

MODULE HANDBOOK
CHEMISTRY



**BACHELOR DEGREE PROGRAM
DEPARTMENT OF
MATHEMATICS
FACULTY OF SCIENCE AND DATA ANALYTICS
INSTITUT TEKNOLOGI SEPULUH NOPEMBER**

ENDORSEMENT PAGE



MODULE HANDBOOK CHEMISTRY DEPARTMENT OF MATHEMATICS INSTITUT TEKNOLOGI SEPULUH NOPEMBER

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>	Arif Fadlan, DSc	Dosen <i>Lecturer</i>		March 28, 2019
Pemeriksa dan Pengendalian <i>Review and Control</i>	Dr. Afifah R, Msi; Dr. Eko Santoso, MSi; Dr. Hendro Juwono, Msi; Dr. Triyanda Gunawan; Dr.Yuly Kusumawati, Msi; Dra. Ita Ulfin, Msi; Dra. Harmami, MS; Drs. Agus Wahyudi, MS; Drs. Djarot S, MS; Drs. Refdinal Nafwa, MSc; Hamdan Dwi R, MSi; Herdayanto S P, MSi ; Lukman Atmaja, PhD; Prof. Dr. Djoko Hartanto, Msi; Prof. Dr. Fahimah Martak, MSi; Prof. Dr. rer. nat. Irminda Kris Murwani; Prof. Fredy K; Prof. Syafsir Akhlus ; Ratna Ediaty, PhD; Suprpto PhD; Yatim L.Nimah, PhD; Zjandra Vianita, Msi	Tim kurikulum <i>Curriculum team</i>		April 15, 2019
Persetujuan <i>Approval</i>		Koordinator RMK <i>Course Cluster Coordinator</i>		July 17, 2019
Penetapan <i>Determination</i>	Subchan, S.Si, M.Sc, Ph.D	Kepala Departemen <i>Head of Department</i>		July 30, 2019

MODULE HANDBOOK

CHEMISTRY

Module name	Chemistry	
Module level	Undergraduate	
Code	UG184101	
Course (if applicable)	Chemistry	
Semester	1 st semester	
Person responsible for the module	Arif Fadlan, DSc	
Lecturer	Arif Fadlan, DSc; Dr. Afifah R, Msi; Dr. Eko Santoso, MSi; Dr. Hendro Juwono, Msi; Dr. Triyanda Gunawan; Dr.Yuly Kusumawati, Msi; Dra. Ita Ulfir, Msi; Dra. Harmami, MS; Drs. Agus Wahyudi, MS; Drs. Djarot S, MS; Drs. Refdinal Nafwa, MSc; Hamdan Dwi R, MSi; Herdayanto S P, MSi ; Lukman Atmaja, PhD; Prof. Dr. Djoko Hartanto, Msi; Prof. Dr. Fahimah Martak, MSi; Prof. Dr. rer. nat. Irmira Kris Murwani; Prof. Fredy K; Prof. Syafsir Akhlus ; Ratna Ediaty, PhD; Suprpto PhD; Yatim L.Nimah, PhD; Zjakra Vianita, Msi	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory , 1 st semester.	
Type of teaching, contact hours	Lectures, <50 students	
Workload	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 80% of the lectures to sit in the exams.	
Mandatory prerequisites	-	
Learning outcomes and their corresponding PLOs	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.1
Content	Basic Chemistry is a course which is designed for the understanding and application of the concept and scientific chemistry principal exclude specific materials. This approach depends on the requirement of the student to improve the ability relating to the broadened technology analysis instead of the specific materials for the short term relevance. Providing practice materials is also the main aspect to support the teaching and learning of the Basic Chemistry course. This course is divided into two levels, namely main ideas and extension ideas.	

	Main ideas: The three parts in the main part are Material, Structure and Properties, and Transformation. These three concepts are related and turn into basic in learning and understanding phenomena and chemical reactions afterwards. Extension ideas: The concept of the main ideas are developed to be learning in a different chemical system, such as the chemistry of organic compounds and transition elements. For example, the understanding of the concept of chemical bonds and the periodic table is developed to the chemistry approach in transition metals. Thus, the students are able to learn and appreciate the similarities and differences when comparing them to the major metal groups. The learning strategies used in this course are lecture, discussion, assignments, and practice in the laboratory.
Study and examination requirements and forms of examination	• In-class exercises • Assignment • Mid-term exam • Final exam
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.
Reading list	Tim Dosen Departemen Kimia ITS. 2018. Kimia 1. Edisi pertama. Penerbit Media Bersaudara.

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	Kode Mata Kuliah	UG.184101
	Semester	I
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RP-S1	Dosen Pengampu	Tim Dosen Kimia Dasar

Bahan Kajian <i>Study Materials</i>	Konsep Dasar Kimia, Model dan Struktur Atom, Konfigurasi Elektron dan Ikatan Kimia, Stoikiometri dan Reaksi Kimia, Wujud Zat dan Perubahan Fasa, Kestimbangan Kimia, Teori Asam Basa, Kestimbangan Ionik dalam Larutan (Asam Basa, Kelarutan, Kompleks dan Pengendapan), Termodinamika Kimia, Kinetika Kimia dan Elektrokimia <i>Basic Concepts of Chemistry, Atomic Model and Structure, Electron Configuration and Chemical Bonds, Stoichiometry and Chemical Reactions, State of matter and Phase Transition, Chemical Equilibrium, Acid-Base Theory, Ionic Equilibrium in Solutions (Acid-Base, Solubility, Complexes and Precipitation), Chemical Thermodynamics, Chemical and Electrochemical Kinetics</i>
CPL yang dibebankan MK <i>PLO</i>	CPL 1. Mahasiswa mampu mengidentifikasi dan menjelaskan pondasi matematika yang meliputi murni, terapan dan dasar-dasar komputasi <i>PLO1. Students are able to identify and explain foundations of mathematics that include pure, applied, and the basic of computing</i>
CP-MK <i>CLO</i>	CPMK.1 Mahasiswa mampu menggunakan prinsip-prinsip dasar ilmu kimia sebagai dasar dalam mempelajari ilmu yang berkaitan dengan kimia. CPMK.2 Mahasiswa dapat melakukan perhitungan-perhitungan dasar kimia. <i>CLO.1 Students are able to use the basic principles of chemistry as a basis for studying science related to chemistry.</i> <i>CLO.2 Students can perform basic chemical calculations.</i>

Perte- muan <i>Meeting</i>	Kemampuan Akhir Sub CP-MK <i>Final Ability</i>	Keluasan (materi pembelajaran) <i>Extent (learning material)</i>	Metode Pembelajaran <i>Learning methods</i>	Estimasi Waktu <i>Duration</i>	Bentuk Evaluasi <i>Evaluation Type</i>	Kriteria dan Indikator Penilaian <i>Assessment Criteria and Indicators</i>	Bobot Penilaian <i>Scoring</i>
1	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Konsep Dasar Kimia <i>Students are able to explain the basic principles of chemistry,</i>	- Kontrak Kuliah - Proses analisis materi (unsur, senyawa, sifat fisika, sifat kimia) - Hukum-hukum dasar penggabungan unsur (Proust, Lavoisier, Dalton) <i>Course agreement</i> <i>The process of material analysis (elements,</i>	Kuliah (Tatap muka) <i>Lecture</i>	TM:(2x50')+(1x50')]		- Ketepatan dalam menjelaskan konsep dasar kimia - Ketepatan dalam perhitungan (rumus dan satuan) - Contoh yang relevan <i>The appropriateness in explain the basic concept of chemistry</i> <i>The appropriateness in the calculation (formula and unit)</i> <i>The appropriate examples</i>	

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	<i>including the Basic Chemistry concept</i>	<i>compounds, physical properties, chemical properties</i> <i>Fundamental laws of combining the compounds (Proust, Lavoisier, Dalton)</i>					
2	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Model dan Struktur Atom <i>Students are able to explain the basic principles of chemistry, including the atomic model and structure</i>	- Perkembangan model dan struktur atom - Percobaan-percobaan yang mendasarinya (Dalton, Thompson, Rutherford, Bohr dan Spektrum Atom Hidrogen) <i>Development of atomic models and structures</i> <i>Underlying experiments (Dalton, Thompson, Rutherford, Bohr and the Atomic Spectrum of Hydrogen)</i>	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2×50')+(1×50')]	Tugas <i>Assignment</i>	- Ketepatan dalam menjelaskan konsep - Ketepatan dalam perhitungan <i>The appropriateness in explain the concept</i> <i>The appropriateness in the calculation</i>	5%
3	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia,	- Perhitungan konsep mol - Rumus empiris dan rumus molekul - Satuan Konsentrasi (M, m, N, F, %, ppm, ppb)	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2×50')+(1×50')]	Tugas <i>Assignment</i>	Ketepatan perhitungan yang berkaitan dengan konsentrasi larutan, stoikiometri dan sifat koligatif larutan.	5%

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	meliputi Konsep Mol, Stoikiometri <i>Students are able to explain the basic principles of chemistry, including the Mole and Stoichiometry Concept</i>	- Stoikiometri dalam Larutan <i>Calculation of the mole concept</i> <i>Empirical formula and molecular formula</i> <i>Concentration units (M, m, N, F, %, ppm, ppb)</i> <i>Stoichiometry in Solution</i>				<i>The appropriateness in the calculation related to the solution concentration, stoichiometry and colligative properties of the solution.</i>	
4	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Konfigurasi Elektron dan Ikatan Kimia <i>Students are able to explain the basic principles of chemistry, including the Electron Configuration and Chemical Bonds</i>	- Konfigurasi elektron suatu unsur dan ion - Sistem Periodik Unsur - Sifat periodisitas unsur - Ikatan Ionik <i>The electron configuration of an element and an ion</i> <i>Periodic System of the Elements</i> <i>The periodicity of the elements</i> <i>Ionic Bonds</i>	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Tugas <i>Assignment</i>	Ketepatan dalam menjelaskan konsep <i>The appropriateness in explain the concept</i>	10%

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5	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Ikatan Kimia <i>Students are able to explain the basic principles of chemistry, including the Chemical Bonds</i>	• Ikatan kovalen dan kovalen polar, momen dipol, ikatan logam, ikatan hidrogen, dan ikatan Van der Waals • Struktur dan bentuk geometri molekul (struktur Lewis, dan hibridisasi) • <i>Covalent bonds and Polar covalent, dipole moment, metal bonds, hydrogen bonds, and Van der Waals bonds</i> • <i>Molecular structures and geometries (Lewis structures, and hybridization)</i>	Kuliah (Tatap Muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Quiz <i>Quiz</i>	• Ketepatan dalam menjelaskan konsep • Ketepatan dalam menjelaskan dan membedakan jenis ikatan kimia • <i>The appropriateness in explain the concept</i> • <i>The appropriateness in explain and distinguish the chemical bonds</i>	
6	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia meliputi Wujud Zat dan Perubahan Fasa <i>Students are able to explain the basic principles of</i>	• Wujud Gas (Hukum-hukum gas dan sifat fisiknya) • Wujud Cair (sifat fisik cairan: tekanan uap, titik didih, tegangan permukaan, viskositas) • <i>Gas State (Gas laws and physical properties)</i> • <i>Liquid state (physical properties of liquids: vapor</i>	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Tugas <i>Assignment</i>	• Ketepatan dalam menjelaskan konsep • Ketepatan dalam perhitungan • <i>The appropriateness in explain the concept</i> • <i>The appropriateness in the calculation</i>	5%

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	<i>chemistry, including</i>	<i>pressure, boiling point, surface tension, viscosity)</i>					
7	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia meliputi Wujud Zat dan Perubahan Fasa <i>Students are able to explain the basic principles of chemistry, including the State of matter and Phase Transition</i>	Wujud Padat (kisi Kristal, kubus sederhana simple cube, kubus berpusat muka face centered cube, kubus berpusat badan body centered cube, indeks Miller, persamaan Bragg) <i>Solid state (Crystal lattice, simple cube, face centered cube, body centered cube, Miller index, Bragg equation)</i>	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2×50')+(1×50')]	Tugas <i>Assignment</i>	• Ketepatan dalam menjelaskan konsep • Ketepatan dalam perhitungan • <i>The appropriateness in explain the concept</i> • <i>The appropriateness in the calculation</i>	5%
8	ETS MIDTERM EXAM						20%
9	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Kesetimbangan Ionik dalam Larutan	• Teori Asam Basa (Teori Arrhenius, Brønsted-Lowry, Teori Lewis) • Derajat ionisasi dan tetapan ionisasi • Kekuatan Asam Basa	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2×50')+(1×50')]	Tugas <i>Assignment</i>	• Ketepatan dalam konsep • Ketepatan dalam perhitungan • <i>The appropriateness in the concept</i> • <i>The appropriateness in the calculation</i>	10%

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	<i>Students are able to explain the basic principles of chemistry, including the Ionic Equilibrium in Solutions</i>	• Acid-Base Theory (Arrhenius, Brønsted-Lowry Theory, Lewis Theory) • Ionization degree and ionization constant • Acid-Base Strength					
10	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Keseimbangan Ionik dalam Larutan <i>Students are able to explain the basic principles of chemistry, including the Ionic Equilibrium in Solutions</i>	• Teori Asam Basa (Teori Arrhenius, Brønsted-Lowry, Teori Lewis) • Derajat ionisasi dan tetapan ionisasi • Kekuatan Asam Basa • Acid-Base Theory (Arrhenius, Brønsted-Lowry Theory, Lewis Theory) • Ionization degree and ionization constant • Acid-Base Strength	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Tugas Quiz <i>Assignment Quiz</i>	• Ketepatan dalam konsep • Ketepatan dalam perhitungan • <i>The appropriateness in the concept</i> • <i>The appropriateness in the calculation</i>	
11	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi,	• Konsep termodinamika (prinsip, keadaan dan proses) • Hukum I Termodinamika: energi dalam, kerja dan kalor	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Tugas <i>Assignment</i>	• Ketepatan dalam konsep • Ketepatan dalam perhitungan • <i>The appropriateness in the concept</i>	5%

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	Termodinamika Kimia dan Termokimia <i>Students are able to explain the basic principles of chemistry, including the Chemical Thermodynamics and Thermochemistry</i>	• 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 • <i>Thermodynamic concepts (principles, states and processes)</i> • <i>First Law of Thermodynamics: internal energy, work and heat</i> • <i>Heat capacity, calorimetry and enthalpy</i> • <i>Second Law of Thermodynamics and Spontaneity</i> • <i>Thermochemistry and its application to explain the spontaneity of chemical reactions</i>				• <i>The appropriateness in the calculation</i>	

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		• <i>Calculations related to the Carnot engine application</i>					
12	Mahasiswa mampu menjelaskan prinsip-prinsip dasar kimia, meliputi Keseimbangan Kimia <i>Students are able to explain the basic principles of chemistry, including the Chemical Equilibrium</i>	• Konsep Keseimbangan Kimia dan Tetapan Keseimbangan (Quotient reaksi, tetapan keseimbangan Kp dan Kc) • Asas Le Chatelier • Faktor-faktor yang mempengaruhi keseimbangan kimia • <i>The concept of chemical equilibrium and the equilibrium constant (reaction quotient, equilibrium constant Kp and Kc)</i> • <i>The Le Chatelier's Principle</i> • <i>Factors affecting chemical equilibrium</i>	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Tugas <i>Assignment</i>	• Ketepatan dalam konsep • Ketepatan dalam perhitungan • <i>The appropriateness in the concept</i> • <i>The appropriateness in the calculation</i>	5%
13	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi Kinetika Kimia	• Konsep kinetika kimia • Laju dalam reaksi kimia • Penentuan laju reaksi, orde dan konstanta laju reaksi • Pengaruh suhu pada laju reaksi • Reaksi elementer	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Tugas <i>Assignment</i>	• Ketepatan dalam menjelaskan konsep • Ketepatan dalam perhitungan • <i>The appropriateness in explain the concept</i> • <i>The appropriateness in the calculation</i>	5%

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	<i>Students are able to explain the basic principles of chemistry, including the Chemical Kinetics</i>	• Katalis • <i>The concept of chemical kinetics</i> • <i>Chemical reaction rate</i> • <i>Determination of the reaction rate, order and rate constant</i> • <i>Effect of temperature on reaction rate</i> • <i>Elementary reaction</i> • <i>Catalyst</i>					
14	Mahasiswa mampu menjelaskan prinsip-prinsip dasar ilmu kimia meliputi Elektrokimia <i>Students are able to explain the basic principles of chemistry, including Electrochemical</i>	• 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 • <i>Redox reaction concept</i> • <i>Electrochemical cells (electrodes and electrolyte)</i>	Kuliah (Tatap muka) <i>Lecture</i>	[TM:(2x50')+(1x50')]	Tugas <i>Assignment</i>	• Ketepatan dalam menjelaskan konsep • Ketepatan dalam perhitungan • <i>The appropriateness in explain the concept</i> • <i>The appropriateness in the calculation</i>	5%

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		<i>solutions in electrochemical cells)</i> • <i>Effect of concentration and the Nerst equation</i> • <i>The use of electrochemical concepts for voltaic cell applications (batteries and Fuel Cells) and electrolysis</i> • <i>Corrosion and corrosion prevention</i>					
15-16	EAS FINAL EXAM						20%

Catatan:

* Presentasi, tugas, diskusi, quiz, praktikum lab

Notes:

**Presentation, Assignment, Discussion, Quiz, Practice*

PUSTAKA/REFERENCES: -