	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences** **Undergraduate Chemistry Education Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Physical Chemistry I: Quantum Chemistry	8420403141		**T=3**	**P=0**	**ECTS=4.77**	3	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Utiya Azizah, M.Pd.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

P.O

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Short Course Description	Study of the basic concepts and principles of quantum chemistry as well as their application to atomic structure, chemical bonds, molecular structure, molecular symmetry, spectroscopy and interactions of molecules that make up matter in theory, practical work and simple engineering.
References	**Main :**
	1. Atkins, S.P.W. and Paula, J. d. 2010. Physical Chemistry, 9th edition. New York: Oxford University Press. 2. Levine, Ira N. 2014. Quantum chemistry, 7th edition. New York: Pearson Education, Inc.
	Supporters:
Supporting lecturer	Dr. I Gusti Made Sanjaya, M.Si. Samik, S.Si., M.Si.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Understanding the dynamics of the development of quantum chemistry	Write a report on the use of quantum chemistry in developing future materials.	**Criteria:** Assessment Rubric (Attached)	Presentation and discussion 3 X 50			0%

2	Understand the basic principles of quantum chemistry	Distinguish between time-dependent and time-independent Schrodinger equations	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
3	Can apply quantum chemistry to translational motion	Determine the particle wave function, energy and particle density in 1, 2 and 3 dimensional boxes	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
4	Can apply quantum chemistry to vibrational motion	Determine the wave function of particles and the energy levels of vibrational motion	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
5	Can apply quantum chemistry to rotational motion	Determine the particle wave function and rotational energy levels	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
6	Can determine the structure and spectrum of the hydrogen atom	Determine the structure, shape and energy of hydrogen atomic orbitals	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
7	Can determine the structure and spectra of complex atoms	Analyzing orbital and term symbol approaches	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
8			**Criteria:** UTS ASSESSMENT	2 X 50			0%
9	Understand valence bond theory or VBT	Explains VBT for homonuclear diatomic molecules and polyatomic molecules	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
10	Understanding MOT for diatomic molecules	Write the electronic configuration of a diatomic molecule	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
11	Understanding MOT for polyatomic molecules	Describe the electronic structure of polyatomic molecules	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
12	Understand the basic principles of molecular symmetry	Determine the elements and operations of molecular symmetry	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
13	Can apply symmetry and symmetry groups of a molecule	Analyzing the symmetry group of a molecule	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
14	Understand the basic principles of molecular spectroscopy	Distinguish between translational, vibrational and rotational spectra of molecules	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%

15	Understand molecular interactions related to electrical properties and interfaces of matter	Analyzing molecular interactions related to electrical and interface properties of matter	**Criteria:** Participation Assessment and assignments	Presentation and discussion 3 X 50			0%
16			**Criteria:** UAS assessment	2 X 50			0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
		0%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.