairan: tekanan uap, titik	**2**

	chemistry including state of matter and Phase Change.	berkaitan dengan 3 wujud zat tersebut (gas, cair dan padat) ● Ketepatan dalam menentukan struktur suatu zat padat dan menjelaskan konsep analisis dasar zat padat menggunakan XRD ● *Accuracy in explaining concepts of 3 kinds of state and their properties* ● *Accuracy in calculations relating to the 3 state of the matter (gas, liquid and solid)* ● *Accuracy in determining the structure of a solid and explaining the concept of basic solid analysis using XRD*		*[FF: 1×(2×50')]* *[FF: 1x(1x50')]*	*Self directed learning* *[SA: 1×(1×50')]* *Grup discussion* *[FF: 1x(2x50')]* *[SS: 1x(1x60')]*	didih, tegangan permukaan, viskositas) ● Wujud Padat (kisi Kristal, kubus sederhana, kubus berpusat muka, kubus berpusat badan, indeks Miller, persamaan Bragg) ● *Gas state (gas laws and physical properties).* ● *Liquid state (physical properties of liquids: vapor pressure, boiling point, surface tension, viscosity)* ● *Solid Form (Crystal lattice, simple cube, face centered cube, body centered cube, Miller index, Bragg equation)*	
8	**EVALUASI TENGAH SEMESTER**						**25**

	MID-TERM EXAM						
9	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Kesetimbangan Kimia *Students are able to explain the basic principles of chemistry, including Chemical Equilibrium*	• Ketepatan dalam menjelaskan konsep dasar kesetimbangan kimia • Ketepatan dalam melakukan perhitungan yang berkaitan dengan kesetimbangan kimia • Ketepatan dalam menjelaskan faktor-faktor yang mempengaruhi kesetimbangan kimia • *Accuracy in explaining the basic concepts of chemical equilibrium* • *Accuracy in performing calculations related to chemical equilibrium* • *Accuracy in describing the factors affecting chemical equilibrium*	Responsi *Review session*		• Self directed learning [BM: 1×(1×50')] • Grup discussion [TM: 1x(2x50')] [PT: 1x(1x60')] • *Self directed learning [SA: 1×(1×50')]* • *Grup discussion [FF: 1x(2x50')] [SS: 1x(1x60')]*	• Konsep Kesetimbangan Kimia dan Tetapan Kesetimbangan (Quotient reaksi, tetapan kesetimbangan Kp dan Kc) • Asas Le Chatelier • Faktor-faktor yang mempengaruhi kesetimbangan kimia • *Concepts of Chemical Equilibrium and Equilibrium Constants (reaction quotient, equilibrium constants Kp and Kc)* • *Le Chatelier's Principle* • *Factors affecting chemical equilibrium*	**2**

10-11	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Kesetimbangan Ionik dalam Larutan *Students are able to explain the basic principles of chemistry, including Ionic Equilibrium in Solutions*	• Ketepatan dalam menjelaskan konsep dasar kesetimbangan ionik dalam larutan • Ketepatan dalam menjelaskan sifat asam-basa dalam larutan • Ketepatan melakukan perhitungan untuk menentukan kekuatan asam-basa dan juga sifat-sifatnya • *Accuracy in explaining the basic concepts of ionic equilibrium in solutions* • *Accuracy in explaining acid-base properties in solution* • *Accuracy in performing calculations to determine acid-base strength and its properties*	Tugas *Assignment*		• Self directed learning [TM: 1×(1×50')] • Grup discussion [BM: 1x(2x50')] [PT: 1x(1x60')] • *Self directed learning [FF: 1×(1×50')]* • *Grup discussion [SA: 1x(2x50')] [SS: 1x(1x60')]*	• Teori Asam Basa (Teori Arrhenius, Brønsted-Lowry, Teori Lewis) • Derajat ionisasi dan tetapan ionisasi • Kekuatan Asam Basa • Larutan Buffer • Kesetimbangan ionik antara zat padat dan larutan • *Acid-Base Theorem (Arrhenius theorem, Brønsted-Lowry Theorem, Lewis Theorem)* • *Ionization degree and ionization constant* • *Acid-Base Strength* • *Buffer Solution* • *Ionic equilibrium between solid and solution*	**2,5**
12	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi, Termodinamika Kimia dan Termokimia	• Ketepatan dalam menjelaskan konsep, kondisi dan proses dasar termodinamika kimia	Responsi *Review session*		• Self directed learning [BM: 1×(1×50')] • Grup discussion [TM: 1x(2x50')] [PT: 1x(1x60')]	• Konsep termodinamika (prinsip, keadaan dan proses) • Hukum I Termodinamika:	**2,5**

	Students are able to explain the basic principles of chemistry including Chemical Thermodynamics and Thermochemistry	• Ketepatan dalam melakukan perhitungan yang berkaitan dengan hukum Termodinamika I dan II • Ketepatan dalam menuliskan reaksi dan melakukan perhitungan untuk menjelaskan kespontanan reaksi kimia • *Accuracy in explaining the concepts, conditions and basic processes of chemical thermodynamics* • *Accuracy in performing calculations related to Thermodynamic Laws I and II* • *Accuracy in writing down reactions and performing calculations to explain spontantaneity of chemical reaction*			• *Self directed learning [SA: 1×(1×50')]* • *Grup discussion [FF: 1x(2x50')] [SS: 1x(1x60')]*	energi dalam, kerja dan kalor • Kapasitas panas, kalorimetri dan entalpi • Hukum II Termodinamika dan spontanitas • Termokimia serta penggunaannya untuk menjelaskan kespontanan reaksi kimia • Perhitungan yang berkaitan dengan aplikasi mesin Carnot • *Thermodynamic concepts (principles, states and processes)* • *First Law of Thermodynamics: internal energy, work and heat* • *Heat capacity, calorimetry and enthalpy* • *Second Law of Thermodynamics and Spontaneity*	

						• *Thermochemistry and its usage to describe the spontaneity of chemical reactions* • *Calculations related to the Carnot engine application*	
13	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi Kinetika Kimia *Students are able to explain the basic principles of chemistry including Chemical Kinetics.*	• Ketepatan dalam menjelaskan konsep dasar kinetika kimia • Ketepatan dalam melakukan perhitungan yang berkaitan dengan laju reaksi, orde dan konstanta laju reaksi • Ketepatan dalam menjelaskan tahapan penentuan laju reaksi dan faktor-faktor yang mempengaruhi laju reaksi • *Accuracy in explaining the basic concepts of chemical kinetics* • *Accuracy in performing calculations related to reaction rates, orders and reaction rate constants*	Responsi Kuis *Review session* *Quiz*		• Self directed learning [BM: 1×(1×50')] • Grup discussion [TM: 1x(2x50')] [PT: 1x(1x60')] • *Self directed learning [SA: 1×(1×50')]* • *Grup discussion [FF: 1x(2x50')] [SS: 1x(1x60')]*	• Konsep kinetika kimia • Laju dalam reaksi kimia • Penentuan laju reaksi, orde dan konstanta laju reaksi • Pengaruh suhu pada laju reaksi • Reaksi elementer • Katalis • *The concept of chemical kinetics* • *Rate of chemical reaction* • *Determination of reaction rate, order and rate constants* • *Effect of temperature on reaction rate* • *Elementary reactions*	Responsi :2.5 Kuis: 15 *Review session: 2,5* *Quiz: 15*

		● *Accuracy in explaining the steps for determining the reaction rate and the factors that affect the reaction rate*				● *Catalyst*	
14	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi Elektrokimia *Students are able to explain the basic principles of chemistry including electrochemistry*	● Ketepatan dalam menjelaskan konsep dasar eektrokimia ● Ketepatan dalam menuliskan sel elektrokimia ● Ketepatan dalam melakukan perhitungan yang menggunakan prinsip dasar elektrokimia (sel volta dan elektrolisis) ● Ketepatan dalam menjelaskan prinsip dasar korosi dan pencegahannya ● *Accuracy in explaining the basic concepts of electrochemistry* ● *Accuracy in writing down electrochemical cells* ● *Accuracy in performing calculations using basic electrochemical*	Responsi *Review session*		● Self directed learning [BM: 1×(1×50')] ● Grup discussion [TM: 1x(2x50')] [PT: 1x(1x60')] ● *Self directed learning [SA: 1×(1×50')]* ● *Grup discussion [FF: 1x(2x50')] [SS: 1x(1x60')]*	● Konsep reaksi redoks ● Sel elektrokimia (elektroda dan larutan elektrolit dalam sel elektrokimia) ● Pengaruh konsentrasi dan persamaan Nerst ● Penggunaan konsep elektrokimia untuk aplikasi sel volta (baterei dan Fuel Cells) serta elektrolisis ● Korosi dan pencegahan korosi ● *The concept of the redox reaction* ● *Electrochemical cells (electrodes and electrolyte solutions in electrochemical cells)*	**2,5**

		principles (voltaic cells and electrolysis) ● *Accuracy in explaining the basic principles of corrosion and its prevention*				● *Effect of concentration and Nerst equations* ● *Use of electrochemical concepts for voltaic cell applications (batteries and Fuel Cells) and electrolysis* ● *Corrosion and corrosion prevention*	
15-16	**EVALUASI AKHIR SEMESTER** ***FINAL-SEMESTER EXAM***						**25**

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 : Probability and Statistics**		**RA&E** Write Doc Code
Kode/*code*: **EB184302**	**Bobot sks/*credits* (T/P): 2/0**	**Rumpun MK: Ilmu Dasar Teknik** ***Course Cluster: Basic Engineering***	Smt: III
OTORISASI ***AUTHORIZATION***	**Penyusun RA & E** ***Compiler A&EP***	**Koordinator RMK** ***Course Cluster Coordinator*** Herdayanto S. Putro S.Si., M.Si.	**Ka DEP** ***Head of DEP*** Prof. Dr.rer.nat. Fredy Kurniawan, M.Si.

Mg ke/ *Week* (1)	**Sub CP-MK / *Lesson Learning Outcomes (LLO)* (2)**	**Bentuk Asesmen (Penilaian) *Form of Assessment* (3)**	**Bobot / *Load* (%) (4)**
1	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Konsep Dasar Kimia	Diskusi dalam kelompok kecil mengenai konsep dasar kimia dan pemecahan masalah terkait perhitungan kimia dasar	*2*

	Students are able to explain the basic principles of chemistry, including the basic concepts of chemistry	*Small group discussion about basic concept of chemistry and solving problems related to calculations in basic chemistry*	
2	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Model dan Struktur Atom *Students are able to explain the basic principles of chemistry, including Atomic Model and Structure*	Pemberian latihan soal berkaitan dengan konsep struktur atom dan perhitungan model atom sederhana *Providing exercises related to concept of atomic structure and calculations of simple atomic model.*	
3	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Konfigurasi Elektron dan sifat sistem periodik unsur *Students are able to explain the basic principles of chemistry, including electron*	Diskusi berkelompok dan melakukan simulasi konfigurasi elektron *Group discussion and simulation of electron configuration*	

	configuration and properties of periodic system of elements		
4	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Ikatan Kimia *Students are able to explain the basic principles of chemistry, including Chemical Bonds*	Membuat permainan peran berhubungan dengan ikatan kimia *Creating a role-playing related to chemical bonds*	**2**
5	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Konsep Mol, Stoikhiometri dan Sifat Koligatif Larutan *Students are able to explain the basic principles of chemistry, including the Mole Concept, Stoichiometry and Colligative*	Penggunaan rumus empiris dan rumus molekul untuk menyelesaikan permasalahan kimia Menjelaskan konsep stoikiometri dan sifat koligatif larutan *The usage of empirical and molecular formula in solving chemical problem* *Explain the concept of stoichiometry and colligative properties of solution*	Responsi: 2 Kuis: 15 *Review session: 2* *Quiz: 15*

	Properties of Solutions		
6-7	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia meliputi Wujud Zat dan Perubahan Fasa. *Students are able to explain the basic principles of chemistry including state of matter and Phase Change.*	Diskusi dalam grup kecil mengenai wujud zat dan perubahan fasa *Small group discussion about state of matter and phase change*	**2**
8	**EVALUASI TENGAH SEMESTER** ***MID-TERM EXAM***	**Tes:** Ujian Tulis/Ujian Daring ***Test:*** *Writing Exams / Online Exams*	**25**
9	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Kesetimbangan Kimia *Students are able to explain the basic principles of*	Menjelaskan konsep dasar kesetimbangan kimia, perhitungan yang berkaitan dengan kesetimbangan kimia, dan faktor-faktor yang mempengaruhi kesetimbangan kimia *Explaining the concept of chemical equilibrium, calculations related to chemical equilibrium, and factors affecting chemical equilibrium*	**2**

	chemistry, including Chemical Equilibrium		
10-11	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Kesetimbangan Ionik dalam Larutan *Students are able to explain the basic principles of chemistry, including Ionic Equilibrium in Solutions*	Memberikan tugas untuk menonton video yang berhubungan dengan kesetimbangan ionik dalam larutan *Giving assignment to watch a video about ionic equilibrium in solutions*	**2,5**
12	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi, Termodinamika Kimia dan Termokimia *Students are able to explain the basic principles of chemistry including Chemical Thermodynamics*	Melakukan percobaan mengenai termodinamika dan termokimia *Doing experiments about thermodynamics and thermochemistry*	**2,5**

	and Thermochemistry		
13	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi Kinetika Kimia *Students are able to explain the basic principles of chemistry including Chemical Kinetics.*	Memberikan soal kuis mengenai kinetika kimia *Giving a quiz about chemical kinetics*	Responsi: 2.5 Kuis: 15 *Review session: 2,5* *Quiz: 15*
14	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi Elektrokimia *Students are able to explain the basic principles of chemistry including electrochemistry*	Melakukan percobaan mengenai kinetika kimia *Doing experiments about chemical kinetics*	**2,5**
15-16	**EVALUASI AKHIR SEMESTER**	**Tes:** Ujian Tulis/Ujian Daring	**25**

	FINAL-SEMESTER EXAM	***Test:*** *Writing Exams / Online Exams*	
		Total bobot penilaian ***Total assessment load***	

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-01 / *PLO-01*	CPMK 2 / *CLO 2*	Minggu ke-1/*Week- 1*	Diskusi kelompok/*Group discussion*	2
		Minggu ke-2/*Week- 2*	Latihan soal/*Exercises*	
		Minggu ke 3/*Week- 3*	Tugas/*Assignment*	
		Minggu ke-8/*Week-8*	Evaluasi Tengah Semester/*Mid-Term Exam*	25
		Week- 16	*Final Exam Question 1 and 2*	16
CPL-05/*PLO-05*	CPMK 1 / *CLO 1*	Minggu ke-4/*Week 4*	Tugas kelompok/*Group task*	2
	CPMK 2 / *CLO 2*	Minggu ke-13/*Week 13*	Responsi/*Review session*	2
		Minggu ke-14/*Week 14*	Responsi/*Review session*	2
CPL-08 / *PLO-08*	CPMK 1 / *CLO 1*	Minggu ke-9/Week-9	Responsi/*Review session*	2
	CPMK 2 / *CLO 2*	Minggu ke-5/*Week- 5*	Kuis dan responsi/*Quiz and review session*	2+15
		Minggu 6-7/*Week 6-7*	Kuis dan tugas/*Quiz and assignment*	2

		Minggu ke-10-11/*Week 10-11*	Tugas/*Assignment*	2,5
		Minggu ke-12/*Week 12*	Responsi/*Review session*	2,5
		Week- 16	*Final Exam Question 4*	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*	0.12				0.05			0.1					**0.27**
2	*Task 2*	0.05							0.05					**0.1**
3	*Task 3*					0.03			0.07					**0.1**
4	*Mid Exam*	0.09				0.07			0.06					**0.22**
5	*Final Exam*	0.15				0.07			0.09					**0.31**
	Total	0.41				0.22			0.37					**1**