INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)
FACULTY OF SCIENCE AND DATA ANALYTICS
DEPARTMENT OF CHEMISTRY

Document Code

TEACHING AND LEARNING PLAN

COURSE	CODE	Course Group	Credits		SEMESTER	Compilation Date
CHEMISTRY I	SK 184101	General	3	0	I/II	24 August 2021

AUTHORIZATION / LEGALIZATION	TLP Development Lecturer	Course Group Coordinator	Head of Study Program (PRODI)
	Lecturers of Chemistry 1	Zjahra Vianita Nugraheni, M.Si.	Prof. Dr. rer. nat. Fredy Kurniawan, M. Si

Learning Outcomes (LO)	**PLO Charged to The Course**	
	A.1 (PLO 1)	Able to report his/her own work in a good and discipline manners
	B.3 (PLO 5)	Able to take responsibility for his/her own work and to give the responsibility of the achievement of anorganization
	D.1 (PLO 8)	Able to apply a chemistry mindset and utilize science and technology in their field and overcome problems that arefaced.
	Course Learning Outcomes (CLO)	
	CLO 1	The students should be able to use the principles of basic chemistry knowledge as a basis to learn chemistry inwhich they will learn further throughout their whole studies.
	CLO 2	The students should be able to do the basic chemistry calculations.

LO - Course LO MAP

	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9
CLO 1					√			√	
CLO 2	√				√			√	

Course Short Description	This subject study the principles of the fundamental chemistry knowledge that covers the theory of atoms, the electron configurations, the different phases and, phase transitions, chemical reactions and stoichiometry, Acid-Base Theories, Ionic Equilibrium in Substances (Acid-Base, Solubility, Complex and Precipitation), Chemistry Thermodynamics, Chemical Kinetics and, Electrochemistry.
Study Material: Subject Matter	The Basic Concepts of Chemistry, Atom Structures and Models, Electron Configurations and Chemical Bonds, Stoichiometric and Chemical Reactions, Chemical Solutions, Concentrations and, Colligative Chemical Properties, Chemistry Equilibrium, TheStates of Matters and Phase Transformations, Acid-Base Theory, Ionic Equilibrium in Substances (Acid-Base, Solubility, Complex and Precipitation), Chemistry Thermodynamics, Chemical Kinetics, Electrochemistry.

Reference	**Primary:** 1. Lecturers of Department of Chemistry, 2019**.** *Kimia 1*, 2nd Edition, Media Bersaudara, Surabaya. **Secondary:** 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.
Lecturer	Team of Chemistry 1
Pre-Requisite Courses	Not required

Week	**Sub-Course Learning Outcome**	**Assessment**		**Learning Design; Learning Method; Student Assignment [Estimated Time]**		**Learning Material [Reference]**	**Assesment Composition (%)**
		Indicator	**Criteria and Technique**				
(1)	**(2)**	**(3)**	**(4)**	**Face-to-face Class (5)**	**Online Class (6)**	**(7)**	**(8)**
1	The students should be able to explain the fundamental principles of chemistry, including the basic concepts of chemistry.	• Accuracy in explaining the basic concepts of chemistry • Accuracy in the calculation (formulas and units) of relevant examples			Lecture **[OM: 1×(2×50')]** **[OM: 1×(1×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]**	• Course agreement • Material analysis process (elements, compounds, physical properties, chemical properties) • Laws of chemical	

						combination (Proust, Lavoisier, Dalton)	
2	The students should be able to explain the fundamental principles of chemistry, including atom structures and models.	• Accuracy in explaining concept of atomic structures • Accuracy in calculation			Lecture **[OM: 1×(2×50')]** **[OM: 1×(1×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]**	• The developme nt of atom structures and model • The underlying experiments (Dalton, Thompson, Rutherford, Bohr and The Atomic Spectrum of Hydrogen)	
3	The students should be able to explain the fundamental principles of chemistry, including electron configurations	Accuracy in explaining the concepts	**Technique:** Team base project (Non test) Pre lab activities		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]** **Laboratory activities** **[1×(1×100')]**	• Electron configurations of elements and ions • Periodic system of elements • The periodicity of elements • Ionic bond	**1**
4	The students should be able to explain the fundamental principles of chemistry, including chemical solutions, concentrations, and coliigative properties	Accuracy of calculation related to the concentration of a solute, stoichiometry in chemical	**Technique:** Quiz (Test) Team base project (Non test)		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]** **Laboratory activities**	• Mole concept's calculation • Empiricaland molecular formula	**12**

		reactions and coliigative properties	Pre lab activities		**[1×(1×100')]**	• Concentration units (M, N, %, m, F, ppm,ppb) • Stoichiometry in solution • Standarization • Colligative properties of a solution	
5	The students should be able to explain the fundamental principles of chemistry, including chemical bonds.	• Accuracy in explaining the concepts of chemical bond • Accuracy in explaining the different kind of chemical bonds	**Technique:** Team base project (Non test) Topic 1: Density measurement of solid and liquid matter		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]** **Laboratory activities** **[1×(1×100')]**	• Polar covalent and covalent bonds, dipole moment, metal bonds, hydrogen bonds, andVan der Walls bonds • Molecular structures and geometrics (Lewis structures and hybridizatio n)	**2**
6	The students should be able to explain the fundamental principles of chemistry, including the state of matters and phase transformations.	• Accuracy in explaining theconcepts • Accuracy inthe calculation	**Technique:** Team base project (Non test) Topic 2: Stoichiometry		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]** **Laboratory activities** **[1×(1×100')]**	• Gaseous state (Gas laws and itsphysical properties) • Liquid state (Liquid physical properties: vapor pressure,	**2**

						boiling point, surface tension, viscosity)	
7	The students should be able to explain the fundamental principles ofchemistry, including the state of matters and phase transformations.	• Accuracy in explaining the concepts • Accuracy in the calculation	**Technique:** Assignment (Non test) Team base project (Non test) Topic 3: Separation of mixture		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]** **Laboratory activities** **[1×(1×100')]**	Solid-state (Crystal lattice, simple cube, face- centered cube, body-centered cube, Miller index, Bragg's equation)	**12**
8	**Mid-Semester Examination**						**20**
9	The students should be able to explain the fundamental principles ofchemistry, including ionic equilibrium in substances	• Accuracy in explaining theconcepts • Accuracy inthe calculation	**Technique:** Team base project (Non test) Topic 4: Chemical equilibrium and buffer		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]** **Laboratory activities** **[1×(1×100')]**	• Acid-base theory (Arrhenius, Bronsted-Lowry theory, Lewis theory) • Degree of ionizationand ionization constant • Acid-base strength • Weak acid-base equilibrium	**2**
10	The students should be able to explain the fundamental principles of chemistry,	• Accuracy in explaining the concepts	**Technique:** Team base project (test)		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]**	• Ionic equilibrium between solid and liquid	**2**

	including ionic equilibrium in substances	• Accuracy inthe calculation	Topic 5: Standarization and solution		**[SA: 1×(3×60')]** **Laboratory activities [1×(1×100')]**	• Buffer system • Solubility	
11	The students should be able to explain the fundamental principles ofchemistry, including chemical thermodynamics and thermochemistry	• Accuracy in explaining theconcepts • Accuracy incalculation	**Technique:** Assignment (Non test) Post lab activities (Test)		Lecture **[OM: 1×(2×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]** **Laboratory activities [1×(1×100')]**	• Thermodynamc concepts (principles, states, and processes) • First Law of Thermodynamics: internal energy, work, and heat • Heat capacity, calorimetry,and enthalpy • The second law of thermodynamics and spontaneity • Thermochemistry and its use to explain the spontaneity of chemical reactions • Calculations related to the	**12**

						Application of Carnot engine	
12	The students should be able to explain the fundamental principles ofchemistry, including chemical equilibrium	• Accuracy in explaining the concepts • Accuracy in the calculation			Lecture **[OM: 1×(2×50')]** **[OM: 1×(1×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]**	• Concept of chemical equilibriumand equilibrium constant (Reaction Quotient, the equilibrium constant, Kp and Kc) • Le Chatelier's principles • Factors that affect chemical equilibrium	
13	The students should be able to explain the fundamental principles ofchemistry, including chemical kinetics	• Accuracy in explaining theconcepts • Accuracy incalculation			Lecture **[OM: 1×(2×50')]** **[OM: 1×(1×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]**	• The concept of chemical kinetics • Rate of chemical reactions • Determination of reaction rates, orders, and rate constants • Effect of temperatureon reaction rates	

						• Elementary reactions • Catalyst	
14	The students should be able to explain the fundamental principles ofchemistry, including electrochemistry	• Accuracy in explaining theconcepts • Accuracy inthe calculation	**Technique:** Quiz (Test)		Lecture **[OM: 1×(2×50')]** **[OM: 1×(1×50')]** **[SL: 1×(3×60')]** **[SA: 1×(3×60')]**	• The concept of the redox reaction • Electroche mical cells (electrodes and electrolyte solutions in electroche mical cells) • Effect of concentration and Nernst equation • Use of electroche mical concepts for voltaic cell applications (batteries and Fuel Cells) and electrolysis • Corrosion and corrosion prevention	**10**
15-16	**Final Semester Examination**						**25**