UNESA	**UNIVERSITAS NEGERI SURABAYA** **FACULTY OF MATHEMATICS AND NATURAL SCIENCE** **UNDERGRADUATE PROGRAMME OF CHEMISTRY**	**Document Code**

SEMESTER LEARNING ACTIYITY PLAN

COURSE	CODE	Course Group	Credit Unit		Semester	Date
Quantum Chemistry	3074213020	Compulsory	**3**	**SCU**	2	6 January 2020

AUTHORIZATION CHEMISTRY	Compiler	Coordinator	Head of Study Program
		Prof. Dr. Suyono, M.Pd.	**Dr. Amaria, M.Si.**

Learning Outcomes		
	Program Learning Outcomes (PLO)	
	PLO1 (KNO-1)	Able to master the concepts of structure, dynamics and energy, as well as the basic principles of separation, analysis, synthesis, and characterization of micromolecular compounds and their applications
	PLO8 (SOC-2)	Able to adapt to various developments in chemistry, continue to develop and learn throughout long-life education, both formal and nonformal
	Course Learning Outcomes (CLO)	
	CLO1	Students can take advantage of digital transformation and various other learning resources to support their understanding of quantum chemistry.
	CLO2	Students can master the concepts and basic principles of quantum chemistry which are appropriate for the structure, bonds, and characteristics of various materials in physical chemistry.
	CLO3	Students are able to make decisions in formulating solutions to quantum chemical problems related to atomic structure, chemical bonds, molecular structure, molecular symmetry, spectroscopy and molecular interactions.
	CLO4	Students have good morals, ethics and personality in completing quantum chemistry assignments independently or in groups and are responsible for communicating the results.
	CLO4	Students have Ability to integrate the concept of technopreneurship in quantum chemistry
	Sub CLO	

	Sub-CLO1	Students are able to master the achievement targets of quantum chemistry course
	Sub-CLO2	Students are able to understand the basic principles of quantum chemistry
	Sub-CLO3	Students are able to apply quantum chemistry on translational motion
	Sub-CLO4	Students are able to apply quantum chemistry on vibrational motion
	Sub-CLO5	Students are able to apply quantum chemistry on rotational motion
	Sub-CLO6	Students are able to determine the structure and spectra of hydrogen atoms
	Sub-CLO7	Students are able to determine the structure and spectra of complex atoms
	Sub-CLO9	Students are able to understand valence bond theory or VBT
	Sub-CLO10	Students are able to understand MOT for diatomic molecules
	Sub-CLO11	Students are able to understand MOT for polyatomic molecules
	Sub-CLO12	Students are able to understand the basic principles of molecular symmetry
	Sub-CLO13	Students are able to apply symmetry and group symmetry of a molecule
	Sub-CLO14	Students are able to understand the basic principles of molecular spectroscopy
	Sub-CLO15	Students are able to understand molecules related interactions which with the electrical and interfacial properties of a matter
Brief Description of the Course	This course studies quantum chemistry and its application of atomic structure, chemical bonds, molecular structure, properties of matter, molecular symmetry, spectroscopy and molecular interactions. This course is presented in theory, practice, and simple engineering through literacy, discussion, and assignments.	
Study Materials: Learning Materials	1. Basic Concepts and Principles of Quantum Chemistry. 2. The application of quantum chemistry to translational, vibration and rotation motion 3. The application of quantum chemistry to the structure of the hydrogen atom and the atom with many electrons 4. Chemical bond theory (Valence bond theory and molecular orbital theory) 5. Molecular symmetry 6. Molecular spectroscopy 7. Molecular interactions	
Reference	**Main :**	
	1. Atkins, P., Paula, J.d., and Keeler, J. 2018. Atkin's Physical Chemistry, 11th edition. New York: Oxford University Press. 2. Levine, Ira N. 2014. Quantum chemistry, 7th edition. New York: Pearson Education, Inc	
	Additional :	
	1. Mortimer, R.G. 2008, Physical Chemistry, 3th edition, London: Elsevier Inc.	
Lecturer	Dr. IGM Sanjaya, M.Si., Samik, S.Si., M.Si., and Findiyani E. Asih, S.Pd., M.Pd.	

Prerequisite courses	Basic Chemistry I						
Meeting	**The final ability of each activity**	**Assessment**		**Learning Forms, Learning Methods, Student Assignment**		**Reference**	**Rating Weight (%)**
		Indicator	**Criteria & Form**	***Offline***	***online***		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Mastering the achievement targets of quantum chemistry course	Mentioning the achievements of quantum chemistry course	Introduction and contract of quantum chemistry Essay Test		Presentation and discussion	RPS KF I	0
2	Understanding the basic principles of quantum chemistry	Distinguishing Schrodinger equations based on dependent and independent time	The basic principles of Quantum Chemistry Essay Test		Presentation and discussion	Ref. 1 hal 249 - 287 Ref. 2	10
3	Applying quantum chemistry on translational motion	Defining function waves of particle, energy and density of particles in squares of 1, 2, and 3 dimensions	Application of translational motion Essay Test		Presentation and discussion	Ref. 1 hal 288 - 300 Ref. 2	5
4	Applying quantum chemistry on vibrational motion	Determining the wave function of the particle and the energy levels of the vibrational motion	Application of vibrational motion Essay Test		Presentation and discussion	Ref. 1 hal 300 - 306 Ref. 2	5
5	Applying quantum chemistry on rotational motion	Determining the wave function of the particle and the rotational energy levels	Application of rotational motion Essay Test		Presentation and discussion	Ref. 1 hal 306 - 323 Ref. 2	5

6	Determining the structure and spectra of hydrogen atoms	Determining the structure, shape and energy of atomic orbitals, and hydrogen spectra	structure and spectra of Hydrogen atom Essay Test		Presentation and discussion	Ref I hal 324 – 338 Ref. 2	10
7	Determining the structure and spectra of complex atoms	Analyzing orbital approximation and term symbol	structure and spectra of Complex atom Essay Test		Presentation and discussion	Ref I hal 338 – 370	10
8	Mid-Term Exam						
9	Understanding valence bond theory or VBT	Explaining VBT of diatomic and polyatomic molecules	Valence bond theory Essay Test		Presentation and discussion	Ref I hal 371 - 377	5
10	Understanding MOT for diatomic molecules	Writing the electron configuration of a diatomic molecule	MOT for diatomic molecules Essay Test		Presentation and discussion	Ref I hal 378 – 395	5
11	Understanding MOT for polyatomic molecules	Describing the electronic structure of a polyatomic molecules	MOT for polyatomic molecules Essay Test		Presentation and discussion	Ref I hal 395 – 401	10
12	Understanding the basic principles of molecular symmetry	Defining elements and operations on molecular symmetry	The basic principles of molecular symmetry Essay Test		Presentation and discussion	Ref I hal 409 – 426	10
13	Applying symmetry and group symmetry of a molecule	Analyzing the group symmetry of a molecule	Symmetry and group symmetry of a molecule		Presentation and discussion	Ref I hal 427 – 444	10

			Essay Test				
14	Understanding the basic principles of molecular spectroscopy	Distinguishing between translational, vibrational and rotational spectra	The basic principles of molecular spectroscopy Essay Test		Presentation and discussion	Ref I hal 445 – 563	5
15	Understanding molecules related interactions which with the electrical and interfacial properties of a matter	Analyzing the molecular interactions which produce the electrical and interfacial properties of a material	The molecular interactions which produce the electrical and interfacial properties of a material Essay Test		Presentation and discussion	Ref I hal 340 – 370	10
16	**Final Exams**						**100**