

## Module/Course Description

### Chemistry (KIM101)

A. Module Identity		
1.	Name	Chemistry
2.	Code	KIM101
3.	Credit	3 (2-3)
4.	Semester	1 / 2
5.	Pre-requisite	-
6.	Coordinator	
7.	Lecturers	Lecturer Team of Departement of Chemistry, Faculty of Mathematics and Natural Sciences
8.	Language	Indonesian
9.	Program(s) in which the course is offered	Internal department: Forest Management Study Program Other departments: all study programs offered by IPB University
10.	Type of teaching	a. Traditional classroom: 100 % b. Blended system: Traditional classroom....%, Online....% c. e-Learning system: .....% d. Others: .....%

B. Workload of course components (total contact hours and credits per semester)								
Credit		Contact Hours				Self-Study	Other	Total
SKS *)	ECTS	Lecture	Exercise	Laboratory	Practice			
<b>3</b>		<b>28</b>		<b>42</b>		<b>56</b>		<b>126</b>

\*) Semester credit unit according to the Indonesian higher educational system

1 credit unit lecture = 2 hours/ week for lecture and 2 hours/ week for self-study within 14 weeks/ semester

1 credit unit class exercise or laboratory or field practice = 3 hours/week within 12-14 weeks/semester

\*\*\*) 1 hour for lecture= 50 minutes; 1 hour for class exercise or laboratory or field practice = 60 minutes

C. Module Objective (Learning Outcomes)
After completing this course, students are able to explain the basic concepts of chemistry, including an understanding of the nature of modern chemistry; chemical equations and reaction products; chemical bonds; substance form; concept of solution; thermodynamics, chemical equilibrium; acid-base; electrochemistry; chemical kinetics; coordination chemistry; introduction of organic compounds; and introduction of organic polymers.

D. Detailed Course Learning Outcomes (LO) in Relation to Learning Domains, Teaching Strategies, and Assignment Methods			
No.	LO in Learning Domains	Teaching Strategies	Assessment Methods
<b>a.</b>	<b>Knowledge</b>		
1.	Students are able to explain the importance of scientific method in science development; explain the development of the atomic arrangement theory; stated amount protons, neutrons, and electrons in certain atoms; determine mass relative of an atom in nature from the mass information of its isotopes; explain information from periodic table; and explain the theory of combining atoms.	Lecturing, discussion, practicum	Authentic assessment
2.	Students are able to determine the empirical formula and	Lecturing,	Authentic

	molecular formula of the compound based on the mass percentage of elements in the compound; equalizing simple chemical equations; use balanced chemical equations to calculate the mass of reactants and the products	discussion, practicum	assessment
3.	Students are able to describe Lewis's point formula; explain the basis of bond formation ionic and covalent bond formation; explain the different types of bonds ionic, covalent bonds; determine and explain the geometry of a molecule based on VSEPR theory; explain the nature of polar covalent bonds; and suspect and explain the polarity of a molecule based the dipole moment	Lecturing, discussion, practicum	Authentic assessment
4.	Students are able to explain the appearance of the gas and the general nature of the gas; explain the number and nature gas through the relationship between temperature, pressure, volume, and quantity; explain the ideal gas law and using the ideal gas equation; explain the gas kinetics theory; explain the nature of liquids and solids; explain intermolecular forces; explain and calculate heat in the phase transition; and explain the phase diagram.	Lecturing, discussion, practicum	Authentic assessment
5.	Students are able to explain the meaning of the composition and concentration of the solution; define various concentration units; explain the different properties of molecular species from ionic species in aqueous solutions; explain the balance of dissolution and deposition; defines the solubility of substances and explain the factor affect the solubility of the substance; explain the colligative nature of the solution	Lecturing, discussion, practicum	Authentic assessment
6.	Students are able to distinguish between systems and environments, recognize various types of boundaries between systems and environments, and various types of systems according to the concept of thermodynamics; explain the symbol and magnitude of thermodynamics for energy as energy in, heat, work and enthalpy; explain the process energy interconversion in the form of heat and work; explain the direction of flow the energy between the system and the environment, identify the characteristics of a spontaneous process and understand the direction of change spontaneous; and explain the symbol and magnitude of entropy and thermodynamics Gibbs free energy which is used as a quantitative measure of the spontaneous level and applies it in some examples of simple chemical reactions related to life daily.	Lecturing, discussion, practicum	Authentic assessment
7.	Students are able to explain the concept of dynamic equilibrium; write the equilibrium constant formula both homogeneous and heterogeneous equilibrium; suspect the direction of the reaction if known the amount of substance mixed at the beginning of the reaction; explain the factor which affects equilibrium and shift in equilibrium caused by changes in these factors; write the ionizing constant formula for various substances and calculate the degree of ionization; explain the effects of namesake ions; and give an example application equilibrium and shift.	Lecturing, discussion, practicum	Authentic assessment
8.	Students are able to explain the concept of acid-base according to Arrhenius, Bronsted-Lowry, and Lewis which includes definitions of acids and bases, strengths of acids and bases, and acid-base reactions; determine a partner acid and	Lecturing, discussion, practicum	Authentic assessment

	base conjugation in the Bronsted-Lowry concept; write down the pH formula to explain the meaning of salt hydrolysis and predict salt that will undergo partial hydrolysis or total hydrolysis; explain the concept of a mixture of anchoring and calculate the pH of the holding mixture.		
9.	Students are able to explain the meaning of electrochemistry; equalizing the reduction oxidation equation based on the concept half reaction; describe cells galvanic and cell diagram; applying the relationship between potential, free energy, and constant equilibrium of redox reactions; explain the effect of concentration on the Nernst equation; explain examples of galvanic cells; determine the electrolysis reaction for a certain substance; and connecting the amount of electricity involved in electrolysis cells with chemical changes.	Lecturing, discussion, practicum	Authentic assessment
10.	Students are able to explain the collision theory that results in a reaction; explain the theory of the transition state that results in a reaction; explain the activation energy and coordinate diagram of potential energy; explain the reaction order and the method of determining the reaction order; explain factors affecting the rate of reaction; explain the Arrhenius equation; explain the molecularity of the reaction; and explain the mechanism enzymes work.	Lecturing, discussion, practicum	Authentic assessment
11.	Students are able to mention the physical nature of the elements of the fourth period transition group; explain the redox chemistry of transition elements; mention various types of ligands; naming complex ions or coordinating compounds correctly; write complex ion chemical formulas and their compounds correctly; explain the geometric shapes found in complex compounds; and explain isomeration in coordination complexes.	Lecturing, discussion, practicum	Authentic assessment
12.	Students are able to describe binding in organic molecules and determine their geometry; identify important hydrocarbons in oil raw earth and describe how these compounds are separated; recognize the classification of organic compounds based on the framework and functional groups; write down the name and structural formula for hydrocarbons and other functional group compounds according to IUPAC provisions; explain the physical properties of organic molecules especially boiling points and solubility; outline the chemical processes for synthesizing important chemical compounds; and explain the reactions that are occurs related to the chemical properties of functional groups.	Lecturing, discussion, practicum	Authentic assessment
13.	Students are able to explain the definitions of polymers and copolymers; explain the addition and condensation polymerization processes; explain the differences in some synthetic polymers; explain the differences in some natural polymers; explain the differences between amino acid groups and protein groups; distinguish bonding in natural and synthetic polymers; explain the understanding of four protein structures; mention and give carbohydrate group example; explain the reaction of carbo-hydrate; and explain the differences in some acids nucleate.	Lecturing, discussion, practicum	Authentic assessment
<b>b.</b>	<b>Skills</b>		
1.	Students are able to demonstrate to distinguish mixtures,	Lecturing,	Authentic

	compounds, and elements; recognize differences in physical and chemical properties; determine mass relative of an atom in nature from the mass information of its isotopes; analyse information from periodic table; and explore the theory of combining atoms.	discussion, practicum	assessment
2.	Students are able to demonstrate for determining the empirical formula and molecular formula of the compound based on the mass percentage of elements in the compound; calculate the mass of reactants and the products; determine the limiting reactants and calculate the mass of reactants and products; and determine the percentage of reaction results from calculation in theoretical and actual results.	Lecturing, discussion, practicum	Authentic assessment
3.	Students are able to explore the basis of bond formation ionic and covalent bond formation; explore the different types of bonds ionic, covalent bonds; determine and explain the shape/ geometry of a molecule based on VSEPR theory	Lecturing, discussion, practicum	Authentic assessment
4.	Students are able to demonstrate to explore the appearance of the gas and the general nature of the gas	Lecturing, discussion, practicum	Authentic assessment
5.	Students are able to define solutions and distinguish them from heterogeneous mixtures; calculate the concentration of substances in various units; change the concentration unit of a solution from the molar concentration unit to percent; calculate the molecular weight of substances based on one of the properties the colligative.	Lecturing, discussion, practicum	Authentic assessment
6.	Students are able to explore the systems and environments,	Lecturing, discussion, practicum	Authentic assessment
7.	Students are able to explore the concept of dynamic equilibrium; calculate the concentration of substances in equilibrium	Lecturing, discussion, practicum	Authentic assessment
8.	Students are able to determine a partner acid and base conjugation in the Bronsted-Lowry concept; estimate nature (acids, bases, or neutral) based on the formula of the salt molecule; calculate the pH of the solution of strong acids, weak acids, bases strong, and weak base of monovalent; calculate the value of $K_a$ or $K_b$ of acid or base based on the pH value and concentration of acid, base or salt; calculate the pH of the holding mixture.	Lecturing, discussion, practicum	Authentic assessment
9.	Students are able to explore the electrochemistry; determine the reduction and oxidation based on changes in the oxidation level of the element and determine the oxidizing and reducing substances; determine the e <sub>0</sub> and the reaction spontaneity.	Lecturing, discussion, practicum	Authentic assessment
10.	Students are able to explore the collision theory; explore the molecularity of the reaction; solve chemical kinetics problems	Lecturing, discussion, practicum	Authentic assessment
11.	Students are able to explore the physical nature of the elements of the fourth period transition group and calculate complex ion charges	Lecturing, discussion, practicum	Authentic assessment
12.	Students are able to explore binding in organic molecules and determine their geometry	Lecturing, discussion, practicum	Authentic assessment
13.	Students are able to explore the polymers and copolymers and distinguish bonding in natural and synthetic polymers	Lecturing, discussion,	Authentic assessment

		practicum	
<b>c.</b>	<b>Competences:</b>		
1.	Students demonstrate a willingness to participate in the class activities	Lecturing, discussion, practicum	Authentic assessment
2.	Students are able to complete all tasks and participate in class discussion	Lecturing, discussion, practicum, assignment	Authentic assessment

<b>E. Module Content</b>		
<b>List of Topic</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>
Modern Chemical Concepts	1	2
Chemical Equations and Reaction Results	1	2
Chemical Bonds	1	2
Substance Form	1	2
Solution concept	1	2
Thermodynamics	1	2
Chemical equilibrium	1	2
Acid and base	1	2
Electrochemistry	1	2
Chemical Kinetics	1	2
Coordination Compounds	1	2
Introduction of Organic Compounds	1,5	3
Introduction to Organic Polymers	1,5	3

<b>F. Course Assessments</b>			
<b>No.</b>	<b>Assessment Type *)</b>	<b>Schedule (Week Due)</b>	<b>Proportion of the Final Mark</b>
1.	Mid-term examination	8 <sup>th</sup> week	35%
2.	Final Examination	15 <sup>th</sup> week	35%
3	Practical Class	Every week	30%

\*) Example: mid-term examination, final examination, quiz, homework, project, etc.

<b>G. Media Employed</b>
Laptop, LCD, Microphone, White Board, Marker, Pointer

<b>H. Learning Resources</b>
<b>h1. Textbooks:</b>
1) Chang R. 2003. <i>Kimia Dasar: Konsep-konsep Inti</i> . Volume 1 dan 2. Ed ke-3. Martoprawiro MA et al., penerjemah. Jakarta: Erlangga. Terjemahan dari: <i>General Chemistry: The Essential Concepts</i> .
2) Oxtoby DW, Gillis HP, Nachtrieb NH. 1999. <i>Prinsip-prinsip Kimia Modern</i> . Volume 1 dan 2. Ed ke-4. Achmadi SA, penerjemah. Jakarta: Erlangga. Terjemahan dari: <i>Principles of Modern Chemistry</i> .